T-16 SEAL Advanced Pilot Trainer

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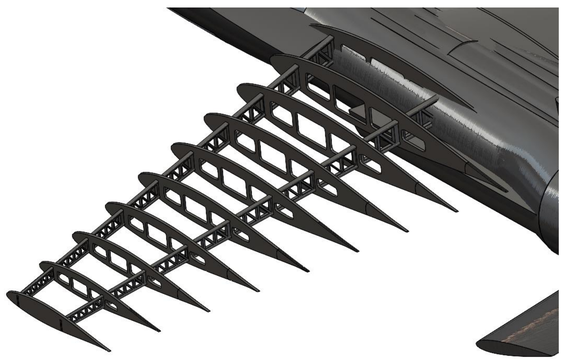
INTRODUCTION

- **Research Question:** How can we design an advanced jet trainer that prepares pilots for high-performance fighters like the F-16, F-22, and F-35?
- **Background:** Existing trainers face limitations in maneuverability and system fidelity. Modern fighters demand a training platform closer to real-world dynamics.
- **Why It Matters:** Training with a realistic and agile platform bridges the gap between basic flight skills and operational fighter readiness.
- **Context:** Inspired by the F-16, T-7, and T-100, the T-16 SEAL emphasizes maneuverability, durability, and ease of maintenance.
- **Visual Approach:** 3D CAD models, wing structure schematics, and performance charts showcase the development.

METHODS

- **Preliminary design:** Focus on maneuverability and transonic speeds; initial weight estimate ~13,000 lbs.
- **Configuration development:** Wing layouts and aerodynamic features iteratively refined.
- **Component selection:** Twin rear-mounted F124-GA-100 engines; NACA 63-212 airfoil.
- **CAD modeling:** Detailed 3-view drawings including CG location and stability analysis.
- **System integration:** Life Cycle Cost (LCC) analysis, system requirements, and SRD compliance.
- **Structural design:** Aluminum I-beam spar wing structure with ribbed support; optimized for weight and strength.
- **Testing parameters:** Stability & control derivatives calculated; aerodynamic modeling at 0.4 Mach at sea level.



RESULTS/DISCUSSION

Key Design Features and Benefits:

- **Twin Rear-Mounted Engines:**
  - Aerodynamic efficiency
  - Reduced noise in the cockpit
  - Stable OEI performance
- **Leading Edge Strakes:**
  - Vortexes reduce flow separation
  - Increase control authority and prevent stall
  - Reduce shock wave interaction
- **High Lift Devices:**
  - Improved takeoff and landing performance
  - Enhanced Low-Speed Control
  - Low Static Margin Shift
  - Static Margin only shifts backwards by 0.61%

Key Performance:

- Maximum Sea Level Thrust: 5,890 lb x2
- Thrust-to-Weight Ratio: 0.75
- Top Speed: Mach 0.91 (sea level), Mach 1.16 (40,000 ft)
- Service Ceiling: 60,000 ft

Takeoff/Landing:

- Takeoff Distance: 1,730 ft (8,000 ft runway)
- Landing Distance: 3,455 ft
- Stall Speed: 59 kts

Stability and Control:

- Static Margin: ~5% MAC (full)
- Dutch-roll and short-period modes meet all stability requirements.

Life Cycle Cost:

- Development + Test Subtotal: ~$2.08 Billion
- Production Unit Cost: ~$22.17 Million

CONCLUSIONS

- The T-16 SEAL meets all advanced trainer requirements, offering realistic flight dynamics and operational fidelity.
- Twin-engine rear-mounted design optimizes noise reduction, aerodynamic efficiency, and safety in engine-out scenarios.
- High-thrust engines and vortex-generating features enable exceptional maneuverability.

REFERENCES

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- Roskam, J. Airplane Design Series.
- Honeywell Aerospace F124 Engine Data.
- NASA Strake Design and NACA Airfoil Databases.

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3D CAD Design