

Ducted Fans



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Overview

- What is a Ducted Fan
- Aircraft that use them
- Other Applications
- Pros/Cons



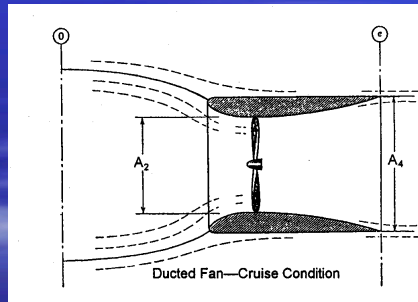
MSU "Marvel" Super STOL Plane

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What is a Ducted Fan?



Essentially a ducted fan is a shrouded propeller, designed in a way that will improve propulsive efficiency and possibly reduce noise.



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Aircraft that Use Ducted Fans

- Seaplanes, Flying Boats, Amphibians
- WIG (Wing-in-Ground Effect) Craft
- Compound Helicopters
- STOL & VTOL Aircraft
- Autogyros
- Airships



Avian 2/180 Gyroplane

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Moller M400 Skycar

Passengers:4

Top speed @ 13,200 ft:375 mph

Cruise speed @ 20,000 ft:275 mph

Maximum rate of climb: 6,000 fpm

Maximum range: 750 miles

Payload excluding fuel: 750 lbs

Operational ceiling: 36,000 ft

Gross weight: 2,400 lbs

Engine power (2 min. rating): 1,200 hp

Fuel consumption: approx. 20 mpg

Fuel: Ethanol

Dimensions (LxWxH): 19.5' x 8.5' x 7.5'

Takeoff and landing area: 35 ft dia

Noise level at 500 ft (Goal): 65 dba

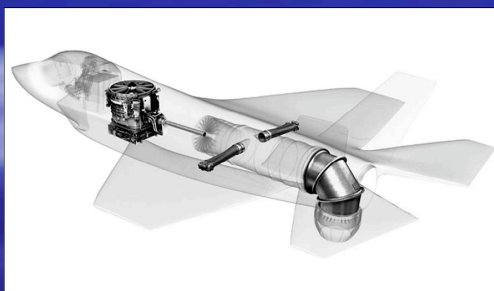
Vertical takeoff and landing: yes

Emergency parachutes: yes



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JSF



Fan: 2 stage counter rotating, 20000 lb vertical thrust

Total Vertical Thrust: 40000 lbs

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Vanguard Omniplane



Length: 25 ft
Wing Fans: 6ft Diameter Variable Pitch, 3 Blades,
 Louvers Close for Horizontal Flight
Engine: Lycoming O-540-A1A 265 hp
Horizontal Propulsion: 5ft Diameter Ducted Fan
Wings: Modified NACA 4421
 240 ft² wing area
Later Mods: 860 hp Lycoming YT53-L-1 Turboshift
 5ft fan added to nose

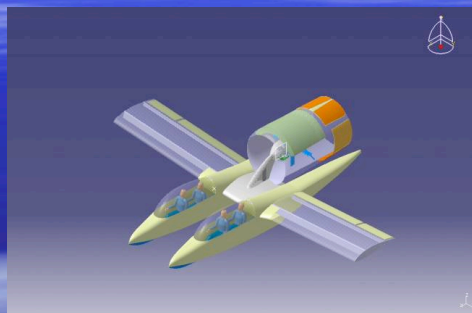
GE-Ryan XV-5A Vertifan

Length: 44 ft
Span: 30 ft
Fans: 5 ft diameter wing fans, smaller fan in
 nose, 16000 lb vertical thrust, 31% excess power
Weight: 7000 lb empty, 12200 lb gross
Problems: Large volume and weight of lift
 system, slow control response, narrow transition
 corridor



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329 Amphibian

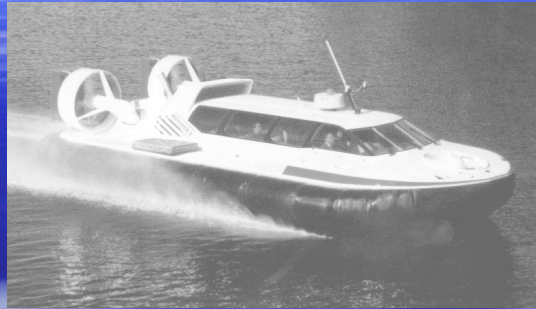


Length: 17.91 ft
Span: 33.6 ft
Fan: 4-Blade, 6-inch chord, 5-foot
 diameter prop. The pitch angle is
 set at an angle such that the prop
 will absorb 210 HP or 70% power
 at 200 MPH in the forward
 direction.
Weight: 3524.7 lb (GTOW)
 2125.01 lb (empty)
Advantages: The duct provides
 vectored thrust which increases
 propulsive efficiencies while adding
 to lateral and longitudinal stability.
Noise: The duct surrounds the prop
 which reduces noise caused by tip
 effects.

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Other Applications

Airboats and Aircushion Vehicles (Hovercraft)



Airlift 1060P



Aircraft File

Hiller 1031 Flying Platform

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RAH-66 Comanche



Tail Rotor of the Eurocopter Dauphin

Helicopter Applications

- Ducted fans used as tail rotors reduce turbulence and vortex shedding that occurs on rotor and propeller blades.
- Doing this will increase the aerodynamic efficiencies of the rotor blades.
- In addition, the shroud serves as a protective barrier to ground crews, as well as protecting the rotor itself.

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Pros

- Noise reduction
 - Propeller run under optimum conditions, reduces 'buzz'
 - Can put various acoustic treatments in the Duct
- Propulsion
 - Fewer design compromises, a Duct performs near its ideal operating point throughout the aircrafts speed range.
 - If shaped correctly the Duct can yield additional Thrust

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Cons

- Hard to design/optimize for a large range of speeds
 - As speed range widens inlets and outlets must be fitted for Variable areas
- Expensive
- Heavy
- Can not autorotate

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