

# Tiago Pardal

FCT/AdI – Trainee Scholarship

Location: ESA/ESTEC

Period: 10/2002 to 1/2005

Sections:

- General Studies and Advanced Concepts
- Propulsion
- Technology Transfer

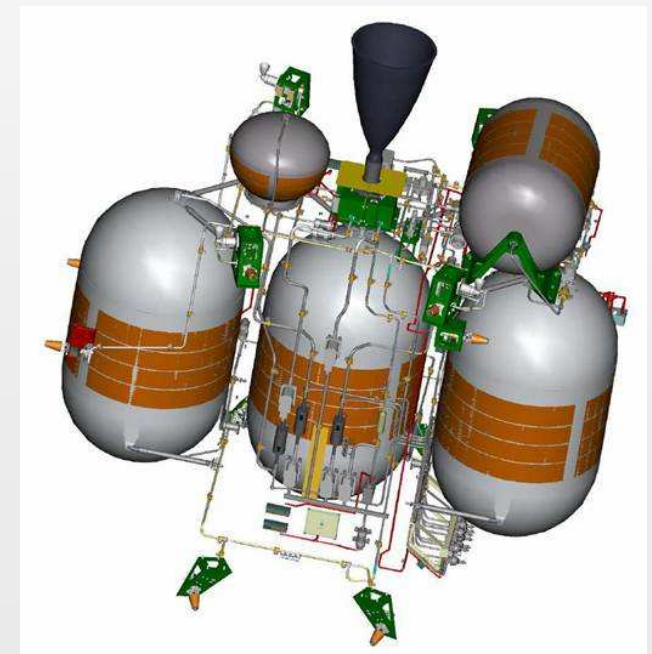
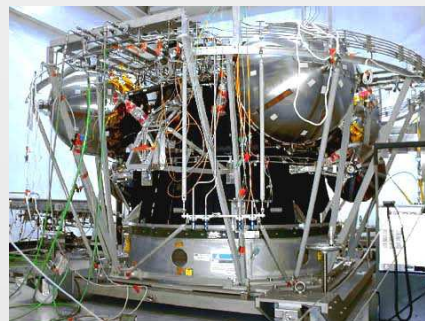
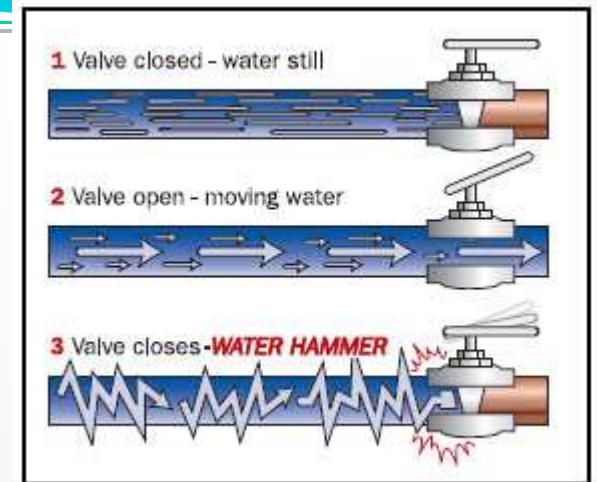
April 30<sup>th</sup>, 2010



# Work Plan - Propulsion Section

## • Water Hammer effect on spacecraft propulsion systems

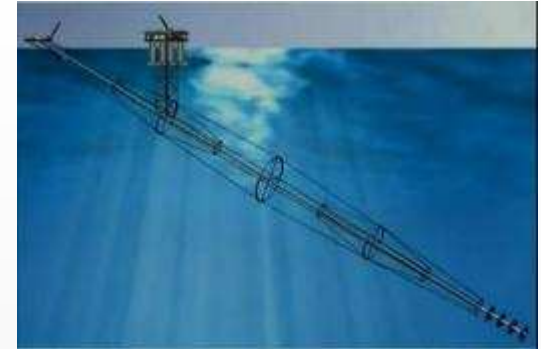
- Problem: Shock waves can burst tubing at start-up when it is flooded with propellant.
- Solution: Simulate the transient mode and its pressure evolution



# Work Plan – Advanced Concepts

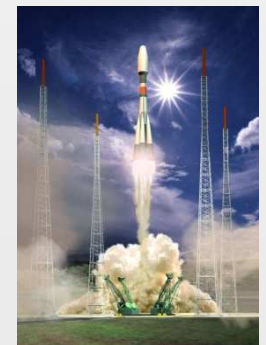
- **Nuclear waste disposal into Space**

- Economical and Political feasibility of Geological depot *versus* Ocean Scattering *versus* Space Disposal



## Space Disposal Possibilities:

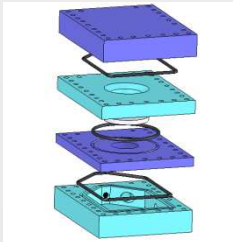
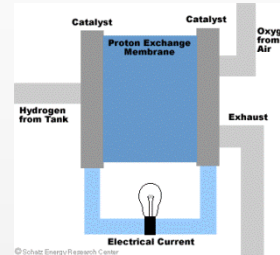
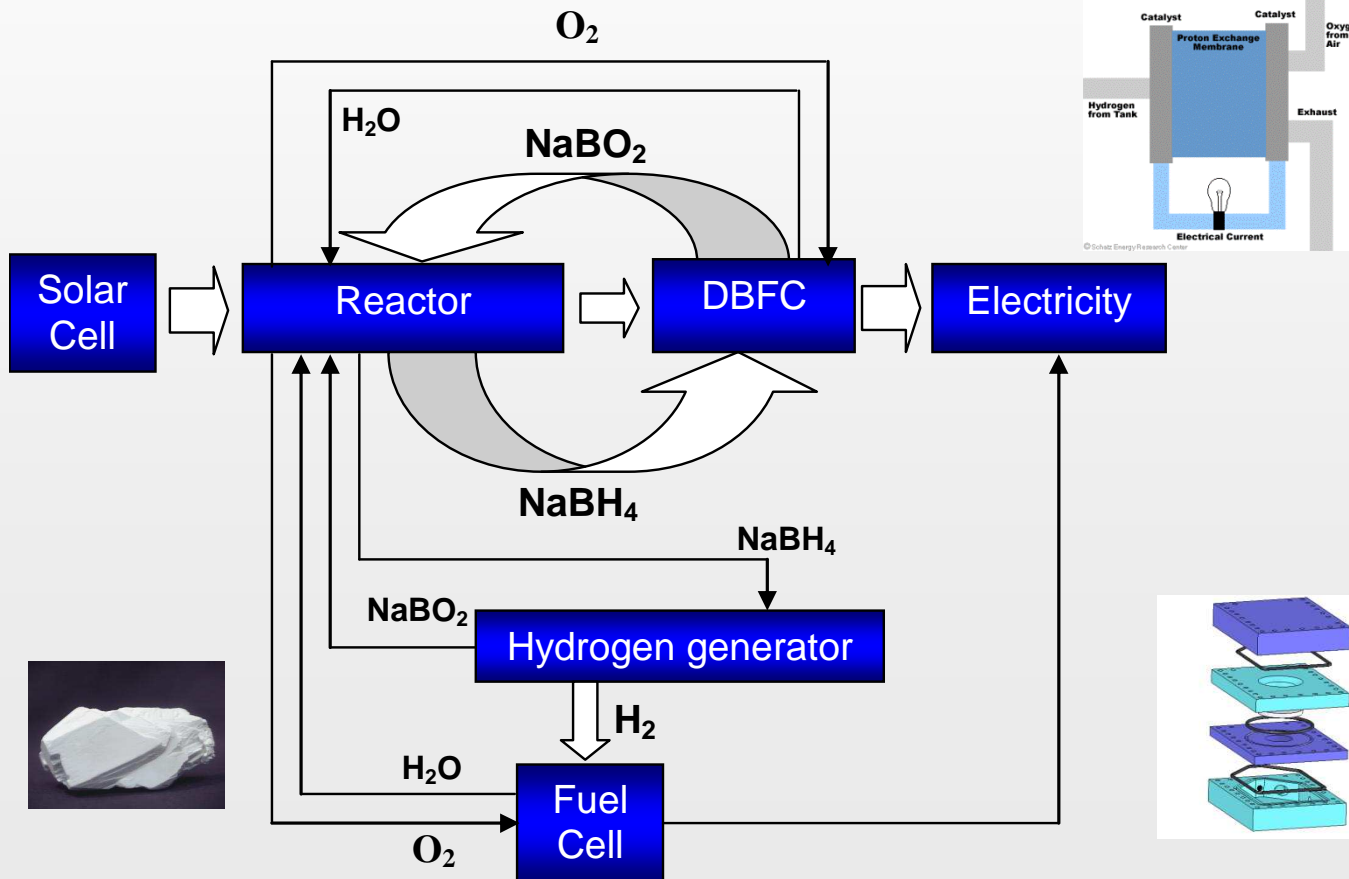
- Dawn shot with coil or rail gun at parabolic escape velocity from Solar system
- Launcher with emergency safe capsule with destination Earth Orbit *versus* Moon *versus* Solar Orbit



# Work Plan - Technology Transfer

## Reversible Energy/H<sub>2</sub> storage through NaBH<sub>4</sub>

- Won the 2<sup>nd</sup> round of “New Venture Business Plan” competition (sponsored by McKinsey&Co.)
- PhD enrollment (@TUGraz) + Space Propulsion 2004 presentation



# Key opportunities and experiences

- Understanding ESA plus setting up networking based on solid professional relationships;
- Broadening horizons in a multicultural environment;
- Technical knowledge assessment and development of project management abilities
- Pursuit of own business/individual interests



# Entrepreneurship

## Company Overview

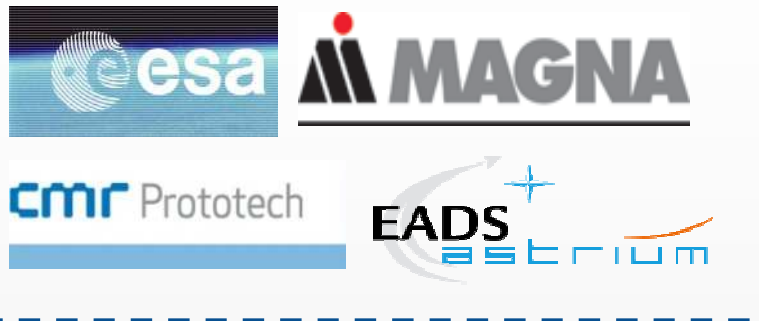
- Omnidea Lda. founded in 2003, incubated in ESA/ESTEC
- All staff with Univ. degreea and 1/3 with PhD.
- 5 contracts as Prime with ESA (over 80% of turnover)

## Mission

Omnidea performs R&D in innovative energy concepts and aerospace technology, intending to license the resulting IPR for use in products with worldwide applications. The strategy focus on breakthrough solutions and technologic know-how ownership.

# Networking

## Space Industry Contacts



**Internationalization  
(Joint Venture)**



**Advanced Research Fac.**

**Knowledge "Cluster"  
& Operating Facilities**



# In Development Technologies

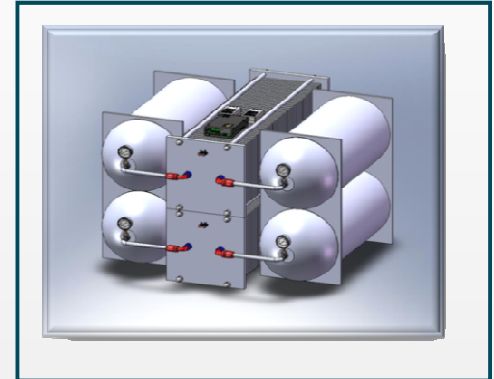
## INNOVGAS – Tube forming technology

- High pressure gas reservoirs
- Liner for COPV
- Reusable reservoirs for chemicals storage



## ENERGON – Hydrocarbons production from CO<sub>2</sub>

- Energy Storage Alternative
- Recycling of CO<sub>2</sub>



## BOREAS – High altitude wind energy

- Wind Energy Conversion
- High Altitude Platforms



omnidea

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# Starting-Up Technologies

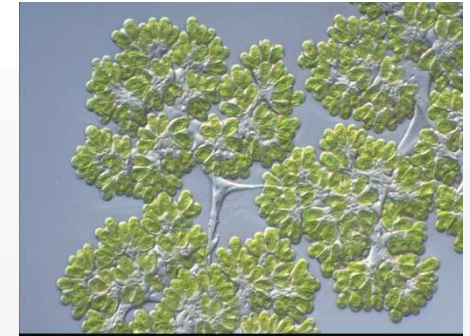
## N-SHE – Naturally-Stable Hybrid Engine

- Solid State (i.e: no moving parts)
- Q&A Low Cost Manufacturing
- Stable Engine



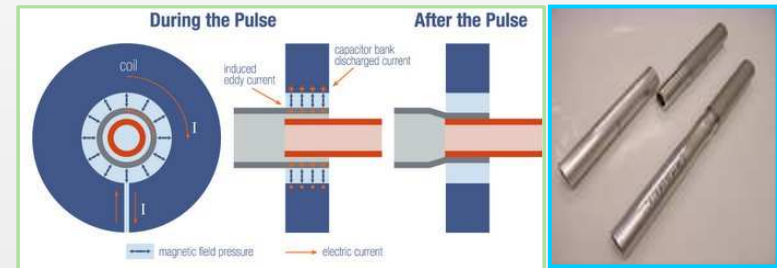
## Energon - Dual Mode

- Offshore closed bioreactor
- CO2 Recycling
- Algae Biomass Production



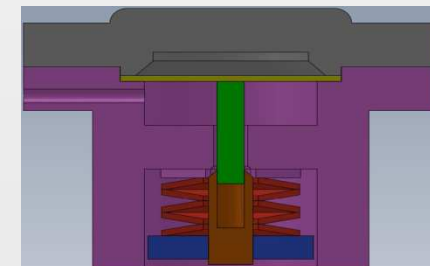
## Al-Ti transition joint

- 7 series aluminium
- Magnetic Pulse Welding



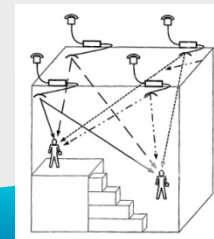
## InnovGas Upgrade

- MEMS Pressure Regulator



## ZPS – Zonal Positioning System

- Indoor GPS



# IPR & Knowledge

## Patents

### High Altitude Wind:

- National Level: September 2008
- PCT Level: submitted May 2007

### Forming technologies:

- National Level: August 2008
- PCT Level: submitted in January 2009



## Publications

1. C. Sequeira, M. Gonçalves, J. Condeço, T. Pardal, B. Aguado; **“Electrochemical and Photocatalytic Reduction of Carbon Dioxide for Fuel Cell Utilization”**;
2. C. Sequeira, T. Pardal, D. Santos, J. Alves, J. Condeço, M. W. Franco, M. C. Goncalves, S. Gama; **“Studies on Sodium Borohydride for Energy Systems”**;
3. T. Pardal, M. Gonçalves, J. Condeço and M. Lang; **“In-situ Electroreduction of Mars Atmosphere”**;
4. D. Santos, J.L.D. Alves, S. Gama, T. Pardal, C. Sequeira; **“Synthesis of Sodium Borohydride in Alkaline Medium and its Relevance to Energy Systems”**;
5. C. Sequeira, T. Pardal and D. Santos; **“Materials Corrosion in Molten Carbonate Fuel Cells”**;
6. M. Gonçalves, J. Condeço, D. Santos, T. Pardal, C. Sequeira; **“Electroreduction of Carbon Dioxide for Fuel Cell Utilization”**;
7. L. Alves, P. Martins, T. Pardal; **“Forming of Thin-Walled Hollow Spheres Using Sacrificial Polymer Mandrels”**.