EAS4710 - Group 2 – Spring 2021

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Swamp Hopper
Light Attack Aircraft

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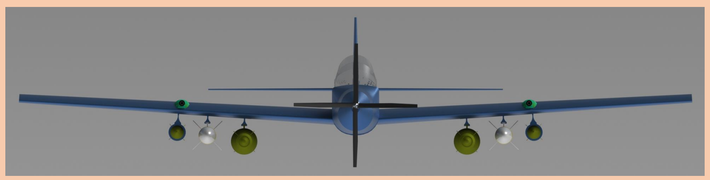
Abstract

The Swamp Hopper Light Attack Aircraft was designed to operate from austere fields near the front lines to provide air support to ground forces at short notice while being affordable and capable of carrying over 3000 lbs. of armament. Furthermore, the aircraft is designed to take off and land over a 50 ft obstacle in 2757 ft and 3150 ft on semi-prepared runways, respectively.

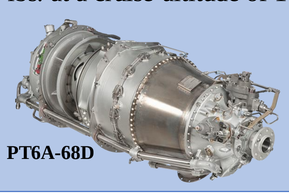
Wing Characteristics

The wing was designed in a way to achieve the performance goals of fuel efficiency, maneuverability, and stability. A NACA 63412 airfoil was selected over other designs due to an optimized range of efficient lift to drag coefficients. Moreover, a low mounted cut-off wing design was chosen to increase maneuverability and lift while reducing drag. In addition, a small dihedral angle of 4° and wing sweep of 5° were utilized to laterally stabilize the aircraft during flight. A wing incidence angle of 2° was implemented to minimize the amount of drag during cruise. A wing twist of -3° was chosen to prevent possible tip stall. A taper ratio of 0.5 was used to directly affect the lift distribution along the wing.

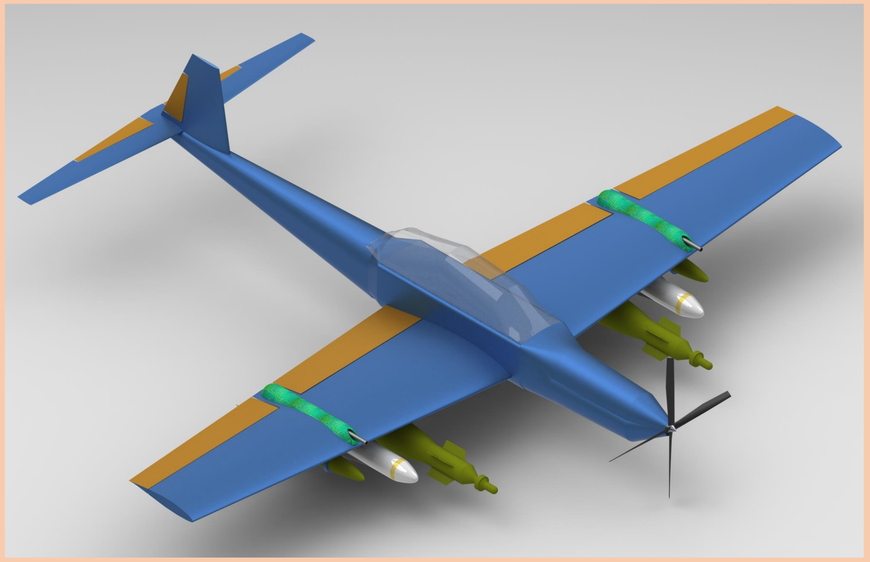


Propulsion

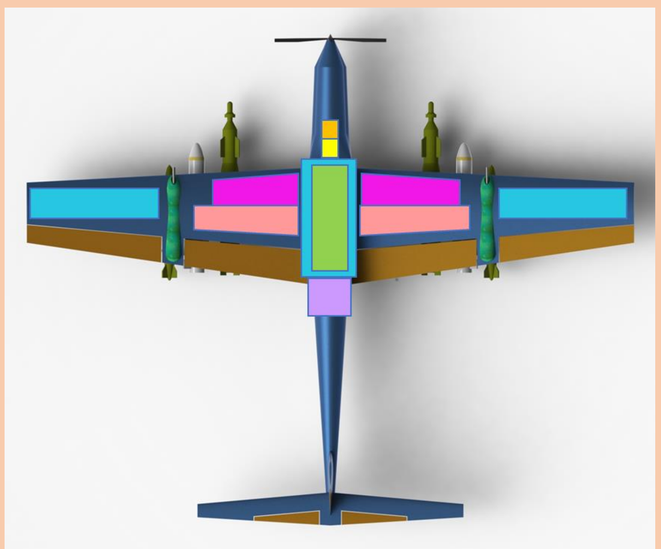
The propulsion system of the aircraft is characterized by a Pratt and Whitney Canada PT6A-68D turboprop engine rated at 1600 hp, which provides a thrust of 4050 lbs. at a cruise altitude of 10,000 ft



PT6A-68D



Subsystems and Flight Control System



- Avionics
- Fuel Tanks
- Electrical
- Hydraulics
- Auxiliary Power
- Pneumatic / ECS
- Landing Gear Storage
- Control Surfaces

Cost Estimation

- Operations and Maintenance Cost Per Year (Total: $2,434,914.05)
  - Maintenance Cost - $1,290,197.67
  - Fuel Maintenance Cost - $399,268.84
  - Crew Salaries - $745,447.54
- RDT&E Cost Per Aircraft (Total: $11,132,255.77)
  - Engineering Cost - $4,261,587.43
  - Tooling Cost - $2,318,794.91
  - Manufacturing Cost - $3,969,977.18
  - Quality Control Cost - $581,866.28
- Flyaway Cost Per Aircraft (Total: $3,127,525.28)
  - Development Support Cost - $1,171,731
  - Flight Test Cost - $899,908
  - Manufacturing Materials Cost - $1,060,981
  - Engine Production Cost - $4,905.28

Static Stability and Control

After designing the control surfaces, wing, and tail, the static stability of the aircraft was verified by taking the derivatives of the pitch, yaw, and roll moment coefficients.

Cmα = -0.648 **Cnβ = -0.138** **Clβ = 0.138**

Armament

The aircraft was designed to carry an overall ordnance load of approximately 3,100 lbs. Equipped with two integrated FN® HMP400 Pod utilizing the M3P .50-caliber machine gun, giving the aircraft high air to air combat capability. In addition, the aircraft is equipped with two Mark 82 Bombs, GBU 12 Pathway II Bombs, and AGM 65 Maverick Missiles carrying a total explosive load of 3024 lbs. This makes the Swamp Hopper light attack aircraft well suited for air to ground interception missions with the ability of utilizing dumb firing and laser targeted methods.

GBU 12 Pathway II Bomb

Mark 82 Bomb