

# Request for Proposal

## General Aviation Trainer Aircraft Family

### Background

As the average age of airline pilots continues to increase, recent reports estimate nearly 20,000 cockpit seats will become available as pilots reach the mandatory retirement age. While airlines have historically filled pilot positions from separating military cockpit crews, the decline in the number of military pilots have forced airlines to recruit larger numbers of civilian pilots. Unfortunately, the number of civilian pilots in training has not been able to meet the demand, both within the United States and worldwide, for career pilots. Already, regional airlines have been forced to reduce service as their pilots move up to the larger national and global airlines. If this trend continues, the air service for smaller cities could be in danger, which would have drastic negative economic impacts for those regions.

This Request for Proposal (RFP) is for the design of two-aircraft trainer family that addresses this market problem by providing economical flight training for both single-engine and multi-engine operations. General aviation aircraft introduced in the last two decades have typically focused on the low-end of the market (light sport aircraft) or the high-end of the market (Cirrus SR-22, Cessna TTx) with little attention focused on the pilot training aspect, especially for career pilots.

These two aircraft should be designed to best serve the pilot training market for both career pilots and pleasure pilots. Secondary markets, such as private aircraft owners and people or organizations that may use an aircraft as part of their business, should also be considered. While light sport aircraft focus on a “fun” value proposition and high-end general aviation aircraft focus on a “luxury” value proposition, this two-aircraft trainer family should focus on providing the best “utility” value proposition.

The aircraft is to be designed to meet all the requirements in General Requirements and the requirements in Mission Requirements. The objectives for designer optimization are listed in Design Objectives.

**Requirements: [R] = Mandatory Requirement [O] = Objective or Goal**

### General Requirements

The requirements and objectives below are applicable to both aircraft within the family.

- [R] Capable of taking off and landing from runways (asphalt or concrete)
- [R] Capable of VFR and IFR flight
- [R] Meets applicable certification rules in FAA 14 CFR Part 23

- All missions below assume reserves and equipment required to meet applicable FARs
- [R] Engine/propulsion system assumptions documented
  - Use of engine(s) that will be widely available by 2025
  - Assumptions on at least specific fuel consumption/efficiency, thrust/power and weight should be specified.
- [O] Capable of semi-autonomous flight with an autopilot
- [O] Capable of flight in known icing conditions

### Mission Requirements

The requirements and objectives below may differ for the two aircraft.

	Single-Engine	Multi-Engine
<b>Crew</b>	1 Pilot Required, 2-Pilot (Dual Instruction) Capable	
<b>Passengers</b>	1+	3+
<b>Takeoff Distance</b>	< 1500 ft	< 2500 ft
<b>Landing Distance</b>	< 1500 ft	< 2500 ft
<b>Endurance</b>	> 3 hr	> 4 hr
<b>Ferry Range</b>	> 800 n mi	> 1000 nmi
<b>Service Ceiling</b>	> 12,000 ft	> 18,000 ft
<b>Certification Category</b>	Utility	Normal

### Design Objectives

- “Right-size” the capability of the aircraft while minimizing the operating cost of the aircraft. Operating cost should include at a minimum: fuel/energy cost, other

consumables such as oil and tires, and on-going maintenance cost (to include periodic and annual inspections and maintenance). Considering other costs will strengthen the proposal.

- Minimize production cost by choosing materials and manufacturing methods appropriate for both ease of production and ease of maintenance.

### Other Features and Considerations

- Flying qualities must meet CFR Part 23.
- Consider re-use between various components and systems between the two aircraft.
- Consider what features will be basic and which will be optional to a customer.
- Consider how different customers (small flight schools, large flight schools, individuals, other organizations) purchase aircraft.

### Notes and Assumptions

Assume an EIS of 2025 when making technology decisions.

### Proposal and Design Data Requirements

The technical proposal shall present the design of this aircraft clearly and concisely; it shall cover all relevant aspects, features, and disciplines. Pertinent analyses and studies supporting design choices shall be documented.

Full descriptions of the aircraft are expected along with performance capabilities and operational limits. These include, at a minimum:

1. A description or graphical representation of the two sized aircraft based on the requirements and design objectives given. This should describe or represent the quantitative justification for the sized wing areas and selected powers/thrusts of the two aircraft that were designed.
2. A description of the design missions defined for the proposed concepts for use in calculations of mission performance as per design objectives. This includes the selection of altitudes and speeds throughout the missions supported by pertinent trade analyses and discussion.
3. Aircraft performance summaries shall be documented and the aircraft flight envelopes shall be shown graphically.
4. A V-n diagram for the two aircraft with identification of necessary aircraft velocities and design load factors.  
Required gust loads are specified in 14 Code of Federal Regulations (CFR) Part 23.

5. Materials selection for main structural groups and general structural design, including layout of primary airframe structure as well as the strength capability of the structure and how that compares to what is required at the ultimate load limits of the two aircraft. The maximum dive speed of the two aircraft shall be specified.
6. Complete geometric description, including dimensioned drawings, control surfaces sizes and hinge locations, and internal arrangement of the two aircraft illustrating sufficient volume for all necessary components and systems.
  - Scaled three-views (dimensioned) and 3-D model imagery of appropriate quality are expected. The three-view must include at least:
    1. Fully dimensioned front, left, and top views
    2. Location of aircraft aerodynamic center (from nose)
    3. Location of average CG location (relative to nose)
    4. Tail moment arms
  - Diagrams showing the location and functions for all aircraft systems.
7. Important aerodynamic characteristics and aerodynamic performance for key mission segments and requirements.
8. Aircraft weight statement, aircraft center-of-gravity envelope reflecting payloads and fuel allocation. Establish a forward and aft center of gravity (CG) limits for safe flight.
  - Weight assessment summary shall be shown at least at the following level of detail:
    1. Propulsion (engine, propeller, gearbox, nacelle, strut, fan, etc. as applicable)
    2. Airframe Structure
      1. Wing
      2. Empennage
      3. Landing Gear (including wheels tires and brakes)
      4. Fuselage
    3. Control System (flight controls linkages, hydraulics, wires, actuators bellcranks, engine controls etc.)
    4. Payloads (seats, baggage compartments)
    5. Systems
      1. Instruments and Avionics
      2. Fuel/oil

3. Hydraulic/pneumatic/electrical systems (if chosen)
9. Propulsion system description and characterization including performance, dimensions, and weights. The selection of the propulsion system(s), sizing, and airframe integration must be supported by analysis, trade studies, and discussion
10. Summary of basic stability and control characteristics; this should include, but is not limited to static margin, pitch, roll and yaw derivatives.
11. Summary of cost estimates and a business case analysis. This assessment should identify the cost groups and drivers, assumptions, and design choices aimed at the minimization of operation costs.
  - Estimate the non-recurring development costs of the airplane including engineering, FAA certification, production tooling, facilities and labor
  - Estimate the fly away cost of each member of the family
  - Estimate the price that each aircraft would have to be sold for to generate at least a 15% profit
    - Show how the airplane could be produced profitably at production rates ranging from 3-15 airplanes per month or another production rate that is supported by a brief market analysis
  - Estimate of operating cost for the two aircraft assuming four student pilots each fly an average of 75 minutes per day per aircraft
    - Fuel, oil, tires, brakes, and other consumable quantities
    - Estimate of maintenance cost per flight
    - Including other costs will strengthen the proposal

The proposal response will include trade documentation on the two major aspects of the design development, a) the concept selection trades, and b), the concept development trade studies.

The students are to develop and present the alternative concepts considered leading to the down-select of their preferred concept. The methods and rationale used for the down-select shall be presented. At a minimum a qualitative assessment of strengths and weaknesses of the alternatives shall be given, discussing merits, leading to a justification as to why the preferred concept was the best proposal response. Quantitative justification of why the selected proposal is the best at meeting the proposal measures of merit(s) will strengthen the proposal.

In addition, the submittal shall include the major trade studies conducted justifying the optimization, sizing, architectural arrangement and integration of the specifically selected proposal concept. Quantitative data shall be presented showing why their concept "works" and is the preferred design compromise that best achieves the RFP.

Specific analysis and trade studies of interest sought in proposals include:

- Mission performance and sizing for the definition of a mission profiles.
- Overall aircraft concept selection (airframe and propulsion system) vs. design requirements objectives

All concept and technology assumptions must be reasonable and justified for the EIS year.

### Procured Data

No data is procured as part of this RFP.

### Additional Contacts

All technical questions pertaining to this RFP should be directed to Jeffrey Corbets at [jeffcorbets@gmail.com](mailto:jeffcorbets@gmail.com)

Any updates to this RFP will be posted on the AIAA Design Competitions web site <http://www.aiaa.org/DesignCompetitions/>

### Reference Material

[FAR Part 23](#)