

Request for Proposal

Austere Field Light Attack Aircraft

Project Objective

The objective of the project is to design an affordable light attack aircraft that can operate from short, austere fields near the front lines to provide close air support to ground forces at short notice and complete some missions currently only feasible with attack helicopters.

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

General Requirements

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

- [R] Austere Field Performance: Takeoff and landing over a 50 ft obstacle in $\leq 4,000$ ft when operating from austere fields at density altitude up to 6,000 ft with semi-prepared runways such as grass or dirt surfaces with California Bearing Ratio of 5
- [O] Survivability: Consideration for survivability, such as armor for the cockpit and engine, reduced infrared and visual signatures, and countermeasures (chaff, flares, etc.).
- [R] Payload: 3000 lbs of armament
- [O] Provisions for carrying/deploying a variety of weapons, including rail-launched missiles, rockets, and 500 lb (maximum) bombs
- [R] Integrated gun for ground targets
- [R] Service life: 15,000 hours over 25 years
- [R] Service ceiling: $\geq 30,000$ ft
- [R] Crew: Two, both with zero-zero ejection seats

Design Mission

The design must be capable of performing the design mission outlined below with the full payload requirement.

1	Warm Up / Taxi	5 minutes
2	Take Off	Austere field, 50 ft obstacle, $\leq 4,000$ ft

3	Climb	To cruise altitude, $\geq 10,000$ ft; with range credit
4	Cruise	100 n mi
5	Descent	To 3,000 ft; no range credit; completed within 20 minutes of the initial climb
6	Loiter	On station, four hours, no stores drops
7	Climb	To cruise altitude, $\geq 10,000$ ft; with range credit
8	Cruise	100 n mi
9	Descent / Landing	To austere field over 50 ft obstacle in ≤ 4000 ft
10	Taxi / Shutdown	5 minutes
11	Reserves	Sufficient for climb to 3,000 ft and loiter for 45 minutes

Ferry Mission

The design should also be analyzed for a long-range ferry mission including full crew and 60% of the payload requirement.

1	Warm Up / Taxi	5 minutes
2	Take Off	Austere field, 50 ft obstacle, $\leq 4,000$ ft
3	Climb	To cruise altitude; with range credit
4	Cruise	At best range speed / altitude ($\geq 18,000$ ft), 900 n mi
5	Descent / Landing	To austere field over 50 ft obstacle in ≤ 4000 ft
6	Taxi / Shutdown	5 minutes
7	Reserves	Sufficient for climb to 3,000 ft and loiter for 45 minutes

Design Objectives

- Provide a “best value” design that meets the performance specifications outlined above with consideration for both acquisition and operational cost over the expected 25-year service life.

Other Features and Considerations

- The procuring office believes a purpose-built light attack aircraft should be more survivable than the helicopters currently used for these missions.
- Design should be certifiable for military standard airworthiness (MIL-STD-516C) and consistent with guidance provided in the Joint Service Specification Guides (JSSGs).
- Military missions today are often unlike those tomorrow; consider how to include mission use flexibility in the design without adding undue cost.

Notes and Assumptions

Assume an entry into service of 2025 when making technology decisions; critical technologies should be at TRL 8 or above

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 sized aircraft based on the requirements and design objectives given. This should describe or represent the quantitative justification for the sized wing area and selected power or thrust of the aircraft designs.
2. An analysis of the performance of the aircraft against the design and long-range ferry missions.
3. Aircraft performance summaries shall be documented and the aircraft flight envelopes shall be shown graphically.
4. A V-n diagram for the aircraft with identification of necessary aircraft velocities and design load factors.
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 aircraft. The maximum dive speed of the aircraft shall be specified.

6. Complete geometric description, including dimensioned drawings, control surfaces sizes and hinge locations, and internal arrangement of the 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) limit 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. Crew (seats, etc.)
 5. Payloads (weapons, armament, ammunition, etc.)
 6. 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, military airworthiness certification, production tooling, facilities and labor
 - Estimate the acquisition (or “fly away”) cost of the design for procurement lots of 50 aircraft.
 - Estimate of operating cost for the aircraft assuming 1,200 flight hours per year in a mixture of training, ferry, and operational flights.
 - 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 Sky Sartorius at sky.sartorius@gmail.com.

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

Reference Material

Military specifications, guides, and handbooks can be found online through a variety of web sites, including www.everyspec.com.