

SPACE TRANSPORTATION SOLUTIONS AND INNOVATIONS SYMPOSIUM (D2)
Technologies for Future Space Transportation Systems (5)

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A HYDROGEN-TURBO-PUMP-POWERED THRUST VECTOR CONTROL SERVO SYSTEM FOR
HIGH THRUST LIQUID-HYDROGEN-LIQUID-OXYGEN ROCKET ENGINES**Abstract**

A TVC (Thrust Vector Control) Servo System for the 500kN Liquid-Hydrogen-Liquid-Oxygen engines in Chinese new generation launch vehicles is described, including its architecture, technical characteristics and flight test results. Ultra high speed turbo-pumps are used to draw high pressure hydrogen gas from engines and transform them to hydraulic power to drive electro-hydraulic servo actuators. Meanwhile, the exhausted low temperature hydrogen gas from the turbines, where they have expanded and worked, are utilized to exchange heat with and cool down the hydraulic oil, whose temperature is stabilized at around 60 degree and meet the requirements of long duration flight missions. The simplicity of power approach also guarantees the system's inherent reliability. Another characteristic of the system is its redundancy design, including triple redundancy in the control loop and dual redundancy in the hydraulic power supply, in order to improve flight reliability further by eliminating SPFs (single point failure) in the critical junctions. The system is featured in its unique structures, where power and control components are highly integrated and gas/liquid passages embedded, with the benefits of simple outside interfaces and convenient maintainability. The system has been tested by numerous hot firing tests of gimballed engines and maiden flight, showing a highly data consistency with design computations.