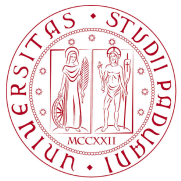
Study and Development of a Hydrogen Peroxide based Liquid Rocket Engine

Marco Santi

University of Padova
Centro di Ateneo degli Studi e Attività Spaziali "Giuseppe Colombo"

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

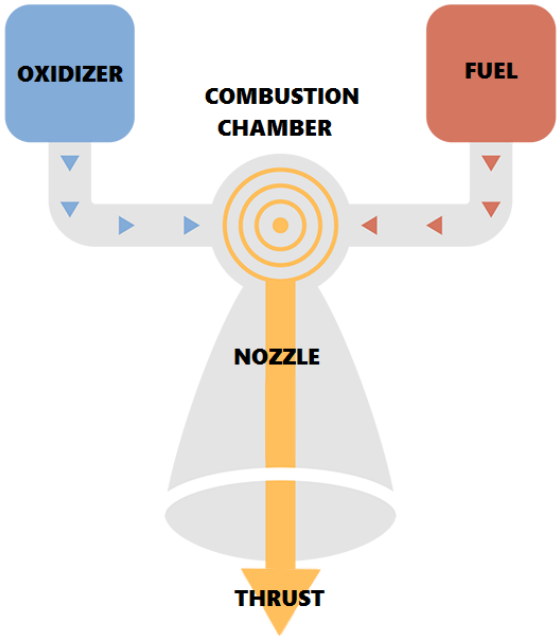
$\Downarrow$

$Isp_{MMH} \backsimeq Isp_{HTP}$

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

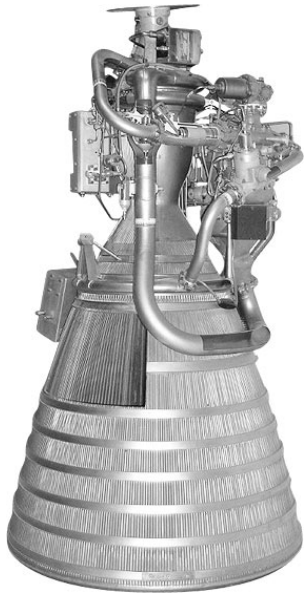
Passive methods

- Very expensive 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

- High combustion efficiency
- Cooled combustion chamber

Future work

- Numerical CFD simulations
- Fire tests

Thank you! Any questions?