# Study and Development of a Hydrogen Peroxide based Liquid Rocket Engine

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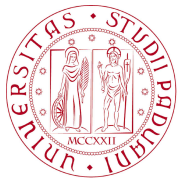
October $20^{th}$ 2017




# Why Hydrogen Peroxide?

$$H_2O_2 \leftrightarrow H_2O + 1/2O_{2(g)} + 98kJ/mol$$

## Main characteristics

- No toxicity
- High volumetric specific impulse
- Easy storable at room temperature

$\Downarrow$

Reduced management,storage and processing costs

HTP (High Test Peroxide)
Concentration $> 80\%$

Versatility:

- Monopropellant
- Bipropellant $\rightarrow$ combustion reaction with fuel

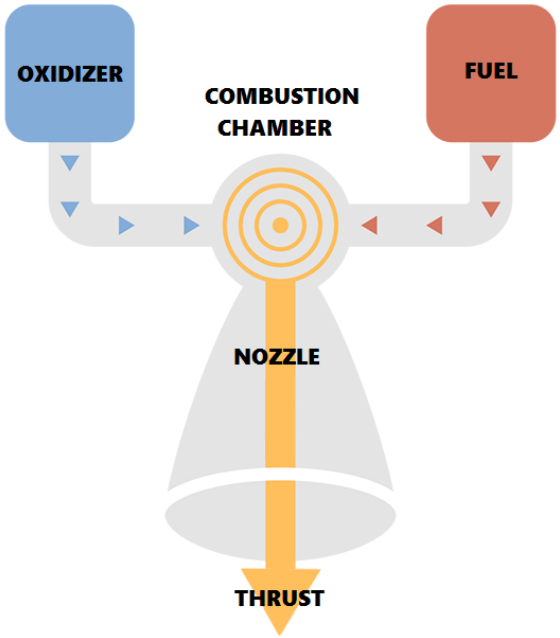
$\Downarrow$

$Isp_{MMH/N_2O_4} \backsimeq Isp_{HTP/RP-1}$

# CISAS knowledge

- Hybrid Rocket background
- HTP oxidizer
- Previous Liquid engine experience
- Equipped test facility

# Introduction to Liquid Rocket Motors




Main characteristics

- Oxidizer and Fuel stored in tanks
- Two controllable feeding lines
- Different Cooling system solutions

**Advantages**

- Operation flexibility
- Multiple shut down and re-ignition
- Mass flow throttling
- Mixture ratio control
- Long burning times

**Disadvantages**

- High manufacturing costs
- Technological complexity

# Cooling systems

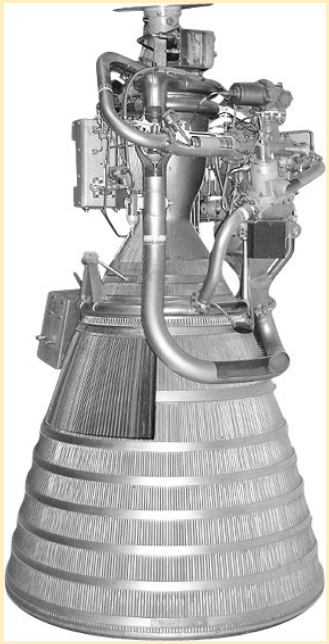
## Passive methods

- Very expensive exotic materials
- Ablative materials
- Small scale thruster

200N Bipropellant Thruster,Orbital Propulsion Centre, Lampoldshausen, Germany

## Active methods

- Regenerative cycle
- Technological complexity
- Larger scale engine



RL10, Aerojet Rocketdyne

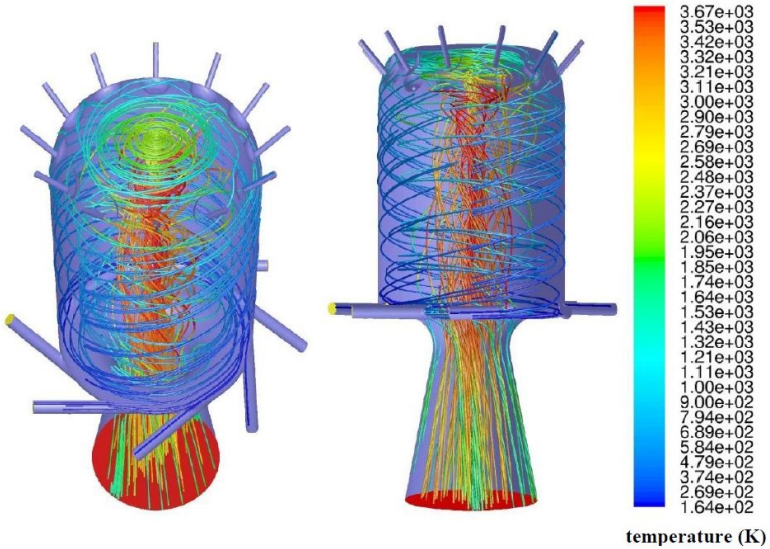
# PhD Project

## Liquid engine

- Oxidizer: HTP
- Fuel: Kerosene
- Vortex oxidizer injection
- Double Vortex flow field

## Achievements

- High combustion efficiency
- Cooled combustion chamber
- Low cost combustion chamber materials




CFD simulation, Chiaverini

## Future work

- Numerical CFD simulations
- Fire tests

Thank you! Any questions?