

# NASA TECH BRIEF

## *Marshall Space Flight Center*



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### Study of High Altitude Plume Impingement

#### The problem:

The exhaust of a rocket engine constitutes a hostile environment for any adjacent surfaces on a spacecraft. Structural loads, heating, contamination and surface erosion are some of the undesirable effects which may occur.

#### The solution:

A computer program has been developed as an analytical tool to predict the severity of the effects of exhaust of a rocket engine on adjacent surfaces. This prediction will be useful as an aid in the design of systems where such problems are anticipated.

#### How it's done:

This computer program computes forces, moments, pressures, and heating rates on surfaces immersed in or subjected to rocket exhaust plume environments. Program capabilities include the treatment of continuum, transitional and "free molecular" flow regimes for arbitrary body shapes. The impingement effects of fuel striations (oxidizer-to-fuel ratio gradients) and internal shock waves in the exhaust plume and body shading effects can be calculated. The program has the capability of analyzing impingement due to any supersonic flow field.

A step-by-step procedure in setting up the data, coding the input data and interpreting the output from the program is given.

#### Notes:

1. This program is written in FORTRAN V to be utilized by the UNIVAC-1108 EXEC-8 computer.
2. Inquiries concerning this program should be directed to:

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