

**SPEEDFEST XIV ALPHA CLASS**  
**STATEMENT OF WORK**  
for a new  
**IC-Powered Airplane Pylon Racing Class**

1. **SUMMARY.** There are several different pylon racing aircraft classes, however all are either based around electric or glow propulsion systems. A new class of racing is proposed that will be based on gas-powered, spark-ignition engines which is the most common class of engine for UAS. 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:

**Design Considerations relating to CONOP**

- 4.1. The aircraft engine must be a single, unmodified Desert Aircraft DA35 engine.
- 4.2. Muffler variations are allowed, and the teams must implement a remotely triggered engine-generated smoke system that will allow for exciting aerial visuals during maneuvering. The smoke system must be capable of generating *significant* smoke for a total of at least **30 s**. Exhaust systems may not be changed for different missions or flights.
- 4.3. Wingspan is limited to **60in** and total maximum aircraft length measured from spinner tip to furthest aft point is **63in**.
- 4.4. Fuel capacity must be sufficient for full-power for **10 min**. Fuel delivery must be reliable and consistent at all flight conditions, g-levels (negative to positive) and all attitudes.

## General

- 4.5. Design must satisfy all AMA requirements.
- 4.6. Recommended launch is bungee assist or ROG.
- 4.7. Aircraft must be stable with good handling qualities, and minimal pitch moment change with thrust over entire envelope
- 4.8. Aircraft must have telemetry to monitor at least: flight system voltage, and airspeed. Voltage low warnings must be enabled.
- 4.9. Control surfaces shall be linked to servos with 4-40 rods, Robart Super Ball horns are preferred. Clevis connectors must lock or be secured with tubing. Horns shall have the ball directly over the hinge line, and plates bolted on each side of the control surfaces. Control surface under the horn plates must be solid. Control slop and flexibility must be minimal.
- 4.10. All servos must be mounted within a servo mount, and mechanically fastened.
- 4.11. All servos must be metal gear type.
- 4.12. Wiring, and any pneumatic harnesses must be labelled.
- 4.13. All servo and other electrical connections must have mechanical locks.
- 4.14. Ignition system must be powered independently from receiver.
- 4.15. 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 – 5.5 involve Key Performance Parameters used for scoring.

- 5.1. Pylon racing. Maximum flags over a 1000 ft course within 3min (time starting at first flag. No dive entry) Threshold: 15 flags, Objective: Highest of Competitors
- 5.2. Aerobatic Show Maneuvering. Threshold: Demonstrate a horizontal figure-8 with turns away from the spectators, a Cuban 8, and an Immelmann turn with *continuous*, easily visible smoke. Objective: Add more aggressive maneuvers that show the capabilities of the airplane using smoke to highlight show. Poor smoke visibility or malfunctions will result in 0 points. *At no time may a maneuver direct the aircraft towards the safety line.*

- 5.3. 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: \$10,000 / airframe. **Objective: \$7,500 / airframe**
- 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 industry.

## 6. PROGRAM MEETINGS, REVIEWS, AND EVENTS.

- 6.1. Program Management Review (PMR) Contractors shall present a PMR on or prior to **date**. The PMR 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 **date**. 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. **date**. 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 including a detailed RCS design justification.

**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](mailto:SpeedfestAERO@gmail.com)

**12. SCORING.**

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

**Objective scoring:**

Objective #	Objective	KPP Score	
		Threshold	Objective
5.1	Pylon Racing	4	9
5.2	Aerobatic Show Maneuvering	2	4
5.3	Unit Cost Bid	4	8
	<b>Subtotal Possible</b>	<b>12</b>	<b>25</b>

### 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:

<b>Aircraft Design</b>	
Fit and finish	0-5
Handling Qualities <sup>1</sup>	0-5
Design Justification	0-5
<b>Subtotal Possible</b>	<b>15</b>
<b>Marketing (Expert Judged)</b>	
Online Marketing Display <sup>2</sup>	0-5
Video	0-5
Judges Choice <sup>3</sup>	0 or 4 (Winner only)
<b>Subtotal Possible</b>	<b>14</b>

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 100<sup>th</sup> 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.