

SPACE PROPULSION SYMPOSIUM (C4)
Hypersonic Air-breathing and Combined Cycle Propulsion (9)

Author: Dr. Lei Shi
Northwestern Polytechnical UniversityNPU, China, shilei@nwpu.edu.cn

Mr. Jian Chen
Northwestern Polytechnical UniversityNPU, China, chenjian2@nwpu.edu.cn

RESEARCHES ON ROCKET-BASED COMBINED-CYCLE INLET IN NORTHWESTERN
POLYTECHNICAL UNIVERSITY

Abstract

With traditional chemical propellant, the rocket propulsion has already been close to its maximum performance capability. Thus, it has become clear that there is a need to develop a reusable vehicle which can reach orbit with low cost, increased reliability and little or no maintenance while operating hundreds of hours. As the motive power for the next generation of space transports, RBCC has been under study, off and on, for over half a century. The research group in Northwestern Polytechnical University has conducted studies on the RBCC engines for decades. Specifically, the great efforts have been paid for the RBCC inlet which plays an important role in the development of the RBCC engine. In present paper, the research progress of RBCC inlet in Northwestern Polytechnical University has been reviewed by addressing the unique features characterized by the RBCC inlet. Primary achievements on several key scientific and technical issues associated with RBCC inlets are presented with focuses on: (1) operation characteristics of a 2-D RBCC inlet in ejector mode, (2) starting characteristics of a sidewall RBCC inlet, and (3) matching characteristics with embedded rocket. Considering the wide operation ranges of Mach number and flight altitude of the RBCC engine, it seems that the traditional inlet with fixed geometry can hardly meet the operation requirements of the RBCC propulsion system. Thus the flexible geometry inlets have become the promising options for the future RBCC-powered vehicles. And three flexible RBCC inlets are successfully designed by our research team, which have been proved with the satisfied performances. The future work and ongoing work in the RBCC inlet are focused on several aspects, such as: (1) dynamic operation and transition characteristics; (2) practical application study for flexible geometry schemes, et al.