

Space Propulsion 2016

Low Cost Liquid Propulsion Systems for Launch-, InSpace and SpaceTourism Applications

Dr.-Ing. Peter H. Weuta, Dipl.-Ing. Neil Jaschinski
WEPA-Technologies GmbH

Jägerstrasse 30 / 51375 Leverkusen / Germany
Phone: +49-151-11657345
peter.weuta@wepa-technologies.de

The development of low cost propulsion systems is a key component to enable private space flight.

An overview of the technology under development at WEPA-Technologies will be given. All propulsion systems focus on simple, cost effective design, high reliability and use of 'green propellants'.

Low cost propulsion will be realized by:

- 1) Simplified design of rocket engines and turbo pumps
- 2) Low-level operational parameters (< 60 bar chamber pressure)
- 3) Use of standard (non-exotic) materials and manufacturing technologies
- 4) Unification of design of propulsion systems for the first and second stages of launch systems via clustering
- 5) Environmentally benign and easy to handle propellant components as LOX / Ethanol or H₂O₂ - Kerosene (no NO₂ / N₂O₄ or Hydrazines)

The development of propulsion technologies at WEPA-Technologies does encompass thrust chambers, injector systems and turbo pumps.

At present the activities are focussed on a turbo pump fed, 35 kN thrust demonstration unit (50 bar chamber pressure) using LOX / Ethanol respective H₂O₂ / Kerosene.

An update about the development activities will be discussed in detail and are focussed on the following areas:

- cryogenic and non-cryogenic turbo pumps (~ 75 bar exit pressure)
- thrust chambers (regeneratively cooled)
- injector systems
- concentration systems for Hydrogen Peroxide production (~50 % => up to 98 %)

H₂O₂-based propellants significantly facilitate development and reliable operation of propulsion- and overall systems architecture – key advantages can be summarized as follows:

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- simplified system design and increased responsiveness due to non-cryogenic characteristics of the storable propellants used
- reliable ignition / operation due to (quasi) hypergolic ignition
- facilitated reusability of propulsion systems due to low combustion temperature
- environmentally benign oxidizer

Taking into account these advantages, WEPA-Technologies considers the use of Hydrogen Peroxide to be one very attractive option to enable fast track development of propulsion systems. In addition to launcher- and sounding rocket applications, utilizations in the field of re-usable space planes may be well suited to H₂O₂-based propulsion systems.

As low leadtime availability of Hydrogen Peroxide even at a concentration level of 87,5 % is not always given and high performance concentrations up to 98 % are - if at all - available under severe legal restrictions only, WEPA-Technologies does offer custom designed concentration plants.

Stationary plants delivering up to 90 % are available on a commercial basis at present and can be visited at a customer's site (capacity: ~ 50 kg / d). Process technology to deliver up to 98 % is under development and will be available by late 2016. Safe and fully automatic, 24 h operability are key features of the plants.