EAS4710 | Spring 2021 | Group 1

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Attack of the Gators
A-11 Rooster

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Summary

Our design is an affordable light attack aircraft meant to operate from short, austere fields to provide close air support to ground forces, tasks typically done by attack helicopters. Our team designed a twin turboprop aircraft carrying 3,000 lbs of armament including rockets, missiles, bombs, and an integrated gun. The Rooster features mid-mounted, unswept wings with a single slotted flap at the trailing edge. The aircraft also features a horizontal and vertical stabilizer to provide adequate stability. The plane is controlled via a fly-by-wire system with a backup cable system, and the plane brakes with a hydraulic disk-brake.

Other requirements include a service ceiling over 30,000 ft, two ejection seats, a service life of 15,000 hours over 25 years, and considerations for survivability, while providing a low-cost product.

Armaments

The aircraft has a total of 6 hardpoints to carry armament for the designed mission, with three located on each wing. The innermost hardpoints between the wing and fuselage are designed to carry 500lb Mk-82 gravity bombs. The remaining 4 hardpoints are located outboard of the engine nacelle, which allow the aircraft to carry 2 pairs of AGM-65E or AGM-114 air-to-ground missiles, as well as AIM-9X sidewinders for hostile air targets.

Mounted in the lower left of the fuselage is the GAU-22/A 25mm cannon. The aircraft will carry 500 rounds of armor-piercing explosive rounds, allowing for 18 seconds of sustained fire.

Performance Metrics

Our aircraft has a range of 1435 nmi, 235 nmi over the AIAA requirements. The A-11 Rooster has a takeoff distance of 3,000 feet and a landing distance of 3,550 feet, both of which are under the 4,000 ft requirement. Attack of the Gators' aircraft has a maximum speed of 506 ft/s, or 345 mph. The aircraft has lateral, longitudinal, and directional static stability according to our stability analysis, ensuring stable flight during missions.

Wings and Tail

The rooster's wing utilizes a NACA 6412 airfoil, achieving a max lift coefficient of 1.71 and an L/D ratio of 136.6 at a five-degree angle of attack. The wing itself was designed with zero sweep due to the aircraft's low subsonic speeds and turboprop engines. Additionally, the wing was developed to have a taper ratio of 0.4 with the root chord length being 14 ft and the tip chord length being 5.6 ft, an aspect ratio of 9.07, a dihedral angle of 2 degrees for lateral stability, a wingspan of 40 ft, and a total reference area of 397 ft^2.

The rooster's tail was designed to provide adequate stability during flight operations in a conventional configuration. The 116.9 ft^2 horizontal stabilizer is mounted with a five-degree incidence angle and utilizes a NACA 2412 airfoil with a total span of 22.55 ft as well as an elevator with a total span of 20.32 ft. The 68.5 ft^2 vertical stabilizer utilizes a NACA 0012-34 airfoil with a span of 8.00 ft as well as a rudder with a span of 7.20 ft.

Cost Estimation

Part	Cost
RDT&E + Flyaway	$2,224,350,000
Fuel Costs	$301,514 / Yr
Crew Salary	$202,304 / Yr
Maintenance Cost	$819,120 / yr
Total	**$2,224,350,000 + $1,322,938 / Yr**

Propulsion

Our team chose two turbo prop engines. This will reduce the infrared signature of the aircraft, the risk of FOD damage from an austere field, and cost, while still performing the required mission.

Our aircraft will utilize two PT6-A-68B engines, one mounted on each wing. These engines provide 1600 HP each, which provides a total HP of 3200. This satisfies the required takeoff horsepower of 2600. The extra horsepower was selected to account for extra weight after refining the estimated takeoff weight. Our propeller design consists of 4 blade with a diameter of 7.6 ft. The propeller blades use an EPPLER-E856 airfoil, due to its design lift coefficient being 0.5, designed to operate at 2000 rpm at cruise.

Safety

This aircraft contains many safety features as keeping the crew alive is our top priority. This includes but is not limited to the following: A weapon system officer (WSO) can land the aircraft if the pilot is unable to do so. The cockpit is enclosed in a one-inch-thick Ti-6Al-4v Titanium-Aluminum alloy bathtub, protecting the crew from below and behind. The front part of the canopy consists of bullet proof material. Two engines incase one fails, and a self-healing fuel tank. The fuel is stored in the fuselage away from the engines in case of fire, reducing the risk of fuel igniting a hot engine. Firewalls and fire suppression systems are present around the engine, fuel tank, and fuel lines. The aircraft is also equipped with an oxygen generating system and ejection seats.