

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS (D2)
Future Space Transportation Systems (4)Author: Mr. Yuki Takahashi
University of California, United StatesNOVEL CONCEPTS FOR AFFORDABLE SPACE TRANSPORT AND TRAVEL:
MICROLAUNCHERS AND PD AEROSPACE.**Abstract**

This paper introduces and examines two ventures that should be noted as the space-faring communities strive to make robotic and human space flight more affordable. Microlaunchers is an effort to build a cultural and technological environment in which many more people than currently possible can directly participate in space exploration by making use of small launchers, spacecraft, and communication systems. It attempts to create a new space access paradigm in ways analogous to the advent of the microcomputer. By starting out small (e.g. 100 gram class spacecraft), launch rates of several per day can become possible to afford opportunities in ways not now economically feasible. Through incremental developments, this can lead to an evolution of capabilities from, for example, simple photo passes to rendezvous and landings on multiple near Earth objects. Just as the microcomputers took off with the appearance of critical technology like the Intel 8008 and 8080 CPUs, new technologies have appeared to enable this: MEMS accelerometers and gyroscopes, diode lasers of multiple wavelengths, and new approaches to design of small launch vehicles. Employing these can engage many to become involved in exploration of space with launches that are several orders of magnitude less expensive, smaller, and more numerous. For human space flight, PD Aerospace is an engineering company focused on developing reusable suborbital space vehicles employing pulse detonation engines (PDE) for both unmanned and manned applications. The vehicle will take off horizontally to reach above a 100 km altitude, where a second stage could be used to place cargoes into orbit. They plan to develop two types of spaceplanes: a 3-meter long unmanned vehicle with a 30 kg payload capacity, and a 9-meter long 5-crew vehicle for space travel. PDEs have a very simple design requiring no mechanical compression. By taking advantage of air breathing and compression through shock wave reaction, PDEs can deliver thrust very efficiently. In the air rich atmosphere, the engine will operate in air-breathing jet mode. Above a 15-km altitude, the combustion mode will switch to rocket mode with internally supplied oxidant. They have developed a small scale test vehicle and performed its first test flight successfully in August 2008. They are currently working toward developing an engine capable of combustion mode switch. Novelities of Microlaunchers and PD Aerospace approaches hold significant potentials in their respective industries.