Novel Air-Breathing Plasma Jet Propulsion for Solar Powered High Altitude Flight Platforms

B. Göksel[1], I. Mashek[2], V. Lashkov[2], A. Lyublinsky[3], S. Korotkov[3],
F. Behrendt[1], I. Rechenberg[1], C. O. Paschereit[1], M. Tajmar[4]

[1]Technical University Berlin, Germany
[2]St. Petersburg State University, Russia
[3]Megaimpulse Ltd., St. Petersburg, Russia
[4]Technical University Dresden, Germany

The paper describes a novel concept for a plasma jet propulsion for stratospheric flight of aerodynamic platforms at altitudes up to 30 km and more to offering opportunities closed to satellite performance, but without the high cost and risk of space flight.

Today the potential of stratospheric platforms (stratollites) is still untapped, but both the carrier and propulsion technology is in reach, and once the integration of these two technologies has been achieved, future plasma jet propelled solar aircraft and airships will not only be competitive with spacecraft in a large variety of commercial and scientific applications or serve as valuable supplement to space-based sensors, but flight at much higher altitudes will become a reality.

Based on the state-of-the-art, a plasma jet propulsion combining ferroelectric field electron emission (FEE) and magneto-plasma flux compression (MPC) will be proposed for high-altitude solar aircraft and airships, where, in particular, the corresponding author has practical flight experience with the world's first air plasma propelled airship in 2005. Before, however, plasma jets can be successfully employed on future solar powered stratollites, the thrust-to-power and thrust-to-area ratios have to be optimized using numerical simulation tools, vacuum test chambers simulating high-altitude flight conditions and new lightweight solid-state highvoltage power supplies.

The paper will describe the necessary steps in reaching a breakthrough in achieving its target of establishing the novel technology of solar powered platforms propelled by novel plasma jets flying at high altitudes and endurance.

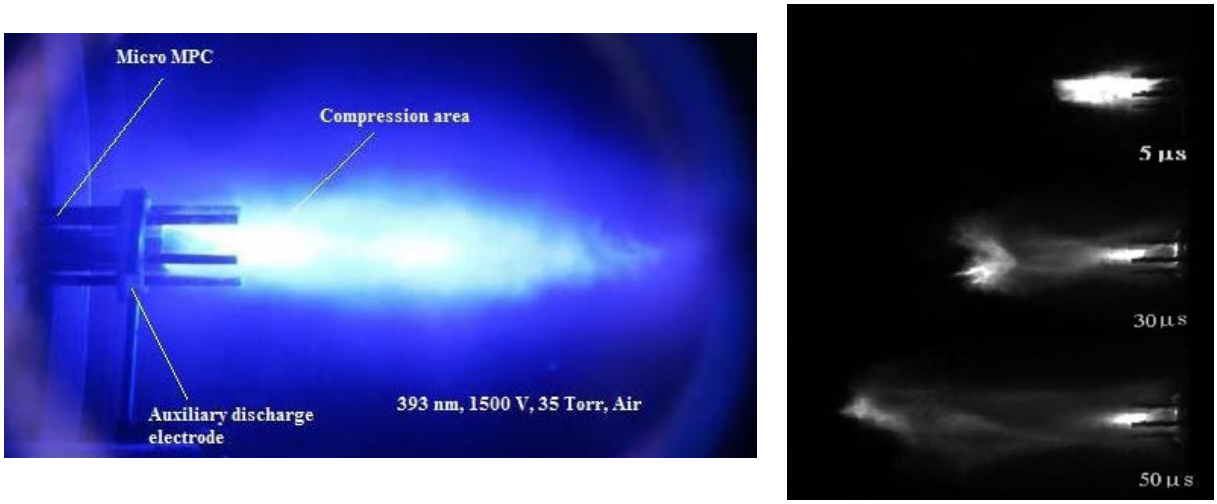

Fig.1. Submerged plasma jet with velocities from 5 to 20 km/s are generated by 12 mm diameter micro MPC actuators in quiescent air (30 Torr). Dynamics of expansion at different time delays.