DEPARTMENT OF MECHANICAL ENGINEERING & MECHANICS
COLLEGE OF ENGINEERING & TECHNOLOGY
OLD DOMINION UNIVERSITY
NORFOLK, VIRGINIA 23529

NAVIER-STOKES CALCULATIONS OF
SCRAMJET-NOZZLE-AFTERBODY FLOWFIELDS

By
Oktay Baysal, Principal Investigator

Final Report
For the period ended August 15, 1991

Prepared for
National Aeronautics and Space Administration
Langley Research Center
Hampton, Virginia 23665

Under
Research Grant NAG-1-811
James L. Pittman, Technical Monitor
SMD-Aerothermal Loads Branch

Submitted by the
Old Dominion University Research Foundation
P.O. Box 6369
Norfolk, Virginia 23508-0369

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INTRODUCTION

Propulsion-airframe integration for hypersonic airbreathing vehicles is an important feature for the design of a national aero-space plane configuration. The lower afterbody expands the supersonic exhaust gases from the scramjet engine, therefore it becomes a part of the nozzle. This strong coupling between the engine and the airframe necessitates a combined analysis of internal and external flows. The hypersonic freestream and the supersonic exhaust flow mix through a shear layer, where mass, momentum, and energy transfers occur. The interference of the exhaust on the control surfaces of the aircraft can have adverse effects on the stability of the aircraft. Therefore, some method of simulating this type of flow is required to properly design the nozzle and the afterbody region.

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James M. Cubbage
Vigyan Research Associates, Inc.
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