

# NASA TECH BRIEF

## *Marshall Space Flight Center*



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### Separation Dynamics of S-II Derivative Launch Vehicle

#### The problem:

A method was needed for analyzing separation dynamics and synthesizing various separation systems of space launch vehicles.

#### The solution:

A computer program was developed for analyzing the separation dynamics between two vehicles from a time prior to separation to a later time when separation may be considered complete.

#### How it's done:

The program has a full six-degree-of-freedom simulation capability for analyzing separation dynamics. It utilizes a spring-damper analog for linkage interaction and has an extensive failure analysis capability. It accounts for the reaction control system, the retromotor system, and individual thrust-vector control systems, and it computes clearance distances and actuator dynamics. In addition, it has the capability of initiating linkage deflections to result in steady-state starting conditions.

The program is applicable to a system in which the payload is mounted in a piggyback fashion to the booster by a set of articulated linkages. The program may also be used if the vehicles are mated using fixed rather than swing-type links or for the separation of vehicles mounted in tandem.

The program assumes that each vehicle has a thrust-vector control system which provides automatic attitude control. This system may be bypassed by using a preprogrammed set of tabulated engine deflections. The program also provides for an auxiliary-reaction, jet-attitude control system, to maintain the attitude of the booster when the main propulsion engines are shut down. In addition, it provides for a retromotor system as a separation aid if desired. The program may also be utilized in evaluating various separation schemes and synthesizing separation systems by the manipulation of data and the various program options.

#### Notes:

1. This program was written in FORTRAN IV for the IBM 360 computer.
2. Inquiries concerning this program should be directed to:

COSMIC  
112 Barrow Hall  
University of Georgia  
Athens, Georgia 30601  
Reference: MFS-24325

Source: L. A. Schmidt and  
W. D. Vinson, Jr., of  
Rockwell International Corp.  
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