SPEEDFEST XV ALPHA CLASS

STATEMENT OF WORK

for a new proposed

F5 Racing Class

1. **SUMMARY.** There are several different aircraft competition classes in the FAI F5 (electric) category. A new class of racing is proposed that will combine elements of the F5B motor-glider class with the F5D pylon racing class into a single, multi-task mission. This mission will focus on the speed, turning and efficiency capabilities of the airplane and without the need for an energy limiter. Contractors will develop and compete prototype aircraft subject to the objectives of this document, and the designs will also be scored 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. Teams must produce an aircraft optimized for the specified mission, a means for transportation (such as a simple carry case, and excluding transmitter), and an assembly tool kit with any tools needed to assemble aircraft. Judges will consider cost, assembly simplicity, weight, and any other relevant factors to the design of the overall system.

   4.2. The aircraft propulsion system must be electric, powered by standard LiPo batteries (4.2V/cell charge, 3.7V nominal). HV LiPo or LiHV batteries are prohibited.

   4.3. Propulsion battery must be no more than 4S, and a maximum energy capacity of 20 W-hr calculated by (3.7 * nS * mah /1000)

   4.4. Wingspan is limited to 1 m.

   4.5. Aircraft must have split-elevators with independent servos on separate channels for redundancy.

4.6. Aircraft must have safety telemetry to monitor at least: flight system voltage, and airspeed. Voltage low warnings must be enabled.

4.7. Aircraft may use roll-off-ground (ROG) or hand launch with no additional type of energy assist.

4.8. Aircraft must be stable with good handling qualities. This must be demonstrated and certified by the contractor pilot before flying at the Speedfest event.

4.9. Control surfaces (CS) shall be linked to servos securely. CS horns shall have the horn pivot hole directly over the hinge line and must be securely fixed to the control surface. Surface bonding alone is not acceptable. The horn must be structurally integrated into the surface. CS under the horn must be solid (not hollow or foam).

Prohibited control linkages:

- Any type of set-screw adjustable linkages.
- IDS, LDS, or RDS types of control surface drive.

Preferred method for connecting servo to CS horn is clevis/z-bend combination, or z-bend/z-bend of 2-56 sized rod. Clevis connectors must lock or be secured with tubing. Control slop and flexibility must be minimal.

4.10. All servos must be metal gear type, and must be mounted within a servo mount or frame, and mechanically fastened.

4.11. All servo and other flight control electrical connections must have mechanical locks.

4.12. No part of the aircraft may be intentionally jettisoned.

4.13. 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.

5. DESIGN OBJECTIVES.

Objectives 5.1 – 5.3 involve Key Performance Parameters used for scoring.

5.1. Speed and Efficiency: Teams are given a total of 5 minutes for a complete mission (multiple missions may be conducted within a teams' flight window if possible.) Time begins at first scored flag of pylon race.

5.1.1. Pylon racing phase: Maximum flags over a 1000 ft figure-8 course within 2 min (time starting at first flag. No dive entry) Pilot must fly pylon course as low and level as practical. SCORE = # Flags

5.1.2. Coast-phase: This phase begins immediately after the 2 min pylon racing phase. The pilot must kill the motor at the 2 min whistle after which the plane is allowed to climb and the mission timer will continue. Timer stops when the aircraft touches down or the pilot applies throttle, yielding a time of T_c [seconds]. Whichever occurs first. $SCORE_c = (T_c - 120) / 10$ Maximum $SCORE_c = 18$ (5 [min] – 2 [min])*60[sec/min] / 10

- *Teams will only retain scores that were awarded during a single complete mission. In other words, points may not be claimed for best pylon and best coast points that happened on different missions.*
- *Pilot must continue to fly figure-8 during climb and coast until ready to approach for landing, but need not fly to the pylons.*
- *If 5 min mission timer expires, team will be awarded the coast phase time at that point.*
- *Aircraft must land within the fence line for score to count.*

5.2. Unit Cost Bid. Cost for sale of each airframe using the cost analysis guidelines of section 14. Unit costs will not be revealed until event day. Detail must be provided sufficient for the Technical Reviewers to judge if the price is realistic. Threshold: $4,200 / airframe. Objective: $2,500 / airframe

5.3. Marketing to industry experts: Teams will develop online marketing materials consisting of a video and informational website to market their aircraft system to expert judges selected from industry.

6. PROGRAM MEETINGS, REVIEWS, AND EVENTS.

6.1. Program Design Review (PDR) Contractors shall present a PDR on or prior to **Thursday, January 29.** 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.

6.2. Critical Design Review (CDR) Contractors shall present a CDR on or prior to **Thursday, February 19.** 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.

6.3. Speedfest Competition Safety inspection. Contractors shall present their aircraft to the Speedfest judges for safety and requirements inspection.

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

6.5. Contractors must present proof of flight that the aircraft design has flown *prior to* Speedfest, 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 (including Friday), 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, all three 5.3 Threshold maneuvers, and a safe landing. Pilot and advisor must certify authenticity. Pilots must also disclose any handling qualities concerns to the judges.

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 and judges for the event.

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

7.4. Contractors will be required to provide an exhibit tent for static display and presentations to the judges and public. Installation and rental of the exhibit tent will be coordinated with the Speedfest contacts.

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

8.3. An online marketing/sales display for the online expert 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. PERIOD OF PERFORMANCE (PoP). Total PoP for this SOW is 15 weeks.

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

12. SCORING.

The scoring system below will be used to select the winning contractor.

Objective scoring:

		KPP Score	
Objective #	**Objective**	**Threshold**	**Objective**
5.1.1	Pylon Phase		# Flags
5.1.2	Coast Phase		$SCORE_c$
5.2	Unit Cost Bid	4	8

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 Justification	0-5
Subtotal Possible	**15**
Marketing (Expert Judged)	
Online Marketing Display[2]	0-5
Video	0-5
Judges Choice[3]	0 *or* 3 (Winner only)
Subtotal Possible	**13**

NOTE: See numbered notes in section 14.

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 flight control and communication 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 a panel of external judges make their decision about the winning design. Due date will be TBD.

3 Judges will include expert who could be in the market for a plane of this class, as well as representatives from the 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", perceived cost of operation. This all-or-nothing category will come down to the simple majority of the judges as to which aircraft they would prefer.