

The M200G Volantor

A revolutionary 2-passenger VTOL ground effect vehicle



THE MOLLER VOLANTOR

Over the past 30+ years Moller International and its predecessor companies have been working on the development of the technologies required for a new class of vehicles called volantors.¹ The M200G will be the first of these vehicles, a vertical take off & landing (VTOL) fast, low-cost personal recreational vehicle.

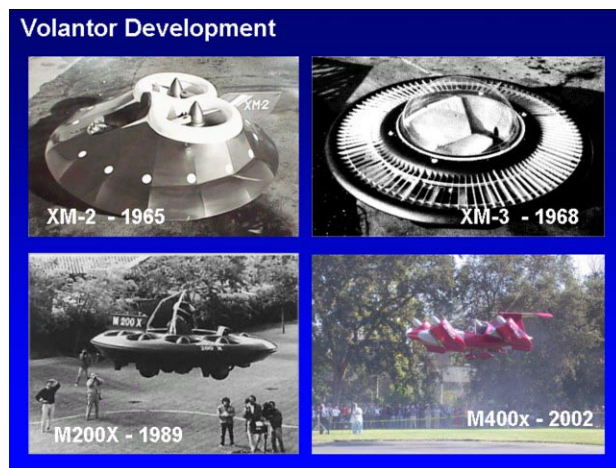
The multipurpose M200G can operate up to 10 feet above any surface: land, water, sand, snow, swamp or grasslands. It can be used like other recreational vehicles, combining the capabilities of a boat, hovercraft, ATV, snowmobile or other off-road vehicle. It also has the hover and vertical take off and landing capabilities of a helicopter and the

dangerous exposed rotor blades and high maintenance costs of rotary-winged aircraft. The vehicle uses state-of-the-art fly-by-wire computer technology to monitor, control and maintain stability of the vehicle, while simultaneously making it simple and easy to operate.

ENVIRONMENTALLY ATTRACTIVE

Low noise is clearly necessary for a recreational vehicle to operate in noise sensitive areas. The volantor's multiple ducted fan arrangement is designed to generate low fan noise with its modest disc loading and tip speeds. Hover tests with earlier models have demonstrated a noise level of 85 decibels at 50 feet, less than 30% of the noise level produced by a Cessna 150 aircraft during take-off. The company's on-going work in mutual noise cancellation is expected to further reduce the noise level in the M200.

M200 Volantor Performance Specifications	
Max speed	100 mph
Cruise speed	75 mph
Range	100 miles
Payload	250 lbs
Size (Diameter x Height)	10' x 3'
Fuel	Ethanol/Gasoline



The Rotapower[®] engine used in the volantor has demonstrated the ability to meet the Ultra Low Emission Vehicle (ULEV) standards without exhaust after-treatment. However the preferred fuel for the volantor is ethanol, which provides even lower NO_x, HC, CO₂, and CO emissions.

SAFETY

The most important attribute of any recreational vehicle is safety. The design of the volantor incorporates a number of safety features including:

- **Multiple engines**—The volantor has eight fans, each being driven by a computer controlled Rotapower engine. All engines operate independently and allow for a vertical controlled landing should any one fail.

ability to leap over barriers and other obstacles. Its ducted fans provide lift and propulsion without the

¹Volantor—A vertical takeoff and landing aircraft that is capable of flying in a quick, nimble and agile manner.

- **Multiple computers**—For redundancy the volantor uses a voting computer system to manage stability and control.
- **Rotapower engines**—Wankel-type rotary engines are very reliable as a result of their simplicity. The three moving parts in a two rotor Rotapower engine are approximately seven percent of those in a four-cylinder piston engine.
- **Enclosed fans**—Each fan is fully enclosed to greatly reducing the possibility of injury to individuals near the aircraft.
- **Automated stabilization**—Since computers control the stability during operation, the only pilot input is speed and direction. Rate of climb and altitude are selected by the operator and maintained by the on-board systems.
- **Low risk fuel**—When fueled by a mixture of 70% ethanol – 30% water, this combination will barely ignite outside the engine. It then burns very slowly for a short time before extinguishing itself as the ethanol reduces and the water remains.
- **Air-bags**—will be used extensively surrounding occupants in the cockpit.
- **Failure tolerant design**—Able to tolerate one engine failure during hover. A second failure will lead to a survivable hard landing.
- **Puncture resistant fuel tanks**—Racecar-like impact-resistant fuel tanks will be used.
- **Active fuel monitoring**—Redundant fuel level warning system will be incorporated.
- **Advanced composite fan blades**—Damage resistant composite fan blades will be used based on the Company's proven experience.

By emphasizing simplicity, durability and redundancy, Moller is making safety an inherent attribute of this revolutionary aircraft.

PROJECTED PERFORMANCE

The M200G's performance is similar to that of a light helicopter, but is safer and potentially less expensive. The vehicle operates within ten feet above ground level. This limitation is imposed by the vehicle's on-board computer systems to ensure that it does not enter regulated airspace, and thereby eliminates the requirement for extensive governmental oversight for either the construction or operation of the vehicle.



ENGINES

Moller International has acquired and developed proprietary technology enabling the company to manufacture high-performance, low cost Rotapower engines producing more than two horsepower per pound of engine weight. This power-to-weight ratio is essential for ducted fan VTOL applications such as the Skycar. The engine's round shape and small size allow it to be placed in the center of the duct behind the fan hub where it directly drives the fan without a gearbox, reducing weight and complexity.

WHY IS A PRACTICAL VOLANTOR NOW FEASIBLE?

Three current technologies govern the volantor's weight and, therefore, its viability.

- **Powerplants**—the Company's Rotapower® engines provide the required attributes for this type of aircraft. Their features include small frontal area to minimize duct drag, perfect radial balance to allow hard mounting, high power for a given weight and volume, a history of reliability, and most importantly, low cost per horsepower generated.
- **Materials and material processes**—composite materials can have strength greater than the strongest alloyed metals while weighing less than the lightest metals. Their use provides the opportunity to minimize airframe weight. Composite materials can be used to generate complex aerodynamic configurations with minimum tooling. They also provide inherent noise dampening.
- **Avionics**—the stabilizing computers, sensors, fly-by-wire controls, communications hardware, etc., achieve high performance at a reasonable cost. They must be lightweight, small, reliable, and require low power if they are to meet the goals of a practical volantor.

UNIQUE FEATURES

The M200G may functionally be thought of as a powered-lift aircraft, although it is constrained by its computerized control system to operate in close proximity to the ground. Vehicles operating within this zone are considered "ground effect" vehicles and are not subject to existing Federal Aviation Authority (FAA) regulations.

The M200G uses multiple thrust-generating ducted fans; each ducted fan is enclosed in a housing and provides thrust under the control of an independent flight control computer. This arrangement ensures that each fan will be available to provide stability and control during flight, and in the event that a controller, fan or engine fails, the others will maintain the vehicle's attitude until the M200G can be safely landed.

Sensors that measure angular rate, angular acceleration and attitude are used to determine the precise position and motion of the volantor in relation to the desires of the operator. This sensor information is used to electronically maintain stability and control by automatically adjusting power levels of each engine to decrease or increase local thrust as required.

Moveable vanes mounted under the ducts in a patented configuration deflect the thrust to control

the direction of travel: vertical, horizontal, banking, turns, etc. —no ailerons, flaps, nor elevators are needed—the speed of each engine determines the local, instantaneous thrust level while the vanes provide the local, less time-sensitive thrust direction.

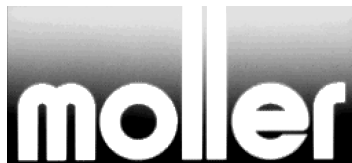
OPERATOR REQUIREMENTS

A volantor is not operated like traditional fixed or rotary wing aircraft. It has only two hand-operated controls that the operator uses to direct the redundant computer controlled system to carry out his or her desired maneuvers.

The left hand control twists to select desired operating altitude and moves fore and aft to select rate of climb and descent. The right hand control twists to select direction and moves side to side to provide traverse movement during hover and early transition. This same control moves fore and aft to determine speed and braking.

AVAILABILITY

The M200G is estimated to be available in 2008. Please see our web site (www.moller.com) for the latest deposit information and updates, or contact us via e-mail at updates@moller.com.



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