

IAF SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Small Launchers: Concepts and Operations (Part I) (7)

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DEVELOPMENT AND LAUNCH EXPERIMENTS OF A HYDROCARBON LIQUID PROPELLANT
ORBITAL/SUB-ORBITAL LAUNCHER**Abstract**

The authors have conducted a project of development and operation of low-cost small liquid rocket system with well-known technologies and easily available parts. A purpose of the project is “Easy Access to the Space”. A near-term goal of the project is a launch system for Micro/Nano-satellites into orbit. We have started a preliminary design of the orbital launcher has minimum components for carrying up to 100 kg of Micro/Nano-satellites into 500 km Sun-synchronous orbit. As a result of developing low-cost launch system, we watch for a chance of fast transfer from experimental to a commercial launch. The orbital launcher has two stages for a minimum configuration and it uses kerosene/liquid oxygen propellant, a gas generator cycle engine system. For design and optimization of an orbit depending on each customer, we developed open-source software and keep updating. Already we have started some series of tests of a gas generator, pumps and a main combustion chamber. As a preliminary step of the orbital launch, we conducted first sub-orbital flight test above 100 km altitude in 2017 and plan to conduct some tests in 2018. The rocket ”MOMO” has 20 kg payload capacity, a 12 kN thrust ethanol/liquid oxygen engine, a Helium pressure feeding system for the propellant, a thrust vector control system with servomotors for a pitch and a yaw angle control and a reentry system for a recovery of an avionics and payloads. At the first launch, a cold gas jet system was used for a roll angle control but it was cleared out that it wasn’t enough to control by after launch analysis. We newly developed hot gas thruster for roll angle control and plan to use on and after second sub-orbital launch. Because of its less impact for environment of the near sea and ease of treatment, ethanol was chosen for a fuel of the sub-orbital launcher. In the conference, concept design and status of components of the orbital launcher and details and flight operation of the sub-orbital launcher will be reported.