

SPACE PROPULSION SYMPOSIUM (C4)  
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Author: Dr. Jianxing Zhou  
Beijing Mech-electro Engineering Institute, CASIC, China

Mr. Ying Wang  
Beijing Mech-electro Engineering Institute, CASIC, China

NUMERICAL INVESTIGATION OF A MA 10 STREAM TRACED SCRAMJET AT OFF DESIGN  
CONDITIONS

**Abstract**

High Mach scramjet could be a prosperous propulsion choice or a working mode for hypersonic vehicles. Although some researches of scramjet in the range of Ma 8 to 12 have conducted around the world, how to design a scramjet to adapt to a HTHL aircraft requirement is still a demanding problem, meaning leaving enough space to undercarriages, fuel tank, and so on. Focusing on the configuration requirements of a HTHL aircraft, a possible scramjet configuration of two scramjets installed in each side of an aircraft were designed and the scramjet performances in the flight corridor at off design conditions were investigated with numerical method and 1-D fast performance prediction method. The inlets were designed with stream traced method to accommodate the requirements of the vehicle's forebody shape and downstream requirements of the flow passage, which is a circular combustor. Connected the inlet and the combustor is a rectangle to circle isolator. The nozzle shape is from circle to rectangle to satisfy the requirements of combustor and the vehicle's afterbody shape. The flow fields without fuel injection were simulated with numerical method and the cold condition performances of the scramjet are presented. Besides, the performances with hydrogen fuel injection were evaluated with numerical method and 1-D fast performance prediction method. The results show that most of the performance deviations with the two methods are located in 15% error band.