

SPACE PROPULSION SYMPOSIUM (C4)  
Propulsion Technology (3)

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THE TURBINE EXHAUST LIQUEFACTION CYCLE ENGINE

**Abstract**

The renovated liquid rocket engine cycle must have high specific impulse and high reliability. The existing engine such as staged combustion engine, gas generator cycle engine and expander cycle engine have limitations. The turbine exhaust liquefaction cycle engine (TELCE) is a novel LH<sub>2</sub>/Lox rocket engine. The exhaust of TELCE turbine is been liquefied into water with heat exchanger by LH<sub>2</sub> and LO<sub>2</sub>, and then be sent back to gas generator and combustion chamber by water pump. Therefore gas generator pressure and propellant main pump exit pressure much small than that of staged combustion engine, and turbine used is supersonic turbine with large pressure ratio. The propellant mixture ratio in gas generator is 8, but temperature of exhaust dropped to 870K, because a lot of the water is injected in. The low pressure, low temperature of the gas generator and the low main pump exit pressure will make engine safer. The analyses show that TELCE has superior performance. The specific impulse is 51m/s higher than SSME, because the combustion chamber pressure of TELCE can reach 35Mpa which is much higher than SSME. If TELCE have the same combustion chamber pressure with SSME, the gas generator pressure of TELCE will be 38 percent lower than SSME, and the exit pressure of LH<sub>2</sub> pump will be 40.4 percent lower. The heat protect performance of TELCE is reliable(35Mpa); the liquid film formed with water will play the important role in MCC heat protection. The water is LH<sub>2</sub>/LO<sub>2</sub> propellant complete combustion production, so performance loss aroused with water liquid film cool is much small. The paper also discussed the key component of TELCE, and gave the solvable method for a problem. Through analyses the paper obtains that this TELCE is feasible in technology.