



FAQ: 2020-2021 Design-Build-Vertical Flight Competition [Updated 3/23/2021]

Q: Are vehicle configurations still locked-in with the cancellation of the fly-off event at ARL?

A: Teams are permitted to make necessary modifications to their vehicle configuration if they choose to do so. However, the DBVF Committee advises against making significant changes this late in the design process ahead of the FTR and final presentations.

Q: For the parts of the final technical report that were completed for the PDR and appear on both PDR and FTR requirements, will there be any penalty for reusing some content from the PDR submission?

A: Teams are permitted to re-use relevant portions from their PDR submission (such as trade studies) in their FTR. However, teams should be cognizant of any PDR feedback received from the judges so that they may improve the FTR material.

Q: Would a drawing package included in the appendix of the final report count against the page limit?

A: Yes, all information should be within the 20-page limit.

Q: Since the length of the presentation has changed from maximum of 10-minutes to 15-minutes have any of the guidelines for the presentation changed from what is in the RFP?

A: See next page for expanded information on the virtual presentation scoring metrics. Teams do not have to use full 15-minutes for presentations re. 15-minutes is the maximum time to present – otherwise it is up to the team's discretion on how you use the allotted time.

DBVF Final Presentation Judging Criteria

Section	Requirement
Originality (15 points)	Major subassemblies not off-the-shelf (other than motors, props, batteries, etc.)
	Innovative engineering used to solve the competition challenges (i.e. out of the box ideas/approaches)
Engineering (25 points)	Presentation of concepts considered and down selection process to final design concept, analyses discussed or shown
	Validation/Testing process (bench testing, flight testing, etc.)
	Flight Video
Drawings (15 points)	Aircraft 3D CAD renderings of vehicle and pertinent sub-systems
	Structural arrangement drawing or rendering (showing mechanical interfaces, spars, ribs, gear, etc.)
Team Organization (10 points)	Breakdown of team roles and responsibilities throughout competition shown
	Gantt chart discussing timelines proposed vs actual
Publicity (15 points)	Good use of graphics or charts to convey vehicle performance
	Team conveyed why their final design was the rational choice given their assumptions
Presentation (15 points)	Clear, easy to follow presentation (logical progression of presentation material)
	Good speaking presence and breakdown of material across team members
Public Relations (5 points)	Successfully fielded audience and/or judges' questions
Total: 100	

Q: Not sure how to approach defining the payload fraction. In the RFP under Section 3.4.2, the payload fraction is defined as payload weight divided by the aircraft weight without payload. For judging guidelines, payload fraction is defined as the payload weight divided by the take-off weight (industry standard). It is assumed that this take-off weight included the payload – which way should the payload fraction be defined?

A: The industry standard for payload fraction is *payload weight divided by take-off weight*. The spirit of DBVF is to have students practicing real world engineering work, teams are encouraged to use this industry standard definition. **However, since the RFP contains an alternate definition, points will not be deducted if one is used as opposed to the other.**

Reminder: the Final Technical Report (FTR) deadline extended to March 29, 2021. Below is expanded guidance on how the FTR will be reviewed and scored by judges.

FINAL TECHNICAL REPORT SCORING	
Section	Requirement
Executive Summary (10 points)	Contains objective statement
	Brief description of problem to be solved (purpose of design)
	Discussed planned approach to achieve all objectives
	Includes main point from subsequent sections.
	Clear and concise; use proper grammar and should not longer than 2-pages
Management Summary (5 points)	Overall description of team organization (leadership, sub teams, and responsibilities)
	Org chart includes all teams/functions indicated in text description
	Schedule includes key actions through report deliverable and presentation
	Schedule includes detail on design, prototype, and testing phases
	Schedule includes detail for subcomponent design
Design Trade Studies (5 points)	Problem statement clearly aligns with competition requirements
	Mission requirements decomposed into aircraft subsystem requirements
	Sensitivity study of design parameters discussed
	Review solution concepts / configurations considered
	Describe concept weighting and selection process and results
Technical Innovations (10 points)	Detail any unique design considerations or technologies used by the team.
	Describe mission model used for predicting system performance.
	Mission model description includes equations
	Mission model discusses source of inputs (aero, propulsion, environment, etc.).
	Mission model includes discussion of assumptions and uncertainties.
Design Definition (15 points)	Document dimensional parameters of final design
	Sub system discusses all key components (airframe, propulsion system, electronics)
	Structural design presents indication of maximum expected loads and load paths on the airframe
	Structural analysis of key structural components
	Weight and balance of final design
	Document mission performance for final design
	Provide estimates of the aircraft performance for each mission
	Provide estimate of the aircraft lift and drag and includes method of prediction
	Provide estimate of static stability and method of prediction
	Provide estimate of dynamic stability and method of prediction
Drawing Package (15 points)	Drawing of aircraft: Front View
	Drawing of aircraft: Side View

	Drawing of aircraft: Top View
	Drawing of aircraft: Isometric View
	Structural arrangement drawing present (showing mechanical interfaces, spars, ribs, gear, etc.)
	Systems layout/location drawing present (showing motor, servos, speed controllers, batteries, receiver, etc.)
	Quality, detail, and thoroughness of drawings
Fabrication Methods (10 points)	Manufacturing processes investigated, discussed, and compared
	Discussion on how investigated materials and methods were down-selected.
	Manufacturing process chosen presented in detail
Test Plan (5 points)	Discussion of major tests planned (ie wind tunnel, structural, propulsive, flight, etc.).
	Test objectives for each
	Event descriptions include detail on proposed set up and what data would be collected for each
Flight Test Results (5 points)	Describe the demonstrated performance of key subsystems (propulsion, structure, electrical, etc.)
	Compare to predictions and explain any differences and improvements made
	Describe the demonstrated performance of your complete aircraft solution (flight testing)
Presentation and Organization (20 points)	Proper grammar, spelling, formatting.
	All figures & texts taken from published works are referenced.
	Bibliography or Works Cited at the end of the document in numerical order as cited in the text.
	Logical progression of report. Easy to read through because of use of headings, etc.
Total (100 points)	

Q: What constitutes a valid shunt plug: can a physical switch, mounted on the drone and operated with a single hand be used as a shunt plug?

A: This would not be permitted as a valid shunt plug. The shunt plug must be able to be 'yanked' so that it would open the circuit between the power supply and the vehicle. The location requirement for the shunt plug is described in Section 4 item 9 (reproduced below), and has a corresponding Figure 6. The tip of the shunt plug must be located at least 6 inches away from the rotors in all direction.

Section 4, Item 9. Shunt Plug: The purpose of the shunt plug is to provide an easy and quick way to manually disarm the aircraft. A shunt plug must be wired between the leads of the battery system and the ESC for manual disarming and arming of the aircraft's power system. The shunt plug must be red. The shunt plug must be removable with only one hand and without any tool. The tip of the shunt plug, where someone would grab it, must be located outside the dotted line as shown in Figure 6, below. The dotted line, if extended both into and out of the page, creates a box around the aircraft that extends outward from the rotors by 6 inches in all directions. Hint: Placing the shunt plug aft of the vehicle may be the best solution for aerodynamic and stability purposes in forward flight.

Q: “When does our team pilot need to be identified, and when do they need to hold the FAA Part 107 Drone Certification?”

A: The team pilot must be identified with the final team roster submission, which is due February 10, 2021. The team pilot must obtain a Part 107 Certification (U.S.-based teams) or UAS pilot certification from a certifying organization (Canada-based teams) prior to April 16, 2021.

Q: Some expanded information from ARL on FAA Part 107 Certification?

U.S.-based teams, the pilot requirements are:

- Hold Part 107 certification
- Perform the ARL-administered pilot-in-command checklist on site at Graces Quarters
- Provide an estimate of cumulative UAS flight (pilot) time
- Submit a list of any other UAS certifications held and training taken, along with date achieved and name of administering organization for each

Canada-based team, the pilot requirements are:

- Hold a UAS pilot certification from a certifying organization
- Perform the ARL-administered pilot-in-command checklist on site at Graces Quarters
- Provide an estimate of cumulative UAS flight (pilot) time
- Submit a list of any other UAS certifications held and training taken, along with date achieved and name of administering organization for each

ARL Document Questions

Q: How much precision is required or how much change is allowed for the measurements listed? (height, max dimension, gross take-off weight, and max attainable speed)

Revised A: *The vehicle maximum dimension and maximum take-off weight must adhere to the specifications in the RFP – refer to Section 4 of the RFP. The values of height and maximum attainable speed will not be measured or assessed during the competition, and may therefore be submitted as estimates based on engineering design or modeling and simulation.*

In other words, ARL does not need to know the UAS height or UAS maximum attainable speed (a product of receiving reduced requirements from the UAS approval authorities). So, these have dropped from requirements to simply “good-to-know.”

Further, ARL are not planning to weigh each individual component for which a weight is required to be known on the UAS component information request form. We will, however, be inspecting each such component to ensure that the make/model that was stated in the UAS component information request form is what we see on the UAS.

Q: What are the COVID-19 protocols at ARL?

A: ARL documents have been emailed directly to team leads.

Q: Will new FAA drone requirements/regulations require any additional hardware for the fly-off competition?

A: ARL is aware and tracking and reviewing the new requirements and will let teams know if there are any additional hardware requirements.

Note: the deadline to submit ARL documents has been extended to January 12, 2021 (email to FLY@vtol.org).

Q: Multiple transmit/receive components be used but is limited to three (3) per device and all components envisioned to be used need to be included in the ARL component request form. What the definition of device is in this context – does that refer to the aircraft?

A: “Device” is defined as a component in each row of Section II of the component request form. For example, if a team is considering alternative flight controllers/autopilots, then they would include all required details for each alternative flight controller/autopilot (aka “device”, aka “component”) – up to 3 – being considered. Similarly, if a team is considering alternative hand-held radio controlled handsets, then they would include all required details for each alternative device – up to 3 – being considered.

It is expected that each team will fly a single UAS configuration in the competition. Therefore, each team is expected to submit a single component request form that addresses alternative components being considered in their final UAS design.

Q: Is a transmit/receive component only something that does both (transceiver) or a component that does either? In the latter case, having two radio transceivers and a GPS antenna on the aircraft would be acceptable.

A: Any device that transmits and/or receives signal must be included in the component request form. Having two radio transceivers (e.g., TX_1 and TX_2) and one GPS antenna on the UAS is acceptable. If the team is considering multiple (up to 3) alternatives for TX_1, then the details for all alternatives must be included in the component request form.

Q: Does this restriction apply only to radio frequency devices (leaving a LIDAR device excluded from restriction)?

A: LiDAR device must be included in the component request form. For example, if a team is considering a UAS configuration where the payload is one LiDAR, one EO camera, one IR camera, one altitude sensor, one GPS, and one depth camera, this is acceptable. However, all required details of all of these sensors must be included in the component request form. If a team is considering multiple (up to 3) alternatives for any of the aforementioned example sensors, then the details for all alternatives must be included in the component request form.

Q: Which components are locked in vs. free to change after the submission of the component request form?

A: Any components that are explicitly required to be on the component request form will be locked in after submission. With that being said, rotors (propellers), motors, batteries, and airframes are not required to be on the component request form, and as such are allowed to change after its submission.

Q: What are the COVID-19 protocols at ARL?

A: Information forthcoming.

Note: as stated in the RFP, VFS and ARL leadership recognize that the fly-off portion of the competition will be contingent on the state of the pandemic prior to April 2021. If the competition fly-off date approaches and VFS, along with input from the Army Research Lab, decides that the competition is not safe enough, then the scoring will take into account the deliverables accomplished prior to the competition fly-off.

Q: Are there limitations to motors, batteries, propellers, frames?

A: The only limitations on these components are related to size constraints and battery constraints that are specified in the RFP and clarified in this FAQ document. No DoD funds shall be used for procurement of components used in the air or on the ground.

Q1: It was mentioned that ARL needs the component list to sum into a complete aircraft in their system, and this is why we can't have multiple options for components because the parts wouldn't add up. For an aircraft with multiple motor/propeller locations, may we suggest on the component list that we are using a different motor and propeller for each location? This would allow us to have more component options confirmed for competition and it would allow ARL to still only receive a component list that totals one complete aircraft.

Q2: What defines a "small" change in prop size?

Q3: Could we give a dimension range for prop size in our component selection if we have a specific prop picked out for each potential size?

A: Propellers and motors have been deemed as not required to be submitted on the component request form, and as such are allowed to change after its submission. No DoD funds shall be used for procurement of components used in the air or on the ground.

Q: Is Part 107 certification required for pilot?

A: Yes, Part 107 is essentially an assessment of knowledge of the rules and regulations and the ARL pilot assessment is a check of whether the pilot does, in fact, know how to pilot the specific vehicle in a safe and stable manner. ARL needs the pilot to show a basic proficiency of holding a hover, turning, flying toward and away from the pilot, and maneuvering in a simple pattern like a figure 8. A draft pilot assessment checklist has been provided by ARL to VFS. The pilot must be a non-Government person.

Q: Can teams have more than one (1) pilot?

A: Yes, as long as each pilot holds a current Part 107 certification and completes the ARL pilot assessment on the UAS that will be flown in the competition. The pilot must be a non-Government person.

Q: Can multiple transmit/receive components be used?

A: Yes, but there is a limit of 3 per device and all components envisioned to be used need to be included in the ARL component request form. No DoD funds shall be used for procurement of components used in the air or on the ground.

NOTE: One condition of allowing the student teams to list out multiple transmit/receive components is that there shall be no Government funds and the pilot must be a non-Government person.

Q: Is encryption a requirement?

A: Encryption is optional. If encryption is used, please provide all requested information on the network diagram and UAS component sheet.

Q: For things like sensors that don't change aircraft size and don't send signals, do we need final component selection with part numbers, or can we provide options we are considering?

A: If a sensor meets the definition of a category within the UAS component request form, then all information must be provided at the time of submission. For components that neither send nor receive a signal, these are still considered as "payload". If multiple payload options are being considered, then include up to 3 options in the component request form. No DoD funds shall be used for procurement of components used in the air or on the ground.

Q: How much precision is required or how much change is allowed for the measurements listed? (height, max dimension, gross take-off weight, and max attainable speed)

A: The vehicle maximum dimension and maximum take-off weight must adhere to the specifications in the RFP – refer to Section 4 of the RFP. With respect to precision and allowable change for these parameters on the ARL component request form, further guidance will be given at a future date before the document deadline.

Q: At the fly-off, will there be an extension cord or some power source in the "Pilot, Navigator, & Judge Box" to be sure the ground station doesn't run out of battery or will we need to come up with a solution to make sure this isn't necessary?

A: Power (e.g., extension cord) will be provided at the Graces Quarters facility.

Q: Can teams send in a video of their pilot completing the pilot checkout test for review by ARL ahead of the competition?

A: Pilots must complete the ARL pilot certification checklist in-person on the day before or the day of the competition, in the presence of both an ARL employee and a VFS DBVF representative.

PDR Questions

Q: With regards to battery restrictions, we are confused as to which discharge rating the mandatory fuses are being restricted by. For example, this 3.3Ah battery has two listed discharge C ratings as 45C Constant / 90C Burst. Should 3.3Ah * 45C to obtain the fuse current rating or 3.3Ah * 90C be used?

A: 3.3 Ah * 45C

Q: For referencing academic & research materials, can an appendix for citing the materials be used without having the appendix count against the 10 page limit?

A: Yes

Q: Is the order of the required information for the PDR submission meant to be a template for how the document is structured, or can we structure it as we deem appropriate as long as all of the information listed is documented?

A: It's preferred that it be in order of the judging criteria but not mandatory.

Q: Are batteries limited to a maximum voltage?

Q: Are the batteries limited by a maximum discharge or continuous discharge rating?

A: From RFP Section 4.3:

For the purpose of competition safety, unaltered commercially available LiPo batteries of six cells or less (6S or less) may be used. The team needs to select the proper capacity for their vehicle. Each battery is limited to 100 W-hr. Each battery used in the propulsion system must have a fuse directly in-line with its positive terminal that has a maximum continuous current rating equal to or less than the maximum continuous discharge rating of the battery (i.e. A-hr x maximum continuous Coulomb rating.) Multiple batteries following the above requirements can be combined in parallel for the propulsion system. Each battery must be identical and have its own fuse on its positive lead. All LiPo batteries at the competition must be charged and stored inside a LiPo charging bag. They are only allowed out while being actively used with the aircraft.

*Note that a 6S LiPo battery has a nominal voltage of 22.2V (3.7V/cell) and charging these batteries to the manufacturer's specified capacity is allowed (typically 4.2V/cell). So, batteries with nominal voltage of up to 22.2V are allowed.

Q: In the section "Design Definition," it mentions that we should "Identify which parts will be procured commercially, procured custom, and designed and fabricated by the team" - is this meant to identify main parts of the aircraft that will be either purchased or manufactured, or should we be getting as specific as a full component list?

A: Please focus on the main components only. Examples: rotors, motors, fuselage/airframe.

Previous Questions Answered

Q: When does our team pilot need to be identified, and when do they need to hold the FAA Part 107 Drone Certification?

A: This information must be submitted with the final team roster in February. Teams selected to participate in the competition will be given further instructions on this front.

Q: How many team members can we have?

A: Teams are free to have as many students at both the undergraduate and graduate levels as they see fit. Teams will be limited, however, to bringing a maximum of 10 students to the fly-off competition in April. Additionally, teams are encouraged to seek out multiple faculty advisers to guide and support the team. The fly-off competition will be limited to a maximum of 2 faculty advisers.

Q: Can we add new team members after the initial proposal is submitted?

A: Yes. Teams are welcome to adjust their unofficial team roster as they see fit. Teams will have to, however, submit an official team roster to VFS and ARL in February that will be used to clear up to 10 students and 2 faculty advisers for the competition fly-off in April. Teams can still have more students and advisers involved, and can make internal team changes throughout the year as they see fit, but the competition fly-off will be restricted to only those individuals that are included on the official team roster in February.

Q: What all counts towards the 20 lb. UAS Group 1 weight requirement?

A: Everything. A vehicle will not be allowed to fly if it is over 20 lbs. This means that the aircraft, all systems, power sources, and any payloads are all counted against this 20 lb. requirement.

Q: Can components be changed out on the aircraft between phases of the competition?

A: No. Any component that is used on the aircraft for a single course or aspect of the competition must be on the aircraft for all parts of the competition. The aircraft configuration is also not allowed to be manually changed for the different challenges. Mechanical systems that actuate components mid-attempt, however, will be allowed. For example, a retractable gear or tilting rotors would be allowed. Components may be switched 1 to 1 to replace a failed component. Varying battery packs will be allowed between course attempts, including a 1 to 1 swap or a change in battery capacity that still follows the RFP rules. Any change in battery capacity must not result in the total vehicle weight exceeding the UAS Group 1 designation (20 lb.)

Q: Can the payload be secured externally?

A: Yes. The payload can be secured internally or externally with a safety wire running through the metal grommet. The securing of the payload must pass the safety inspection at the competition. There will be a Q&A session this December with the competition host, ARL, which will serve as a good opportunity for teams to pose related questions to ARL about the safety checks.

Q: Can the payload weight be changed?

A: The payload quantity cannot be modified mid-attempt. Whatever weight the team chooses must be used for the entire course attempt. Multiple SoftGrip weights can be used to add up to a combined payload weight. Note that each team must use a 2 lb. payload for the maneuverability course. The maximum range course will allow teams to select their payload weight.

Q: Can the SoftGrip weights be modified?

A: No. They can not be modified. They will be inspected and weighed at the competition. Teams must supply their own SoftGrip payloads.

Q: Are minors allowed to participate at the competition fly-off?

A: No.

Q: For the maximum range course, it is described that the aircraft must come to "a complete landing" for each lap. Does this mean that the aircraft must come to a complete stop, or would it be permissible to perform a touch-and-go as long as it touches down and takes off again within the VTOL zone?

A: Within the VTOL zone, it is expected that the aircraft will land vertically and take-off vertically. The aircraft's rotors may remain spinning during the touchdown, but the aircraft must be in contact with the ground and not translating for an amount of time perceivable by the human eye before again taking off for the next lap. This means that a rolling touch and go is not permitted. A VTOL touch and go is the intent (i.e. land briefly and take off again.)