

SPEEDFEST X ALPHA CLASS
STATEMENT OF WORK
FOR A
30N-CLASS JET HOTLINER

1. **SUMMARY.** Contractors are requested to demonstrate their ability to quickly design, develop and test, a new high-speed jet hotliner to compete in the 30N class. The aircraft must not only demonstrate specific speed and efficiency characteristics, but it also must be easy and fast to assemble, reliable and desirable for purchase.

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. If Applicable: AMA Turbine Waiver Application 510-d, AMA Safety Regulations for Model Aircraft Powered by Gas Turbines 510-a.
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 only propulsion system allowed is a single Kingtech K30G3 turbojet.
 - 4.2. Design should be FOD resistant for engine longevity.
 - 4.3. Design must satisfy additional AMA requirements detailed in 510-a "Safety Regulations for Model Aircraft Powered by Gas Turbines".
 - 4.4. Aircraft must be stable with good handling qualities. This must be demonstrated and certified by the contractor pilot before flying at the Speedfest event.
 - 4.5. Aircraft must have safety telemetry to monitor at least: flight system voltage, and airspeed. Voltage low warnings must be enabled.
 - 4.6. Control surfaces shall be linked to servos with 4-40 rods. 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.

- 4.7. All servos must be mounted within a servo mount, and mechanically fastened.
- 4.8. All servos must be metal gear type.
- 4.9. Wiring, and any pneumatic harnesses must be labelled.
- 4.10. All servo and other flight control electrical connections must have mechanical locks.
- 4.11. Flight control must always be manual. No autopilots are allowed for flight control, however gyros for stability augmentation are permitted. Contractors may only use the following radio systems: Futaba 2.4 GHz FASST (not FHSS) OR Jeti Duplex system with 2.4GHz primary. Range / fail safe testing will also be performed at the event.
- 4.12. Aircraft receiver/flight control/servos must be powered from a battery independently from all other systems and may not use a voltage regulator. The propulsion system, or any payload system may not be powered from the receiver/flight control power source.
- 4.13. One complete aircraft and any ground support and launch equipment except fuel and transmitter, must be protected and transportable in one crate or case provided by the contractor. The length of the case must be no more than 6 ft.
- 4.14. No part of the aircraft may be intentionally jettisoned.
- 4.15. Fuel must be contained in "hard" constant volume fuel tank(s). No bladder tanks of any type are allowed, including hard shelled with internal bladder.
- 4.16. Aircraft must be hand-launchable by a pilot holding a transmitter in the other hand, in no-wind conditions.

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

- 5.1. Assembly / Simplicity / Reliability: Aircraft and all required components start in a closed box. Time starts when the box is opened. The time will stop at T_A when the aircraft is ready for engine start and preflight check. All flight controls must work properly, and aircraft must pass preflight safety check for any components that do not meet requirements otherwise a score of 0 is awarded. Threshold: $T_{THA} = 2$ minutes. $score = 10 * (1 - T_A / T_{THA})$.
- 5.2. Performance: Aircraft fly as many flags as possible in 3 min in the figure-8 pattern. Timer starts when aircraft enters the course and crosses the first flag.
- 5.3. Aerobatics: Aircraft must perform an aerobatic demonstration show of at least 4 min in length. Time starts on engine start and ends on landing. Maneuvers are chosen by the contractor, but energy must be directed away from the crowd for all maneuvers. (No score for flight of less than 4 min)

- 5.4. Hotliner Marketing: Winner selected by hotliner judges. Judges will be selected jet-rated pilots who will vote for the design they would most like to purchase based on a contractors online marketing material.
- 5.5. 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: \$5,000 / plane.
Objective: \$3,000 / plane

6. PROGRAM MEETINGS, REVIEWS, AND EVENTS.

- 6.1. Preliminary Design Review (PDR) Contractors shall present a PDR on or prior to **TBD, 2020**. 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 2020**. 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, 23 April 2021**. 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, 23 April 2020**, 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 including fuel.

7.4. Contractors will be required to provide a CO₂ fire extinguisher as part of the required airplane ground equipment. The extinguisher must be with the flight team at all times while operating the engine.

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.

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

Objective scoring:

Objective #	Objective	KPP Score	
		Threshold	Objective
5.1 ¹	Assembly / Simplicity / Reliability		$10*(1 - T_A / T_{THA})$
5.2	Performance		# of Flags
5.3	Aerobatics		5
5.5	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 ²	0-5
Design optimization	0-5
Cost bid certification	*
Subtotal Possible	15
Marketing	
Online Marketing/Sales Display ³	0-5
Video	3 Threshold 5 Winner
5.4 Hotliner Marketing ⁴	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 5.5 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

When a team is granted their flight demonstration window, they must announce to the judges table, which objective(s) they will be demonstrating.

- 1 Assembly mission does not have to be done within a flight window. It may be done before the judges at tech-in, or in the pit area before a flight window. Batteries may be in the airplane, but must be disconnected from all circuits. If switches are used, they must be properly rated. Aircraft need not be fueled.
- 2 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
- 3 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 jet. Due date will be **TBD**.
- 4 Hotliner judges may be different than design review team. Hotliner judges will be RC jet pilots who would be in the market for a plane of this class. 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.

