

SPEEDFEST XI ALPHA CLASS
STATEMENT OF WORK
FOR A
E-Powered “Drag Racer”

1. **SUMMARY.** Contractors are requested to demonstrate their ability to quickly design, develop and test, a new electric powered aircraft optimized for vertical and horizontal speed. The aircraft must not only demonstrate specific speed, but it also must be reliable and durable.

Contractors will develop and demonstrate prototype aircraft subject to the objectives of this document, and the winning design will be chosen by a qualified team of judges selected from the aerospace industry, government, and academia.

2. **REFERENCES.** Official AMA National Model Aircraft Safety Code 105.
3. **SCOPE.** This document includes all required objectives, Key Performance Parameters (KPP), Key System Attributes (KSA), and Measures of Performance (MOP), for the contractor to provide essential engineering, research, development, test and evaluation.
4. **DESIGN REQUIREMENTS AND CONSTRAINTS.** Aircraft not meeting the following list of requirements and constraints will not be considered for evaluation:
 - 4.1. The propulsion system must be electric with a 6S battery.
 - 4.2. The same capacity battery must be used for all flights.
 - 4.3. All current to the ESC must pass through a single 40-amp fuse (Mouser #:504-ATC-40) which will be provided to the team when they enter the field ready to fly.
 - 4.4. The fuse must serve as the arming shunt to the esc, and conveniently accessible from the outside of the airplane without requiring disassembly.
 - 4.5. Aircraft receiver/flight control/servos must be powered from a battery *independently* from propulsion systems and may *not* use a BEC (voltage regulator). The receiver battery must have a minimum capacity of 650 mah.
 - 4.6. Aircraft must have safety telemetry to monitor at least: flight system voltage, and airspeed. Voltage low warnings must be enabled.
 - 4.7. Pitot/Static ports Must be at least 6 inches away from any surface *laterally*. If pitot tip is aft of the prop plane, the pitot must be at least 1 prop diameter lateral from the prop tip. Pitot speed and telemetry will be verified by judges prior to each flight. The intent of the rule is to prevent any team from measuring a higher speed due to pitot placement. ****edited****

- 4.8. Aircraft may use ground roll or hand launch with no additional type of energy assist. ****edited****
- 4.9. Aircraft may not use any type of ground-based arresting system.
- 4.10. Aircraft must be stable with good handling qualities. This must be demonstrated and certified by the contractor pilot before flying at the Speedfest event.
- 4.11. Control surfaces shall be linked to servos securely, without set-screw type linkages. Clevis connectors must lock or be secured with tubing. Horns shall have the clevis pivot directly over the hinge line and must be securely fixed to the control surface. Surface bonding alone is not acceptable. Control surface under the horn must be solid (not hollow or foam). Control slop and flexibility must be minimal. ****edited****
- 4.12. All servos must be mounted within a servo mount, and mechanically fastened.
- 4.13. All servos must be metal gear type.
- 4.14. Wiring, and any pneumatic harnesses must be labelled.
- 4.15. All servo and other flight control electrical connections must have mechanical locks.
- 4.16. Flight control must always be manual. No autopilots are allowed for flight control, however gyros for stability augmentation are permitted. Futaba 2.4 GHz FASST (not FHSS) or Jeti Duplex system with 2.4GHz primary are preferred. Range / fail safe testing will also be performed at the event.
- 4.17. No part of the aircraft may be intentionally jettisoned.

5. DESIGN OBJECTIVES. Objectives 5.1 – 5.5 involve Key Performance Parameters used for scoring.

5.1. Airplane Drag Racing:

5.1.1. Vertical Drag Race (VDR)

- Time starts on airplane release.
- Climb to 500 ft agl based on FAI F5J-approved [telemetry](#). Provided by judges before flight.
- Score based on total time from airplane release to land to a complete stop.
- Score only counts if Horizontal Drag Race completed within same mission.

5.1.2. Horizontal Drag Race (HDR)

- Must be done immediately after VDC, with same airplane, and airplane configuration. Battery must not be changed or charged. A broken prop may be changed for *same* prop type. A damaged or unsafe airplane will not be allowed to continue obj. 5.1.2. ****edited****
- Time starts at release

- Score based on top airspeed recorded within 10 s.
 - Aircraft must accelerate in figure-8 pattern. No pattern size limit other than pilot and judge ability to see unaided.
- 5.2. Flight Demonstration:
- Must fly for at least 4 min on same battery pack type used in 5.1.
 - Flight demo must include some classical aerobatic maneuvers. Must include some vertical maneuvers that demonstrate features of plane.
 - Prop is the only configuration change allowed from 5.1 ****edited****
- 5.3. Unit Cost Bid. Cost for sale of each airframe using the cost analysis guidelines of section 14. Detail must be provided sufficient for the Technical Reviewers to judge if the price is realistic. Threshold: \$3,000 / plane. Objective: \$2,000 / plane.
- 5.4. Marketing to industry experts: Teams will develop online marketing materials consisting of a video and informational website to market their aircraft to expert judges selected from the RC aircraft field and industry.

6. PROGRAM MEETINGS, REVIEWS, AND EVENTS.

- 6.1. Preliminary Design Review (PDR) Contractors shall present a PDR on or prior to **TBD, 2021**. The PDR shall consist of briefing slides through conceptual design of the aircraft. Slides should consist of sections for: Program management including schedule and budget, performance, aerodynamics and stability and control, propulsion, structures. Slides from this presentation must be emailed to the Speedfest email address no later than COB this date.
- 6.2. Critical Design Review (CDR) Contractors shall present a CDR on or prior to **TBD February 2021**. The CDR shall consist of briefing slides through preliminary and detailed design of the aircraft. Slides should consist of sections for: Program management including schedule and budget, performance, aerodynamics and stability and control, propulsion, structures, test and evaluation plan. Slides from this presentation must be emailed to the Speedfest email address no later than COB this date.
- 6.3. Speedfest Competition Safety inspection. **Friday, April 2022**. Contractors shall present their aircraft to the Speedfest judges for safety and requirements inspection. Contractors must present proof of flight that the aircraft design has flown *prior to* **Friday, April 2021**, in order to be allowed to compete in the event. First flight may *not* be conducted at the Speedfest site. If the deadline is not met, the aircraft will not be allowed to fly at the event, and the team's score will not count in the standings. Proof of flight must be a video showing a single flight consisting of: takeoff and a safe landing. Pilot and advisor must certify authenticity. Pilots must also disclose any handling qualities concerns.

6.4. Speedfest static and flight demonstrations. Contractors will present deliverables outlined in this document for judging.

7. TEST FACILITIES AND EQUIPMENT.

7.1. The Speedfest event is an AMA contest, and as such will be conducted under all AMA safety guidelines at the AMA-sanctioned UAFS airfield.

7.2. Speedfest will provide the test range, display tent, and judges for the event.

7.3. Contractors will be required to bring their aircraft and all associated equipment.

8. DELIVERABLES.

8.1. Recommended minimum of two aircraft; one for flight demonstrations and one for static display and judging.

8.2. A 2 minute marketing video per guidelines and deadline on Speedfest website.

8.3. An online marketing/sales display for the online judging. Details in section 14.

8.4. A detailed cost analysis per guidelines in this document.

9. INTEGRATED MASTER SCHEDULE (IMS). Contractors shall develop and maintain a detailed Integrated Master Schedule incorporating all tasks and milestones necessary for completion of the project. IMS shall be continuously updated, and presented at all design reviews.

10. TECHNICAL REVIEWS. Technical reviews of the contractors work will be provided at the Speedfest event. Technical review team will consist of individuals from the aerospace industry, government, academia. Handling qualities will be scored by pilots. Reviews will be documented on scoring sheets that will be used to select the winning contractor.

11. POINTS OF CONTACT: All questions should be sent via email to SpeedfestAERO@gmail.com

12. SCORING.

Objective scoring:

| | | | |
|----------------------------|----------------|---------------------------|----|
| 5.1.1 Vertical Drag Race | Based on place | 1 st | 15 |
| | | 2 nd | 10 |
| | | 3 rd and lower | 5 |
| 5.1.2 Horizontal Drag Race | Based on place | 1 st | 15 |
| | | 2 nd | 10 |
| | | 3 rd and lower | 5 |

Best score during the competition for each mission is retained for scoring. eg. The best 5.1.1 score may not be during the same mission as the best 5.1.2 score. No points will be awarded for objective 5.1 unless a qualifying score is obtained for *both* 5.1.1 and 5.1.2. Also, a qualifying score must be obtained for *both* objectives in an individual mission, for any individual flight score in that mission to count.

****edited****

| | | Threshold | Objective |
|-----|---------------|-----------|-----------|
| 5.2 | Aerobatics | 3 | 5 |
| 5.3 | Unit Cost bid | 2 | 5 |

Subjective Scoring:

The following scores will be judged by the Technical Review teams outlined in this document. Scores will be averaged on the following scale:

| | |
|---------------------------------------|-------------------------|
| Aircraft Design | |
| Fit and finish | 0-5 |
| Handling Qualities ¹ | 0-5 |
| Design optimization | 0-5 |
| Cost bid certification | * |
| Subtotal Possible | 15 |
| Marketing | |
| Online Marketing Display ² | 0-5 |
| Video | 3 Threshold 5 Winner |
| 5.4 Expert Marketing ³ | 0 or 5 (Winner only) |
| Subtotal Possible | 15 |

NOTE: See numbered notes in section 14.

* Technical Review team will certify that the cost bid is reasonable based on detailed and convincing evidence provided by the contractors. Majority vote in the affirmative will certify. If the majority votes in the negative, the objective 5.3 score will be scored 0.

13. COST ANALYSIS

Cost Analysis must be based on the projection that the winning contractor goes on to create new production tooling as well as 100 units. Assume labor to build the aircraft would be drawn from the same individuals who built the prototypes. Final cost analysis must show unit costs for sale of individual airframes including all of the following factors:

Labor and materials for all tooling and 100 airplane systems. Assume a fully loaded labor rate of \$40/hr. All tooling, aircraft, and ground support materials and equipment, non-flight control radio gear, etc. needed to operate each aircraft with the exception of fuel, must be included in the bid. *Do NOT include flight transmitter, receiver, servos and associated flight control systems into cost. It is not the intent of this SOW to encourage low-quality flight control systems.* Contractors should track labor during production of the prototypes, and be able to justify projected labor man-hours in the following categories as appropriate:

- Production Tooling
- Fuselage
- Empennage
- Wing
- Finish, Paint and Graphics
- Flight control systems (servos, linkages, telemetry, electrical systems)
- Propulsion integration
- Landing gear system
- Payload system
- Launching/Recovery/Ground system

Contractors may apply projections of cost reductions for 100 aircraft using quantity discount information, as well as logarithmic learning curves for labor hours. Learning curve projected man hours at the 100th unit may not be projected to drop below 50% of the lowest number of man hours documented for the final prototype actually built by the contractor. Use of machining such as a CNC shall be included at \$95/hr

14. SPEEDFEST EVENT DEMONSTRATION REQUIREMENTS

- 1 Pilots will provide a score for their teams' plane based on a C-H scale but with 5 being the high score, and 0 being low score
- 2 The competitors will develop a web page for marketing and sales of the aircraft. This web page will be the means by which the Hotliner Judges make their decision about the winning design. Due date will be **TBD**.
- 3 Judges for this category may be different than design review team. Judges will include expert RC pilots who could be in the market for a plane of this class, as well as representatives from the RC aircraft industry. They may use any reasonable criteria in their judgement. Examples include, but are not limited to: performance, novelty of design, fit and finish, simplicity and reliability, transportability, "sexiness", etc. Cost may not be considered unless a team does not meet the cost estimate threshold. This all-or-nothing category will come down to the simple majority of the judges as to which aircraft they would prefer to own.

15. COURSE

The course consists of pylons spaced 1000 ft apart. Aircraft must perform figure-8 patterns with turns away from the safety line. High-speed aircraft may not fly within the East fence line except during takeoff and landing.

