Rim-rotor Rotary Ramjet Engine

CAMUS Team:

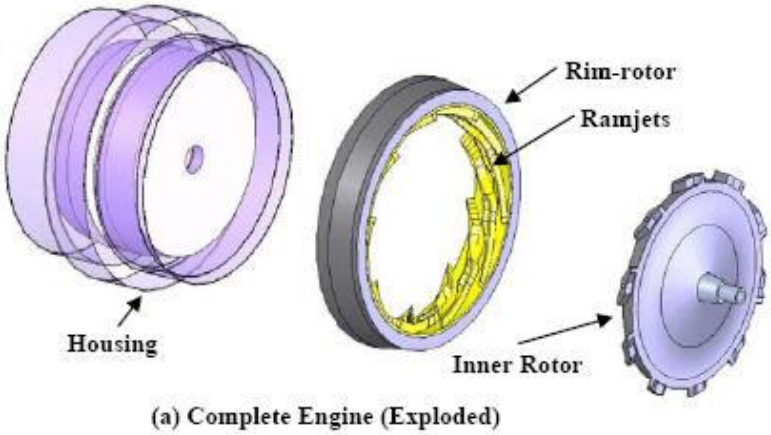
- Jean-Sébastien Plante (Director)
- David Rancourt (MS Student)
- Mathieu Picard (Future MS Student)

Collaborators:

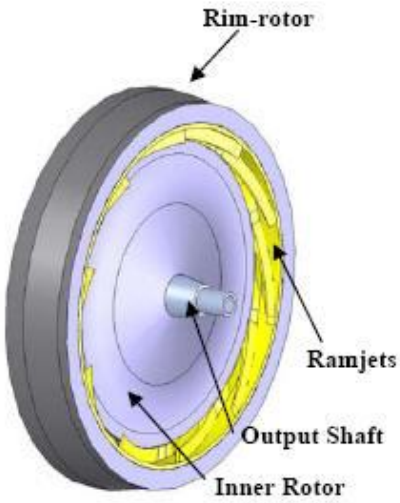
- Martin Brouillette, Locus
- Luc Fréchette, MEMSlab
- Ahmed Maslouhi,

Project:

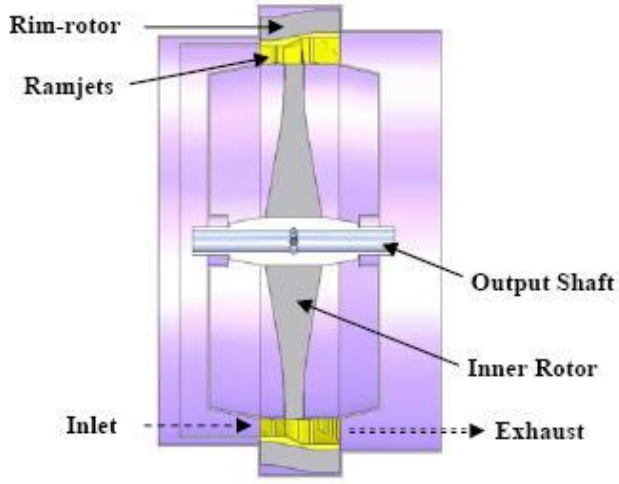
The research studies a new engine concept based on rotating ramjets. Ramjets are thrust producing supersonic engines with no moving part. In the proposed engine, ramjets are brought to supersonic speeds while being attached to a high speed rim-rotor flywheel. At tip speeds of Mach 3, the ramjets produce significant thrust and therefore deliver large amounts of rotating power:



(a) Complete Engine (Exploded)



(b) Rotating Assembly



(c) 2D Section View

Rim-rotor Rotary Ramjet Engine

This engine technology has high power-to-weight ratios (10kW/kg vs 1.6kW/kg for high power piston engines) and could be manufactured at relatively low production costs (similar to today's automotive turbochargers). Efficiencies are similar to piston engines (10-30%).

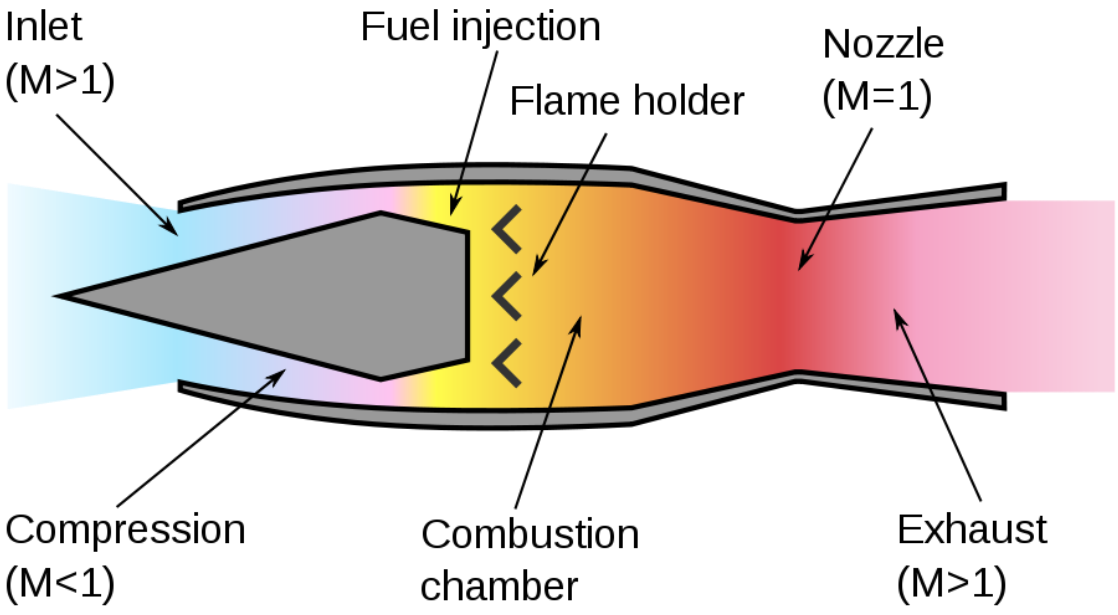
Rotary ramjet engines could be used in applications requiring large amounts of power and low system mass. One key application is for developing hybrid fuel cell power trains that could significantly reduce the cost of fuel cells powered vehicles. For exemple, a hybrid fuel cell system using the proposed engine would have costs of ~22$/kW compared to the actual costs of full fuel cell systems of ~73$/kW. Moreover, system weight and size would be about 3 times lower (from 163kg to 50kg and 114L to 31L), further improving fuel economy and easing vehicle design. The engine has multi-fuel capabilities and can operate on any kind of gaseous or liquid fuels.

The research aims to demonstrate the feasibility of the proposed technology by showing that a ramjet designed for the rim-rotor configuration can produce thrust and by showing that a representative rim-rotor engine can achieve rim speeds of Mach 3.

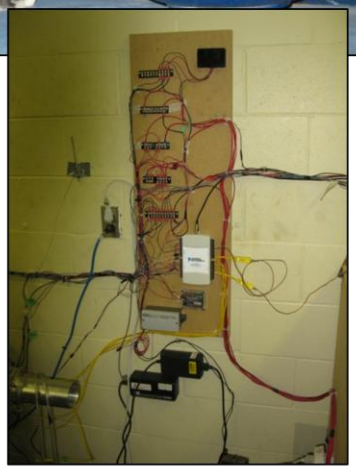
Sponsors:

- NSERC Strategic Grant

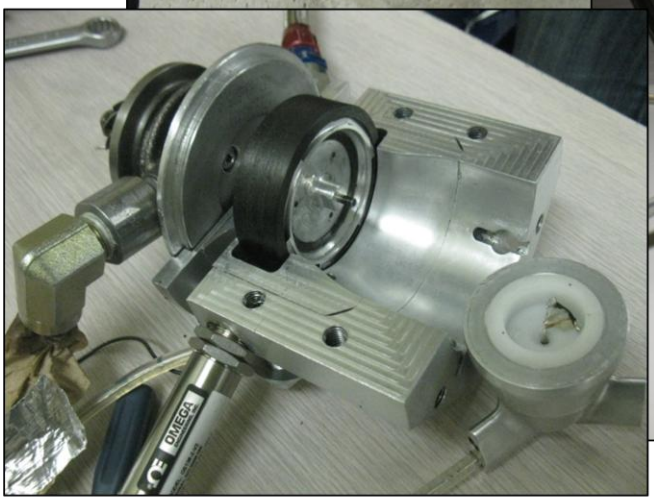
RAMJET PRINCIPAL (Wikipedia):



Rim-rotor Rotary Ramjet Engine



Prototype test bench



Design, validation, realization >> 1st R4E test!!

Infinity Project – Supermileage SAE 2011

The project

For their end of degree project, 14 students wish to design and build a single-seated vehicle with minimalistic fuel consumption. The aim is to maximise the output of a single liter of fuel to do 1500 km.

Our team

Projet Infinity is a team of fourteen students from the cooperative bachelor's degree in mechanical engineering at the Université de Sherbrooke. As well as the degree's curriculum, they have developed management, design and manufacturing skills thanks to several internships in the industry and implication in various technical groups, student associations and engineering competitions.

The members of Projet Infinity are passionate about it and are aiming high for the Supermileage competition!

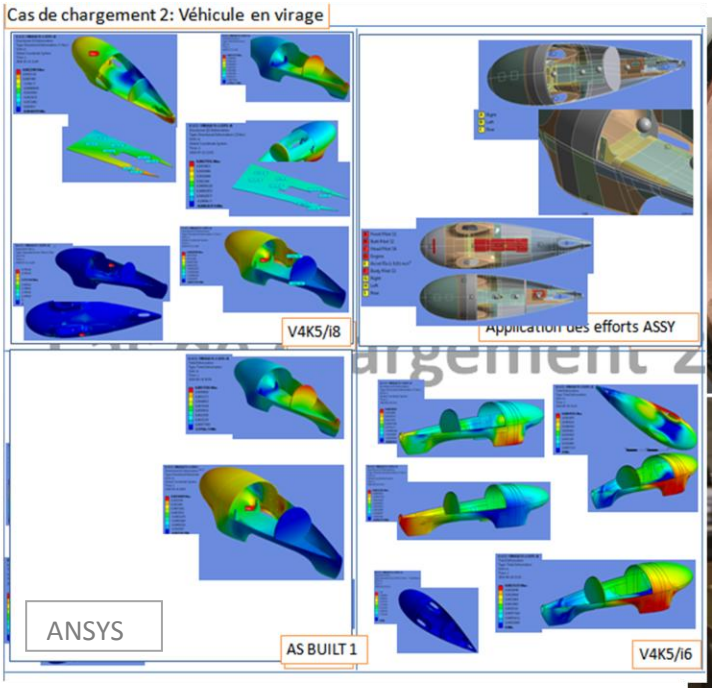
Competition

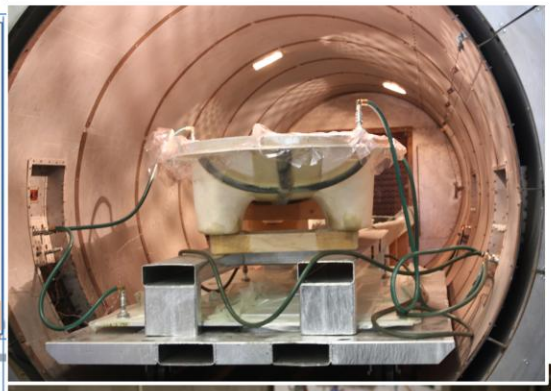
The supermileage SAE competition is held in Marshall, Michigan. For 2009, 45 teams have entered and more keep adding up every year.

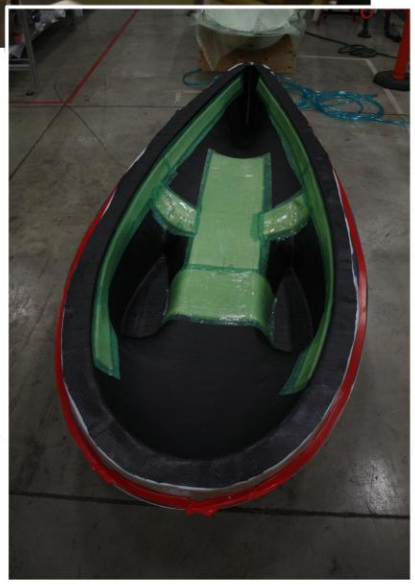
The main event at the competition is the endurance run, where teams are asked to complete six laps for a total of 15.5 kilometers to demonstrate the minimalistic fuel consumption of their vehicle. However, teams are also judged based on their team presentation, their technical report and the vehicle's design, in order to score a maximum of points to determine the winner of the competition.

Team Infinity's aim is to participate to the SAE competition in 2011 and have a fuel consumption of 1500 km/L. Considering that the current record is 1347 km/L, we are hoping to be part of the elite at this event.

Infinity Project – Supermileage SAE 2011







Carbon fibre monocoque frame

-External body shape optimisation (CFD)

- Drag coefficient < 0,13 (Car ~0,3)

- Complete structural design (FEA)

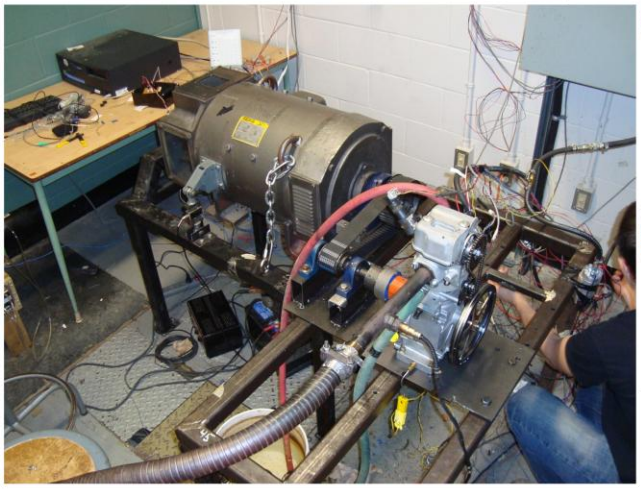
- Validation of deflection and failure

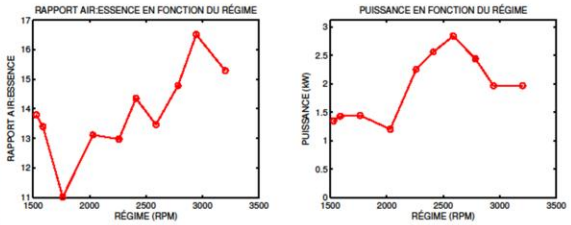
- Realization with aerospace methods

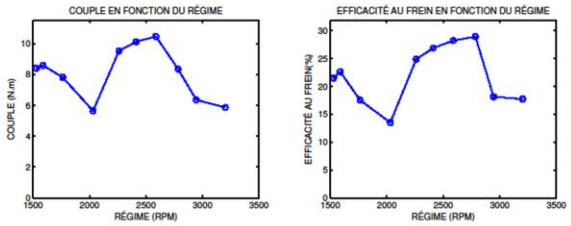
Design, validation, realization >>

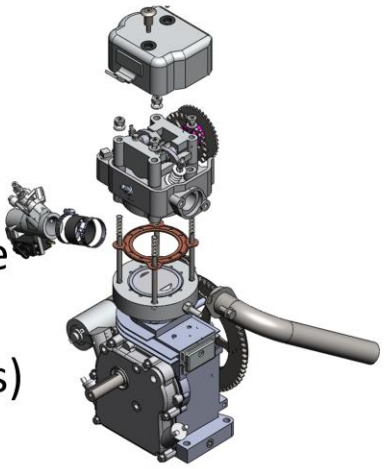
complete monoplace car frame of less then 14 kg

Infinity Project – Supermileage SAE 2011









Modification of the Briggs & Stratton Engine
- Complete new head
  - New cam profile (Ricardo Wave Analysis)
- New electronic system and software
- Cylinder & Piston coating (Thermal analysis)

Design, validation, realization, tests >>

150cc engine with brake efficiency over 28%

Baja SAE 2007, 2008 & 2009

The project

The Sherbrooke University's Baja SAE is an all-terrain-vehicle created by a team of engineering students. The team has to design, manufacture, assemble and test the vehicle in view of competing in international events grouping teams from around the world. These events are organized by the Society of Automotive Engineers (SAE).

The vehicle must be designed and built in accordance to the SAE's list of rules and regulations, including the obligation to run on a 10 hp Briggs & Stratton single-cylinder engine.

The team

The Sherbrooke University's team is composed of twenty or so full time engineering students. The entire team benefits from this hands-on, extra-curricular approach to design, manufacturing and management.

Competition

For every single team, competitions are the moment of truth. The vehicle's performance is evaluated and compared to that of the other teams' ATVs. Several tests are organized in order to judge the sound design of the vehicle's different components:

Reports : Design report and cost report

Statics Events: , overall design, aesthetics, innovation, marketability

Dynamics Events : Suspension, top speed, acceleration, braking, sled pull, manoeuvrability, hill climb, rock crawl (individual Bajas)

Eendurance Race: 4 hours long race on rugged terrain (all bajas)

Baja SAE 2007, 2008 & 2009

2009 Team leader, technical director
and suspension head designer

Results : 1st place in Alabama (among 70 universities)
4th place in Wisconsin (among 120 universities)

Baja SAE 2007, 2008 & 2009






2008 Chassis head designer & Driver
2007 Floatation designer

Results : 10th place in Tenessee(among 70 universities)
6th place in Quebec (among 120 universities)
Results : 1st place in Florida (among 60 universities)
2nd place in New York (among 140 universities)