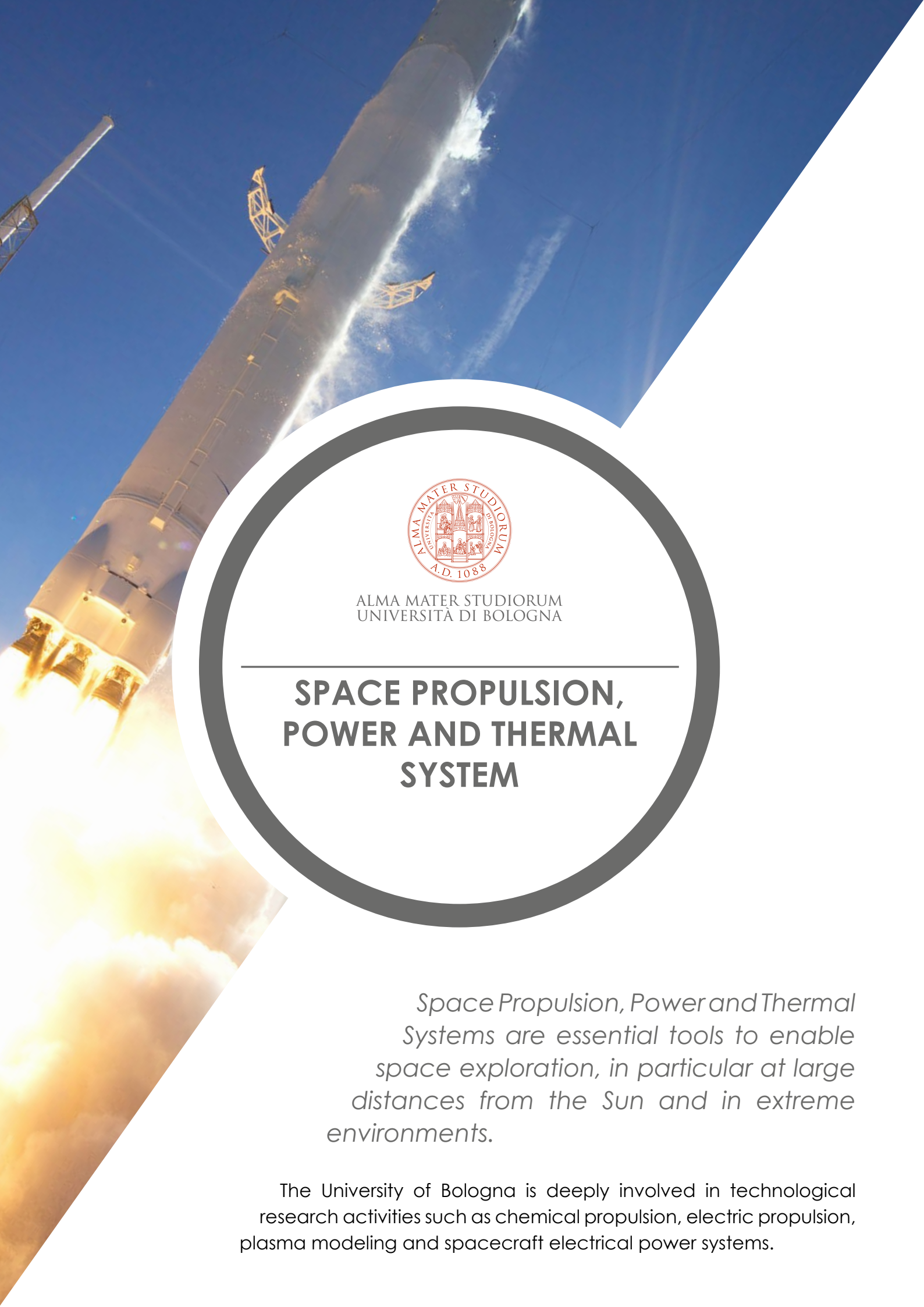

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

SPACE PROPULSION, POWER AND THERMAL SYSTEM

Space Propulsion, Power and Thermal Systems are essential tools to enable space exploration, in particular at large distances from the Sun and in extreme environments.

The University of Bologna is deeply involved in technological research activities such as chemical propulsion, electric propulsion, plasma modeling and spacecraft electrical power systems.

The research of the University of Bologna covers a wide range of topics:

- Magneto Hydro Dynamics electric power generation
- Space electric propulsion (Magneto Plasma Dynamic – MPD, and Hall effect thruster)
- MHD interaction in hypersonic regimes, with a focus on the re-entering of space vehicles in the atmosphere, as a technique to mitigate thermal fluxes and to control the vehicle trajectory
- Dielectric barrier discharges (DBD) capable of producing a cold plasma volume in air at atmospheric pressure. Basic analysis of the discharge, including modelling and plasma diagnostics, as well as the development of specific technological applications
- MEMS-based Gold-Gas Micropropulsion (molecular nitrogen)
- MEMS-based monopropellant Warm-Gas Micropropulsion (high-text peroxide)
- Solid Rockets Propellant packing analysis, using analytic and numerical approaches, both for close and loose packing. Capability to relate packing parameters with the propellant viscosity
- Solid rocket engines internal ballistic modeling: 3D burning surface regression models, fluid-dynamic approach for the internal parameters, and modeling both for solid/hybrid rocket engines
- Spacecraft Power Systems modeling, analysis and simulation

HIGHLIGHTS

The University of Bologna's participation in space missions and experiments:

- Development of MEMS based monopropellant high-test peroxide µ-thrusters
- Investigation on the physics and microfluidics of the decomposition of H2O2 in MEMS µ-thrusters (USAF AFOSR)
- Research projects aimed at using the MHD interaction in the re-entry phase of a spacecraft (PS-just/HPF/MHD-AFC)
- Research projects aimed at the development and implementation of aerothermodynamic codes
- Research on DBD actuators for flow control

Infrastructures:

- Micropropulsion testing equipment within the **Microsatellite and Space Microsystem Labs**: microscope equipped with high speed camera, thrust balance, high-test peroxide distillation facility, mass flow meter and controller plus various fluidic equipment
- **LIMP** – *Magnetofluiddynamic Engineering and Plasma Lab*

Different research groups have established an **extensive network of collaborations** with primary European companies operating in the space sector as well as several institutions and research centers at national and international level, such as: ASI (Italian Space Agency), ESA, AFOSR (Air Force Office of Scientific Research).