

October 1968

Brief 68-10374

# NASA TECH BRIEF



NASA Tech Briefs are issued to summarize specific innovations derived from the U.S. space program, to encourage their commercial application. Copies are available to the public at 15 cents each from the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

## Axisymmetric Two-Phase Perfect Gas Performance Program

### The problem:

To develop an axisymmetric method which calculates the performance of propellant systems having both gaseous and condensed exhaust products.

### The solution:

A computer program which calculates the inviscid axisymmetric nozzle expansion of propellant systems having both gaseous and condensed exhaust products.

### How it's done:

The program considers the velocity and thermal lags (for ten particle groups) between the gaseous and condensed combustion products (when they are present in the chamber). It does not consider mass transfer (only momentum and energy transfer) between gaseous and condensed combustion products, nor does it consider nonequilibrium effects of finite rate chemical reactions between gaseous and combustion products. This program considers only the expansion of a uniform mixture (the ideal engine case).

Standard explicit integration methods are used. The program is designed for engineering use and is

specified and programmed in a straightforward manner to facilitate its use as a development tool.

### Notes:

1. This program is written in Fortran IV for use on the IBM 7094 computer.
2. This program will perform calculations for contoured nozzles as well as conical nozzles.
3. Related computer programs are described in NASA Tech Briefs 68-10375, 68-10376, and 68-10377.
4. Inquiries concerning this program may be made to:

COSMIC  
Computer Center  
University of Georgia  
Athens, Georgia 30601  
Reference: B68-10374

### Patent status:

No patent action is contemplated by NASA.

Source: J. R. Kliegel and G. R. Nickerson  
of TRW Systems  
under contract to  
Manned Spacecraft Center  
(MSC-11774)

Category 06