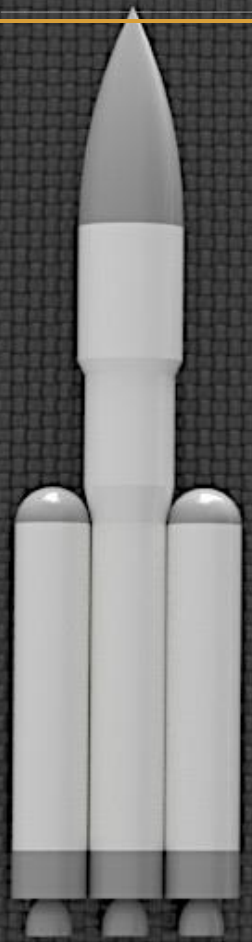
# SCC –
# energy source for proton rocket engine

Skyward Technologies Group



## Any rocket engine uses a source of energy and a propulsive mass

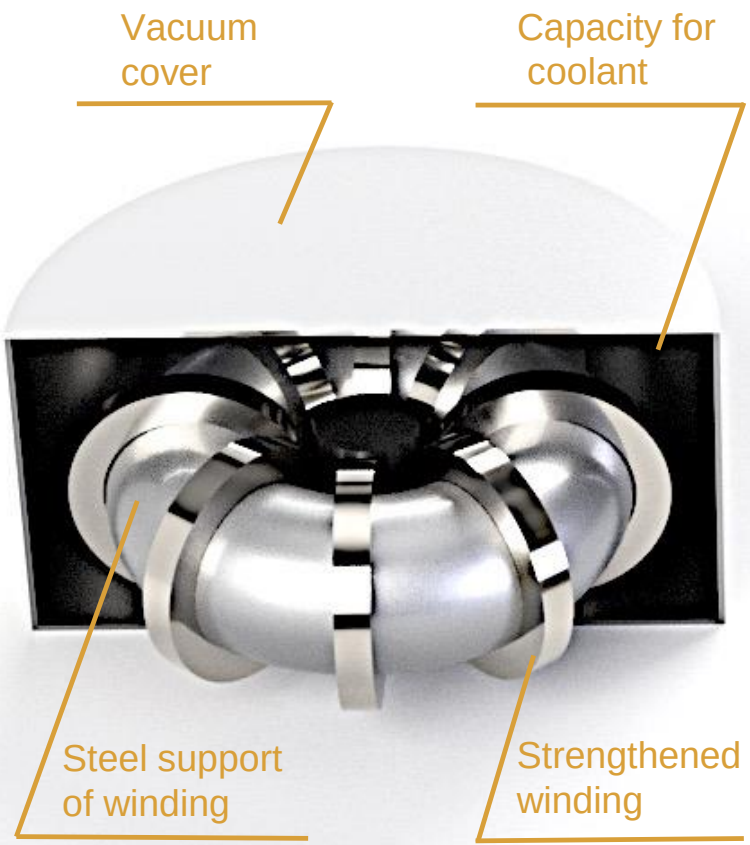
### Chemical RE

- Uses chemical energy to accelerate gases;
- Specific impulse is constant and low, up to 4.5 km/s;
- Has a high thrust;
- Operating time is short (minutes)

### Electric RE

- Uses electrical energy to accelerate ions or plasma;
- Specific impulse is variable and high, up to 200 km/s;
- Has a poor thrust;
- Operating time is long (years)

# TASK DEFINITION




The energy source with high specific power and energy as well as propulsive mass with the minimum atomic mass is necessary to create rocket engine which combines the advantages of electrical and chemical engines.

Only SMES - superconducting magnetic energy storage has most suitable specific power (up to $10^8$ W/kg) from modern devices. Liquid hydrogen having the minimum atomic mass can be used as the coolant necessary for their functioning ... However high pressures of magnetic field in the fragile superconducting winding prevents the creation of devices with high specific energy; so the specific energy of modern SMES is low, about 10 Wh/kg, only.

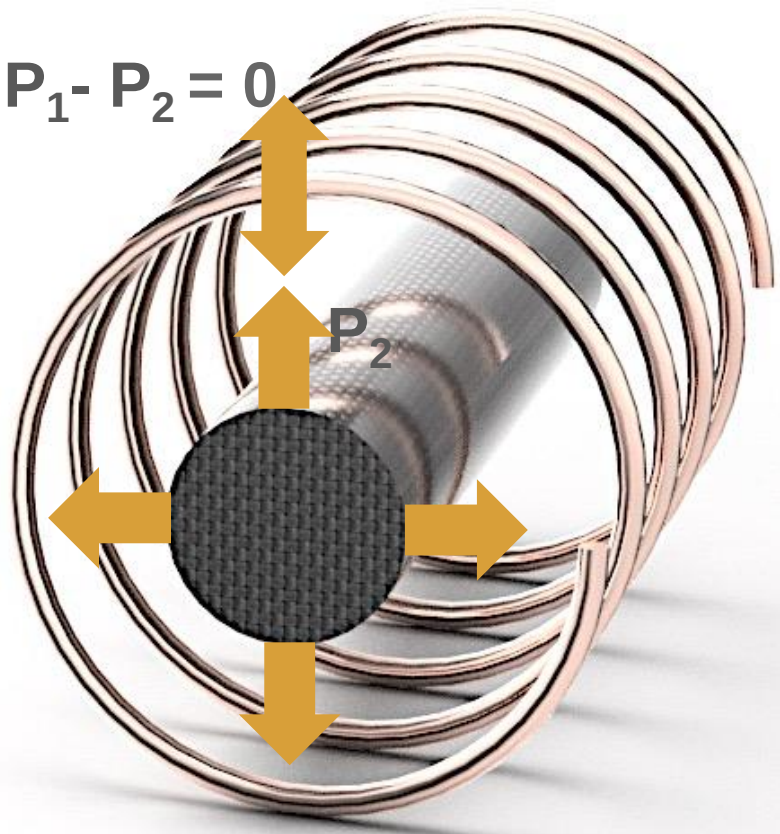
The decreasing of pressure of magnetic field on the winding would open a way of application of SMES in a number of devices, including the source of power and propulsive mass in proton rocket engines.

# DECISION

The invention of the company is the way of equilibration of magnetic field pressure $P_1 = B^2/2\mu_0$ (at B = 90 T $P_1 = 3{,}2*10^9$ Pa) on the winding of SMES by electric field pressure: $P_2 = E^2\varepsilon_0/2$. For this purpose the high-strength conducting core is included in the design of SMES, also the dielectric gasket is arranged between a winding and the core (for prevention of field emission from the winding). Further, high positive potential is provided to the core, and the electric current is directed to the winding and at the same time the winding receives high negative potential. Thus, the superconducting and not fading electric current appears in the charged winding (nobody have tried to do it before).

Total energy of the system (called "SCC" – the superconducting coil-capacitor) increases and it consists of energy of the coil and energy of the capacitor:
$W = LI^2/2 + CU^2/2$.

The specific energy of SCC can be $0{,}6\text{-}1*10^3$ Wh/kg (when B = 90 T) and much above (if to use very modern composite materials in the core).

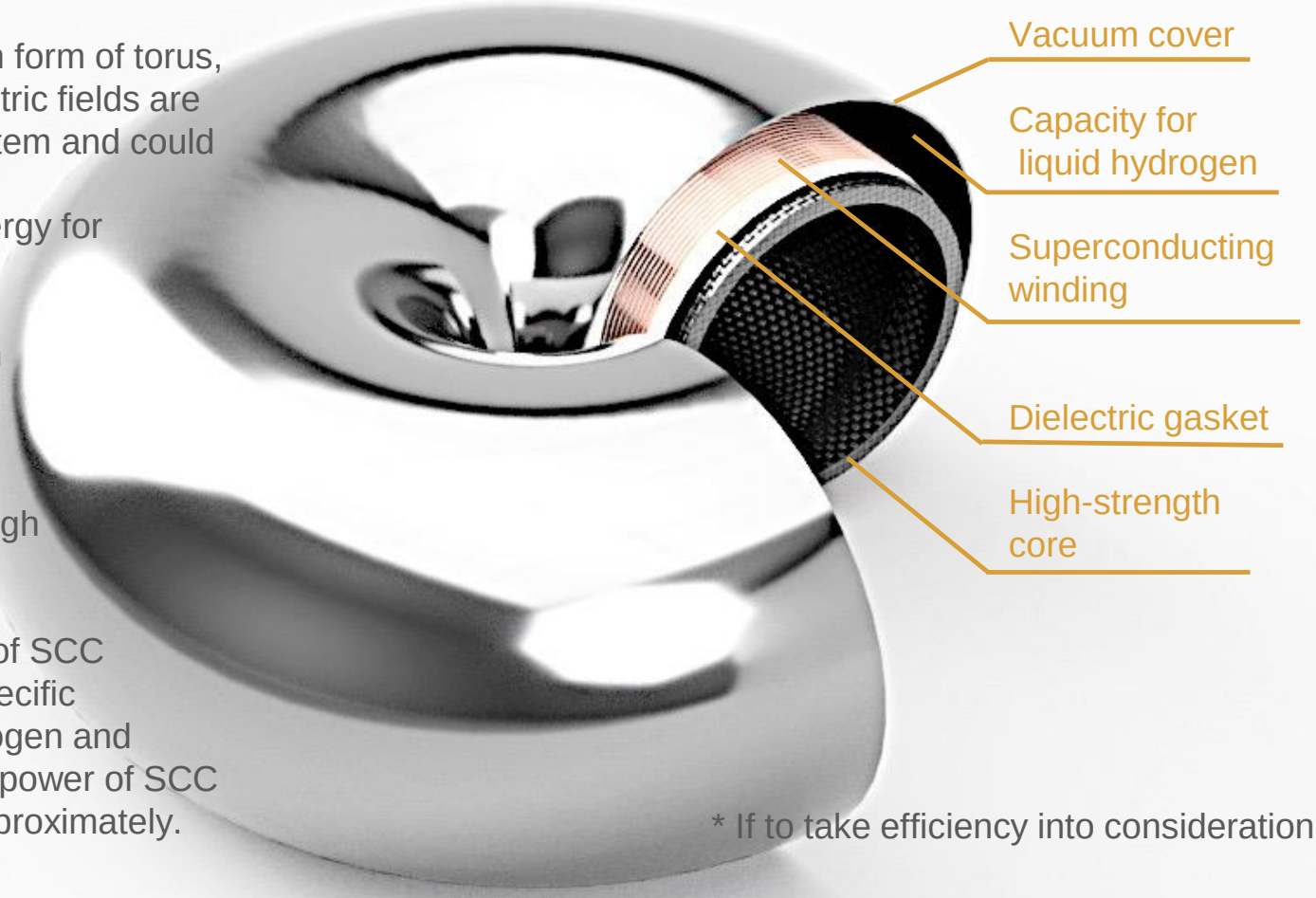


# CONCEPTUAL CONFIGURATION OF SCC

If SCC is executed in form of torus, the magnetic and electric fields are located inside the system and could serve
as the sources of energy for proton rocket engine.

Liquid hydrogen can be the coolant, which could be used for the creating of propulsive mass (protons) with high specific impulse, also.

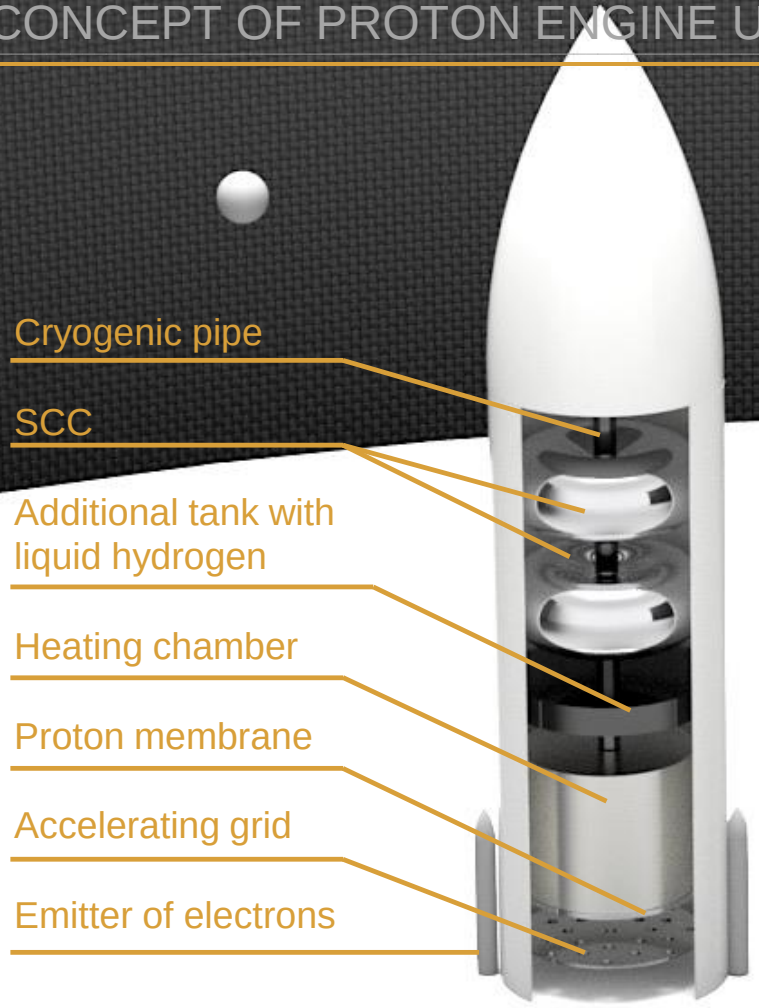
The specific energy of SCC is comparable with specific energy of mix of hydrogen and oxygen*, and specific power of SCC is 100 times more, approximately.




* If to take efficiency into consideration

# CONCEPT OF PROTON ENGINE USING SCC



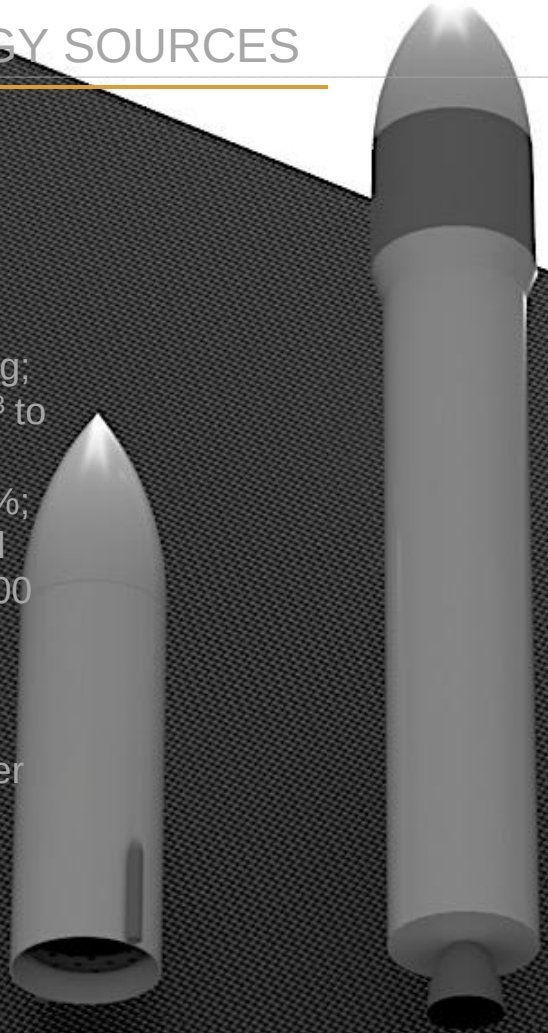



## Operating principles

Energy of SCC is spent on: evaporation of hydrogen in the heating chamber; removal of electrons from membrane and ejection of these electrons to stream of protons; creation of high positive potential on the accelerating grid. Liquid hydrogen moves from the additional hydrogen tank through the cryogenic pipe to the heating chamber. Gaseous hydrogen under high pressure passes from the heating chamber through a membrane, where it breaks up to atoms and each atom loses an electron and becomes a proton. Protons are accelerated by the grid and form a propulsive mass. Electrons from a membrane are thrown out to the propulsive mass by means of emitters of electrons.

Further the process repeats, but the using hydrogen is taken from the SCC which was discharged earlier.

# COMPARISON OF ENERGY SOURCES



## Proton ES

- Specific power is up to $10^8$ W/kg;
- Specific energy is from $0{,}5*10^3$ to $10^3$Wh/kg, and the average common efficiency is about 90%;
- Specific impulse is variable and theoretically unlimited, (up to 500 km/s and above);
- Temperature in the heating chamber is from 0 to 400°C;
- Pressure in the heating chamber is variable up to 700 atm.

## Chemical ES

- Specific power is up to $2*10^6$ W/kg;
- Specific energy is from $0.7*10^3$ to $3{,}5*10^3$ Wh/kg, but the average common efficiency is up to 35%;
- Specific impulse is constant, and theoretically is up to 4.5 km/s, in practice is less;
- Temperature in the combustion chamber is up to 4200°C;
- Pressure in the combustion chamber is up to 200 atm.

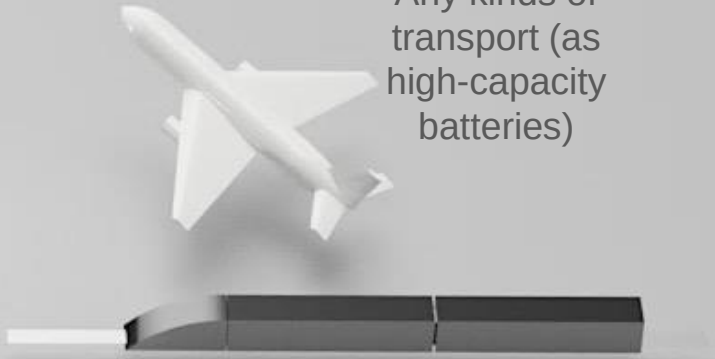
# SOME OTHER APPLICATIONS OF SCC



Industrial accumulators with high specific energy, specific power and the shortest time to recharge

Thermonuclear reactors (to create extra high magnetic fields)

Any kinds of transport (as high-capacity batteries)



SCC

Compact systems for energy improving

Scientific researches of high magnetic fields

# THE TEAM

DMITRY KHARITONOV
/ PM, inventor, SC-engineer

EVGENY DEMIKHOV
/ SC-scientist, professor of Physical Institute of Russian Academy of Science

NIKOLAY IVANOV
/ SC-motors constructor, assistant professor of Moscow Aviation Institute

ALEXANDR SAUTKIN
/ Aircraft constructor

DMITRY DEZHIN
/ SC-motors constructor, assistant professor of Moscow Aviation Institute

DENIS CHERNYKH
/ Co-founder, legal supporting

Skyward Technologies Group Limited,
Location: Unit 1503, 15/F No 69 Jervois St Sheung Wan Hong Kong
Phone: 007 499 34 777 05
E-mail: info@skyward-moto.ru