Freedom Motors & Moller International
Executive Overview

Executive Summary:

There are two multi-trillion-dollar world markets where the extraordinary power to weight ratio of the **Rotapower® rotary engine is uniquely viable.**

Air taxi market. Morgan Stanley predicts that the advanced air mobility (AAM) market will total $1.5 trillion by 2040 and $9 trillion by 2050. The AAM market will be dominated by air taxis. Existing piston engines have a very low power to weight ratio and cannot be used as a primary power source in this application [Morgan Stanley Study].

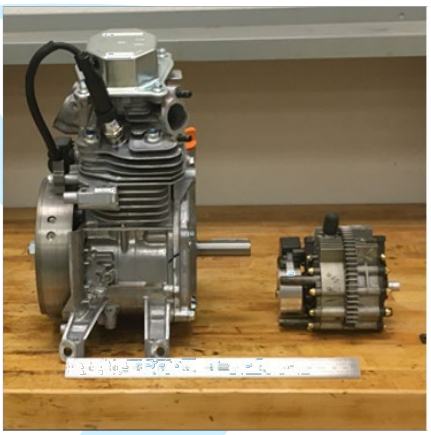
Portable engine market. Over 165 million non-automotive engines are produced annually worldwide. Most original equipment manufacturers (OEM's) consider power per weight ratio and its life as the most important engine requirements.

Marine engine comparison

Mercury engine HP/Lbs = 0.94

Rotapower® engine HP/Lbs = 3.33

2 & 3 Wheelers engine comparison



Predator engine HP/Lbs = 0.25

Rotapower® engine HP/Lbs = 2.45

The Air Taxi Challenge:

All air taxis utilize distributed propulsion patented by Dr Moller in 1971 (3614030). Distributed propulsion uses a number of smaller power plants in place of a single power plant to safely tolerate a power plant failure, It requires the power plant to have a high power to weight and power to volume ratio. During vertical takeoff and landing (VTOL) even a one passenger air taxi weighing 1000 pounds requires over 450 horsepower. Batteries and electric motors working together have the necessary high power to weight ratio needed for VTOL, but batteries possess a very low energy per pound. Consequently, a battery powered air taxi has a range of less than 37 miles [Review of Selected Advanced Air Mobility Aircraft]. Engines as a power and energy source present an entirely different problem. **Fuel has fifty times more energy per pound than a battery, however the lightest piston engine produces less than one horsepower per pound which eliminates its use during VTOL**.

In 1967 a revolutionary new engine was invented in Germany by Dr Felix Wankel. A number of these Wankel rotary engines were acquired by Moller Corporation (predecessor to Moller International (MI) and Freedom Motors (FM)) since they appeared uniquely adaptable as a power plant to be used with distributed propulsion. This engine was very under-developed but despite this, its power to weight ratio exceeded that of the lightest piston engine. **It also had a very high power to volume ratio which is a critical requirement for use with distribution propulsion.** In the following years, Moller Corporation created a

number of products that helped fund its air taxi and engine development as well as the production of various prototypes. Highly modified versions of the German Wankel engines were able to produce 1.4 horsepower per pound by 1982 with a power to volume ratio 7 times higher than piston engines.

Moller International:

Moller International was created in 1983 to design, develop, manufacture and market personal vertical takeoff and landing (VTOL) aircraft now referred to as air taxis. **To accelerate its engine development and production, MI was able to acquire the entire rotary engine assets of Outboard Marine Corporation (OMC), the only company besides Mazda Motors to put a Wankel rotary engine into volume production**. Acquired assets included production tooling, IP library and a large inventory of engines and parts. MI was also able to acquire the rotary engine assets of General Motors Corporation. (GMC) and those of Infinite Engine Company (IEC). **In effect MI was able to acquire the entire rotary engine assets of the only three companies in America that had developed or put rotary engines into production**.

The OMC rotary engine was a cost competitive recreational engine with a projected life of 500 hours. Collectively it had run for millions of hours with many engines exceeding 1000 hours. This 530cc engine became the foundation on which the MI Rotapower® rotary engine was built. MI continued the development and integration of numerous technologies required to produce a variety of air taxi configurations through electronic stabilization and control systems, efficient ducted fan designs, thrust vectoring mechanisms and aerodynamically stable composite airframes. **In 1989 MI demonstrated the world's first distributed propulsion air taxi before the international press**. It was powered by eight highly modified OMC engines producing over two horsepower per pound. This was followed in 2003 by a demonstration of its four passenger Skycar® 400 configuration, a more marketable air taxi.

Moller Skycar® 400 on ground and in flight

Moller Neuera® 200 on ground and in flight

MI remains the only company to have demonstrated air taxis using distributed propulsion powered by engines.

The opportunity. In 2023 over $ 4 billion was spent on the development of five to seven passenger air taxis and this is expected to double in 2024. Five to seven passenger air taxis must be FAA certified under Part 21. This can be expected to take many years and billions of dollars per model while this size air taxi is only useful in a ridesharing role on dedicated routes such as hotel to airport. At $7.5 to $ 10 million cost per air

taxi, each trip will cost at least $5 per passenger mile. Ridesharing air taxis will not be a significant contributor to the multi-trillion dollar air taxi market [The Future of Advanced Air Mobility Aircraft]. **76.4% of automotive trips carry one person and 7.5% carry two persons while ridesharing carries a declining 9%. It is therefore reasonable to assume that one and two passenger autonomous air taxis will dominate this future market. The FAA provides a much shorter and less costly path to approval for one or two passenger air taxis. MI has completed a one passenger airframe Skycar® 100X [Specifications] and is in preparation for installing compound 5-stroke Rotapower® engines that are in development by FM.**

Freedom Motors:

During the 1990s it became apparent that there was a substantial market for an engine with the attributes of the Rotapower® rotary engine for many applications in addition to air taxis. In 1997 Freedom Motors became a division of MI with exclusive rights to manufacture and market the Rotapower® engine for all applications except aircraft and ducted fans. In 2001 it became a separate C corporation.

Worldwide production of engines totals over 250 million per year. For over 60% of this engine market, power to weight ratio is the top priority This includes portable power equipment, gensets, drones, motor scooters/ motorcycles and recreational vehicles such as boats, snowmobiles, and all-terrain vehicles.

150cc Rotapower® engine genset weighs 65 lbs. and produces 15 Kw compared to Gillette genset weighs 395 lbs. and produces 13.5 Kw

Airforce Drone with 530cc Rotapower® engine weighs 110 lbs. with payload of 95 lbs. and 125 miles range

Hybrid car with 530cc Rotapower® engine in 0.94 Ft^3 lead lined enclosure producing 93 Kw

The Rotapower® engine has the following attributes. [FM Comprehensive Project Plan]

- Power to weight ratio over three times higher than the lightest 4-stroke piston engine currently available in the market.
- Power to volume ratio that is nine times higher than the lightest 4-stroke piston engine currently available in the market.
- Freedom from vibration.
- Meets California ultra-low emission standard.

- Has only two moving parts versus twenty-four in a 4-stroke piston engine.
- Carbon neutral when consuming numerous fuels like methanol and ethanol and carbon free with hydrogen and ammonia.

- With numerous patents issued and many others in process its technical expertise is well protected.
- Seals and wear surface life documented at over 20,000 hours.

FM has completed a beta production run of its 530cc and 150cc Rotapower® engines and demonstrated their performance in numerous applications including airplanes, jet boats, all-terrain vehicles, hybrid car, motor scooter, two and four passenger air taxis, gensets and various drones for US Army, Navy, and Airforce. FM has also licensed production of its 650cc Rotapower® engine for use in mud boats [The Toledo Blade Article].

The tooling acquired from OMC and GMC is entirely unique and was developed under a $125 million contract between GMC and Gleason Machine Works. Gleason refused to manufacture similar rotary engine production equipment. **Therefore, FM will manufacture engines for MI.**

Freedom Motors, Inc.
410 Gateway Plaza, Suite G
Dixon, CA 95620
Phone: +1 (916) 597 0403
Fax: +1 (530) 240 7460
Email: FM@Freedom-Motors.com

Moller International
410 Gateway Plaza, Suite G
Dixon, CA 95620
Phone: +1 (530) 760 7177
Fax: +1 (530) 240 7460
Email: Info@Moller.com