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TECHNICAL REPORT TG-77-18

ASSESSMENT OF A DYNAMICAL GYROSCOPE MODEL UTILIZING DIGITAL SIMULATION TECHNIQUES

Guidance and Control Directorate
Technology Laboratory

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therefore,

$$\theta(t) = \frac{H}{J}\int_0^t \psi(t)\, dt \quad .$$

A similar derivation holds for the other axis; i.e., a transfer function relating θ and ψ can be interchanged so that

$$\frac{\Psi(s)}{\theta(s)} \quad .$$

The "ideal" model (Section III.A), behaves like a perfect gyroscope. The "dynamic" gyroscope is far more complicated with realistic inertia and damping terms being considered. A 2-DOF dynamic gyro is represented by two second order differential equations as given in Section III.B.

III. MATHEMATICAL GYRO MODELS

The mathematical formulation of the two gyroscope models is given in the following paragraphs.

A. Ideal 2-DOF Gimballed Gyroscope

Figure 1 describes the orientation of the seeker gyro coordinate system (x_s, y_s, z_s) by using the seeker Euler angles θ and then ψ with respect to the body coordinate system (X_B, Y_B, Z_B). The gyro coordinate system is chosen so that the origin is at the center of mass of the gyro and the x_s-axis is the axis of symmetry of the gyro. Also let ω' be the absolute angular velocity or rate of the seeker gyro. Then the general expression for components of angular momentum H of the gyro is

$$H_x = I_{xx}\,\omega'_x$$

$$H_y = I_{yy}\,\omega'_y$$

$$H_z = I_{zz}\,\omega'_z \quad . \qquad (1)$$

Let ω be the absolute angular velocity of the x_s, y_s, z_s system and s be the angular velocity or spin rate of the gyro as measured relative to the x_s, y_s, z_s system. Then the angular velocity terms (ω'_x, ω'_y, ω'_z) are

CONTENTS

I. INTRODUCTION

A gimballed two-degree-of-freedom (DOF) attitude gyro whose spin axis is torqued to a point along the line-of-sight (LOS) is a primary guidance device used in today's missile technology. LOS rate for proportional navigation guidance (PNG) is derived from this type of gyro. The guidance law for this scheme is PNG. The missile used here is tail controlled with proportional vane deflection and roll rate controlled. When the missile is near enough to the target to be seen by the guidance device (seeker) which is mounted on the gyroscope, an LOS error (the difference as measured in both yaw and pitch plane of where the seeker is presently pointing and where it should be pointing) is computed. This LOS error torques the gyroscope and eventually drives the missile body vanes which turn the body into line with the pointing seeker. Missile targeting accuracy is described for two types of 2-DOF gimballed gyros (idealized and dynamic) models when implemented in a 6-DOF digital missile simulation with no changes in airframe, aero, autopilot, and guidance law.

II. PROBLEM DEFINITION

For many studies using digital simulation, it is desirable to model a gyro which has no second order (inertia) and damping terms in the mathematical formulation. This model is one represented by a perfect integrator, 1/s, in the Laplace notation. The following paragraphs display the rationale in developing such a model.

The differential equation relating output axis motion to input torque or rate is

$$J\ddot{\theta} + B\dot{\theta} + K\theta = H\dot{\psi} \quad .$$

Laplace transformation with zero initial conditions is applied

$$\frac{\Theta(s)}{\Psi(s)} = \frac{Hs}{Js^2 + Bs + K}$$

and it is assumed that $J \gg B$ and $J \gg K$

$$\frac{\Theta(s)}{\Psi(s)} = \frac{Hs}{Js^2} = \left(\frac{H}{J}\right)\frac{1}{s} \quad ;$$

therefore,

$$\theta(t) = \frac{H}{J}\int_0^t \psi(t)\, dt \quad .$$

A similar derivation holds for the other axis; i.e., a transfer function relating θ and ψ can be interchanged so that

$$\frac{\Psi(s)}{\theta(s)} \quad .$$

The "ideal" model (Section III.A), behaves like a perfect gyroscope. The "dynamic" gyroscope is far more complicated with realistic inertia and damping terms being considered. A 2-DOF dynamic gyro is represented by two second order differential equations as given in Section III.B.

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Let ω be the absolute angular velocity of the x_s, y_s, z_s system and s be the angular velocity or spin rate of the gyro as measured relative to the x_s, y_s, z_s system. Then the angular velocity terms (ω'_x, ω'_y, ω'_z) are

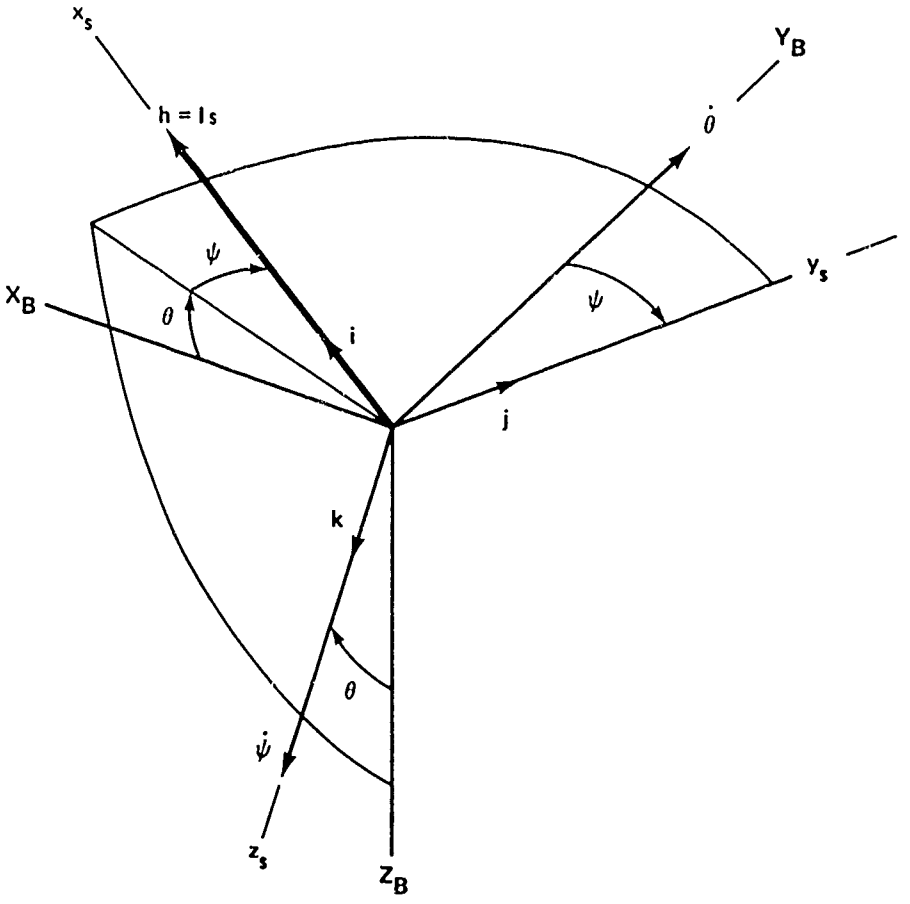


Figure 1. Seeker gyro coordinate system.

$$\omega'_x = \omega_x + s$$

$$\omega'_y = \omega_y$$

$$\omega'_z = \omega_z \qquad (2)$$

and Equation (1) becomes

$$H_x = I_{xx} (\omega_x + s)$$

$$H_y = I_{yy}\,\omega_y$$

$$H_z = I_{zz}\,\omega_z \qquad . \tag{3}$$

The general vector equation of motion is $\underline{M} = \dot{\underline{H}}$. Recalling that the rate of change of $\underline{H}$ is

$$\dot{\underline{H}} = (\dot{\underline{H}})_r + \underline{\omega} \times \underline{H} \tag{4}$$

where $(\dot{\underline{H}})_r$ is the rate of change of the absolute angular momentum as measured in the seeker gyro basis, i.e.,

$$(\dot{\underline{H}})_r = I_{xx}\,(\dot{\omega}_x + s)\underline{i} + (I_{yy}\,\dot{\omega}_y)\underline{j} + (I_{zz}\,\dot{\omega}_z)\underline{k} \qquad . \tag{5}$$

From Figure 1,

$$\underline{\omega} = \dot{\theta}\sin\psi\,\underline{i} + \dot{\theta}\cos\psi\,\underline{j} + \dot{\psi}\underline{k} \qquad . \tag{6}$$

Because of the gyro symmetry and actual specification values, a special case is treated here, i.e.,

$$I = I_{xx} = I_{yy} = I_{zz} \qquad . \tag{7}$$

In Figure 1, s is a constant spin rate and $s \gg \omega_y$ and ω_z; therefore,

$$\underline{H} \doteq Is\underline{i} = \underline{h} \qquad . \tag{8}$$

For an ideal gyro, the rotor gimballed terms ($\dot{\omega}_y$ and $\dot{\omega}_z$) are small when compared to the ω_ys and ω_zs terms; also, no $\dot{\omega}_x$ term is possible due to the physical system constraints. Therefore, $(\dot{\underline{H}})_r$ can be neglected in comparison with $\underline{\omega} \times \underline{H}$.

Evaluating $\underline{\omega} \times \underline{H}$ using the determinant form of the cross product gives

$$\underline{\omega} \times \underline{h} = \begin{vmatrix} \underline{i} & \underline{j} & \underline{k} \\ \dot{\theta} \sin \psi & \dot{\theta} \cos \psi & \dot{\psi} \\ I_s & 0 & 0 \end{vmatrix} \quad . \tag{9}$$

Then

$$M_x = 0$$

$$M_y = Is\ \dot{\psi}$$

$$M_z = -Is\ \dot{\theta} \cos \psi \quad , \tag{10}$$

where Is is angular momentum and is considered a constant gain value in the model.

B. Dynamic (Realistic) 2-DOF Gimballed Gyroscope Model

Figure 2 shows the system in a configuration (with respect to body fixed reference X_I, Y_I, Z_I) and orientation of the gyro system by using the seeker Euler angles ψ and then θ. The system has 2-DOF (the speed n of the rotor with respect to gimbal G prescribed as constant). Angle θ defines the angular position of the inner gimbal G with respect to the outer gimbal O. The angle ψ defines the angular position of the outer gimbal with respect to the vehicle I. Using the general vector equation of motion $(\underline{M}) = (\dot{\underline{H}})$ and rewriting in matrix expressions gives

$$\{M_0\} = \{\dot{H}_{TS}\}_I \tag{11}$$

$$\{H_{TS}\} = \{H_0\} + \{H_G\} + \{H_R\} \tag{12}$$

but

$$\{H_0\} = [I_0]\ \{\omega_{0-I}\} \tag{13}$$

$$\{H_G\} = [I_G]\ \{\omega_{G-I}\} \tag{14}$$

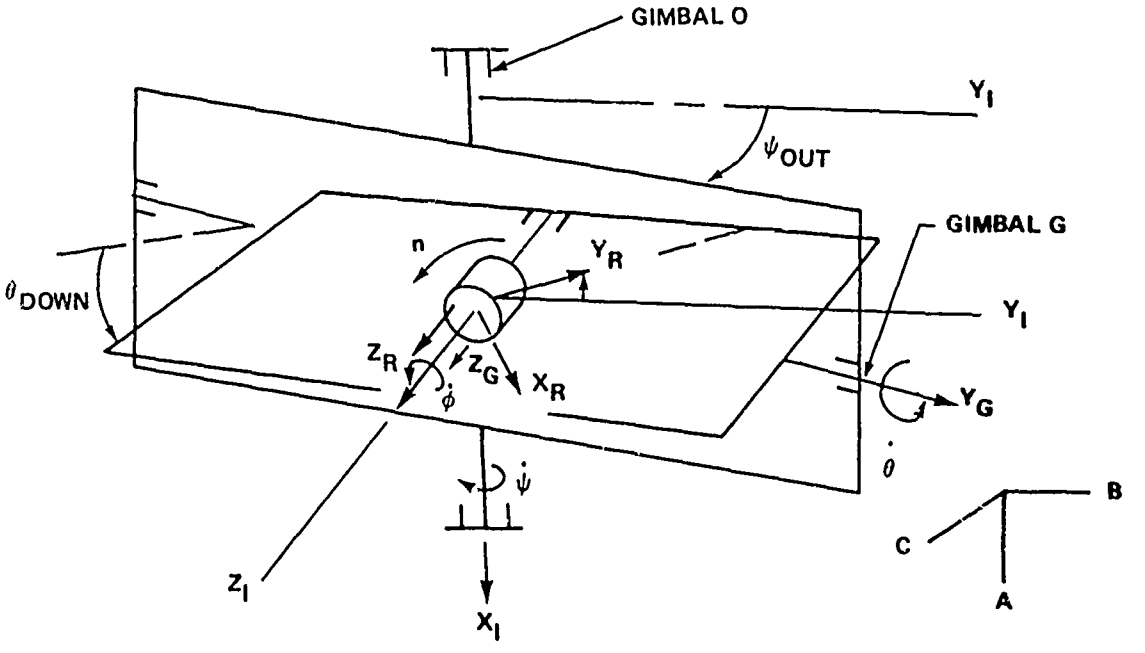


Figure 2. Dynamic seeker gyro coordinate system.

and

$$\{H_R\} = [I_R]\ \{\omega_{R-I}\} = [I_R]\ \{\omega_{R-G}\} + \{\omega_{G-I}\} \tag{15}$$

but $\{\omega_{R-G}\} \doteq \{\dot{\phi}\}$. Therefore,

$$H_R = [I_R]\ \{\dot{\phi}\} + [I_R]\ \{\omega_{G-I}\} \tag{16}$$

but $[I_R]\ \{\dot{\phi}\} \doteq \{h\}$. Then

$$\{H_R\} = \{h\} + [I_R]\ \{\omega_{G-I}\} \tag{17}$$

where

$\{M_O\}$ = moment or torque (column matrix) about outer gimbal

$\{H_{TS}\}_I$ = angular momentum of total system (column matrix) in vehicle frame

$\{H_O\}$ = angular momentum (column matrix) of outer gimbal

$\{H_G\}$ = angular momentum (column matrix) of inner gimbal

$\{h\}$ = angular momentum (column matrix) of rotor

$\{H_R\}$ = total angular momentum (column matrix) of rotor

$[I_O]$ = inertia tensor of outer gimbal

$[I_G]$ = inertia tensor of inner gimbal

$[I_R]$ = inertia tensor of rotor

$\{\omega_{O-I}\}$ = angular velocity (column matrix) of outer wrt vehicle

$\{\omega_{G-I}\}$ = angular velocity (column matrix) of inner wrt vehicle

$\{\omega_{R-I}\}$ = angular velocity (column matrix) of rotor wrt vehicle .

$$\{\dot{\phi}\} = \begin{Bmatrix} 0 \\ 0 \\ \dot{\phi} \end{Bmatrix}$$

Rearranging Equation (12) and taking derivatives of Equations (11) and (12) gives

$$\{M_O\} = \{\dot{H}_{TS}\}_G + [\omega_{G-I}]\{H_{TS}\} = \frac{d}{dt}\Big[\{h\} + [I_R]\{\omega_{G-I}\} + [I_G]\{\omega_{G-I}\} + [I_O]\{\omega_{O-I}\}\Big]_G + [\omega_{G-I}]\Big[\{h\} + [I_R]\{\omega_{G-I}\} + [I_C]\{\omega_{G-I}\} + [I_O]\{\omega_{O-I}\}\Big] \qquad (18)$$

where

$$[\omega_{G-I}] = \begin{bmatrix} 0 & -\omega_z & \omega_y \\ \omega_z & 0 & -\omega_x \\ -\omega_y & \omega_x & 0 \end{bmatrix} .$$

Therefore,

$$\{\dot{H}_{TS}\}_I = \{\dot{h}\}_G + [\dot{I}_R]_G \{\omega_{G-I}\} + [\dot{I}_R]_G \{\dot{\omega}_{G-I}\}_G + [\dot{I}_G]_G \{\omega_{G-I}\}$$
$$+ [I_G] \{\dot{\omega}_{G-I}\}_G + [\dot{I}_O]_O \{\omega_{O-I}\} + [I_O] \{\dot{\omega}_{O-I}\}_O$$
$$+ [\omega_{G-I}] \{h\} + [\omega_{G-I}] \left([I_R] + [I_G]\right) \{\omega_{G-I}\}$$
$$+ [\omega_{G-I}] [I_O] \{\omega_{O-I}\} \quad . \quad , \tag{19}$$

Collecting terms gives

$$\{M_O\} = \{\dot{H}_{TS}\}_I = \{\dot{h}\}_G + \left([I_R] + [I_G]\right) \{\dot{\omega}_{G-I}\}_G + [I_O] \{\dot{\omega}_{O-I}\}_O$$
$$+ [\omega_{G-I}] \{h\} + [\omega_{G-I}] \left([I_R] + [I_G]\right) \{\omega_{G-I}\} \quad . \tag{20}$$

Consider that for a constant speed motor

$$\{\dot{h}\}_G = 0, \tag{21}$$

and neglecting the second order terms,

$$[\omega_{G-I}] \left([I_R] + [I_G]\right) \{\omega_{G-I}\}$$

then,

$$\{M_O\} = \left([I_R] + [I_G]\right) \{\dot{\omega}_{G-I}\}_G + [I_O] \{\dot{\omega}_{G-I}\}_O + [\omega_{G-I}] \{h\} \quad . \tag{22}$$

Thus, Equation (22) is the simplified moment equation, but the moment equation for a complete gyro is Equation (20).

Coordinating the equation to get scalar components in the inner gimbal frame G, then

$$\{h\} = [I_R] \{\omega_{R-G}\} \quad . \tag{23}$$

Therefore,

$$\{\dot{h}\}_G = \frac{d}{dt}\left([I_R]\ \{\omega_{R-G}\}\right)_G = [\dot{I}_R]_G\ \{\omega_{R-I}\} + [I_R]\ \{\omega_{R-G}\}_G \quad . \quad (24)$$

Then

$$\{\dot{h}\}_G = [I_R]\ \{\dot{\phi}\} \quad . \quad (25)$$

$\{\dot{h}\}_G$ would be zero if spin rotor rotated at a constant speed as with a hysterisis motor. In some application, "h-modulation" may be desirable, so retain the term $\{\dot{h}\}_G$, i.e., $\{\dot{h}\}_G \neq 0$

Using the matrix properties of the inertia tensor to find an orientation of a given rigid body so that all products of inertia are zero simultaneously, i.e., the inertia matrix is diagonal. Substituting A, B, C for I_{xx}, I_{yy}, I_{zz}, respectively, then Equation (25) becomes

$$\{\dot{h}\}_G = [I]_R\ \{\dot{\phi}\}_G = \begin{bmatrix} A_R & 0 & 0 \\ 0 & B_R & 0 \\ 0 & 0 & C_R \end{bmatrix}\begin{bmatrix} 0 \\ 0 \\ \ddot{\phi} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ C_R\ddot{\phi} \end{bmatrix} \quad (26)$$

$$\left([I_R]_G + [I_G]_G\right) = \begin{bmatrix} A_R + A_G & 0 & 0 \\ 0 & B_R + B_G & 0 \\ 0 & 0 & C_R + C_G \end{bmatrix} \quad . \quad (27)$$

Knowing

$$\{\omega_{G-I}\}_G = \{\omega_{G-O}\}_G + T_{OG}\ \{\omega_{O-I}\}_O \quad ; \quad (28)$$

then

$$\{\omega_{G-O}\}_G = \begin{bmatrix} 0 \\ \dot{\theta} \\ 0 \end{bmatrix}; \quad \{\omega_{O-I}\}_O = \begin{bmatrix} \dot{\psi} \\ 0 \\ 0 \end{bmatrix} \quad (29)$$

and

$$T_{OG} = \begin{bmatrix} c\theta & 0 & -s\theta \\ 0 & 1 & 0 \\ s\theta & 0 & c\theta \end{bmatrix} \tag{30}$$

where $c\theta = \cos\theta$, $s\theta = \sin\theta$. Therefore,

$$\{\omega_{G-I}\}_G = \begin{bmatrix} 0 \\ \dot{\theta} \\ 0 \end{bmatrix} + \begin{bmatrix} c\theta & 0 & -s\theta \\ 0 & 1 & 0 \\ s\theta & 0 & c\theta \end{bmatrix} \begin{bmatrix} \dot{\psi} \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} \dot{\psi}c\theta \\ \dot{\theta} \\ \dot{\psi}s\theta \end{bmatrix} . \tag{31}$$

Thus

$$\{\dot{\omega}_{G-I}\}_G = \begin{bmatrix} \ddot{\psi}c\theta - \dot{\psi}\, s\theta\, \dot{\theta} \\ \ddot{\theta} \\ \ddot{\psi}s\theta + \dot{\psi}\, c\theta\, \dot{\theta} \end{bmatrix} \tag{32}$$

and

$$[I_O]\{\dot{\omega}_{O-I}\}_O = \{\dot{H}_O\} = [I_O]_I \{\dot{\omega}_{O-I}\}_O = \begin{bmatrix} A_O\ddot{\psi} \\ 0 \\ 0 \end{bmatrix} . \tag{33}$$

Therefore, the derivative of H_O in I frame coordinatized in the G frame is

$$\{\dot{H}_O\}_G = T_{OG}\, T_{IO}\, \{\dot{H}_O\}_I$$

$$= \begin{bmatrix} c\theta & 0 & -s\theta \\ 0 & 1 & 0 \\ s\theta & 0 & s\theta \end{bmatrix} \begin{bmatrix} 1 & 0 & 0 \\ 0 & -s\psi & c\psi \\ 0 & c\psi & s\psi \end{bmatrix} \begin{bmatrix} A_O\ddot{\psi} \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} A_O\ddot{\psi}\, c\theta \\ 0 \\ A_O\ddot{\psi}\, s\theta \end{bmatrix} \tag{34}$$

and

$$[\omega_{G-I}]_G \{h\}_G = \begin{bmatrix} \dot{\theta}h \\ -h\, \dot{\psi}\, c\theta \\ 0 \end{bmatrix} \tag{35}$$

where

$$[\omega_{G-I}]_G = \begin{bmatrix} 0 & -\dot{\psi}s\theta & \dot{\theta} \\ \dot{\psi}s\theta & 0 & -\dot{\psi}c\theta \\ -\dot{\theta} & \dot{\psi}c\theta & 0 \end{bmatrix}$$

and

$$[\omega_{G-I}]\ [I_R] + [I_G]\ \{\omega_{G-I}\} = \begin{bmatrix} (C' - B')\ \dot{\theta}\dot{\psi}s\theta \\ (A' - C')\ \dot{\psi}^2 c\theta s\theta \\ (B' - A')\ \dot{\theta}\dot{\psi}c\theta \end{bmatrix} \qquad (36)$$

where

$$A' = A_R + A_G$$

$$B' = B_R + B_G$$

$$C' = C_R + C_G$$

$$\{M_O\}_G = \begin{bmatrix} M_{OXG} \\ M_{OYG} \\ M_{OZG} \end{bmatrix} . \qquad (37)$$

Collect all terms in Equations (26) through (37) to get matrix formulation:

$$\begin{bmatrix} M_{OXG} \\ M_{OYG} \\ M_{OZG} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ C_R\ \ddot{\phi} \end{bmatrix} + \begin{bmatrix} A' & 0 & 0 \\ 0 & B' & 0 \\ 0 & 0 & C' \end{bmatrix} \begin{bmatrix} \ddot{\psi}c\theta - \dot{\psi}s\theta\dot{\theta} \\ \ddot{\theta} \\ \ddot{\psi}s\theta + \dot{\theta}c\theta\dot{\theta} \end{bmatrix} + \begin{bmatrix} A_O\ddot{\psi}c\theta \\ 0 \\ A_O\ddot{\psi}s\theta \end{bmatrix}$$

$$+ \begin{bmatrix} \dot{\theta}h \\ -h\dot{\psi}c\theta \\ 0 \end{bmatrix} + \begin{bmatrix} (C' - B')\ \dot{\theta}\dot{\psi}s\theta \\ (A' - C')\ \dot{\psi}^2 c\theta s\theta \\ (B' - A')\ \dot{\theta}\dot{\psi}c\theta \end{bmatrix} . \qquad (38)$$

Add all matrices as indicated and break out individual components as follows to get complete nonlinear equations with no restraints on motor:

$$M_{OXG} = (A_R + A_G + A_O)\,\ddot{\psi}c\theta$$

$$+ (-A_R - A_G - B_R - B_G + C_R + C_G)\,\dot{\theta}\dot{\psi}s\theta + h\dot{\theta}$$

$$M_{OYG} = (B_R + B_G)\,\ddot{\theta} + (A_R + A_G - C_R - C_G)\,\dot{\psi}^2 c\theta s\theta - h\dot{\psi}c\theta$$

$$M_{OZG} = C_R\,\ddot{\phi} + (C_R + C_G + B_R + B_G - A_R - A_G)\,\dot{\theta}\dot{\psi}c\theta$$

$$+ (C_R + C_G + A_O)\,\ddot{\psi}s\theta \qquad (39)$$

where

$$M_{OXG} = M_\psi\, c\psi - r\dot{\psi}$$

$$M_{OYG} = M_\theta\, c\theta - b\dot{\theta}$$

$$M_{OZG} = 0 \qquad (40)$$

and

$r\dot{\psi} \triangleq$ gimbal bearing friction between the outer gimbal and base

$b\dot{\theta} \triangleq$ bearing friction between outer and inner gimbal .

For a general linear solution of Equation (39), linearize about an equilibrium position by letting:

$$\theta = \theta + \delta\theta$$

$$\dot{\theta} = \dot{\theta} + \delta\dot{\theta}$$

$$\psi = \psi + \delta\psi$$

$$\dot{\psi} = \dot{\psi} + \delta\dot{\psi} \quad , \quad \text{etc.}$$

Substitute into the nonlinear Equation (39); i.e., about $\theta = 0$ for small θ about equilibrium, e.g.,

$$c\theta = c(\theta + \delta\theta) = c\theta c\delta\theta - s\theta s\delta\theta = 1$$

$$s\theta = s(\theta + \delta\theta) = s\theta c\delta\theta + c\theta s\delta\theta = \delta\theta \quad . \tag{41}$$

Using the first of Equation (39) and substituting the preceding gives

$$M_{OXG} \text{ (linearized)} = A\ddot{\psi} + A'\dot{\theta}\dot{\psi}\delta\theta + h\dot{\theta} \tag{42}$$

where

$$A = A_R + A_G + A_O$$

$$B = -A_R - A_G - B_R - B_G + C_R + C_G$$

$$M_{OXG} + \delta M_{OXG} = A\ddot{\psi} + A\delta\ddot{\psi} + B(\dot{\theta} + \delta\dot{\theta})(\dot{\psi} + \delta\dot{\psi})\delta\psi + h\dot{\theta} + h\delta\dot{\theta} \quad . \tag{43}$$

Subtracting Equation (42) from Equation (43) gives

$$\delta M_{OXG} = A\delta\ddot{\psi} + B\dot{\theta}\delta\dot{\psi}\delta\theta + B\delta\dot{\theta}\dot{\psi}\delta\theta + B\delta\dot{\theta}\delta\dot{\psi}\delta\theta + h\delta\dot{\theta} \quad . \tag{44}$$

All small second terms can be removed in Equation (45), therefore,

$$\delta M_{OXG} = A\delta\ddot{\psi} + h\delta\dot{\theta} \quad . \tag{45}$$

A similar method can be applied to the M_{OYG} equation in Equation (39) to give

$$\delta M_{OYG} = B\delta\ddot{\theta} - h\dot{\psi} \quad , \tag{46}$$

dropping the δi terms for small angle approximation to get

$$M_{OXG} = A\ddot{\psi} + h\dot{\theta}$$

$$M_{OYG} = B\ddot{\theta} - h\dot{\psi} \quad . \tag{47}$$

Substituting values from Equation (40) for M_{OXG} and M_{OYG} with small angle approximation into Equation (47) to get

$$A\ddot{\psi} + r\dot{\psi} + h\dot{\theta} = M_{\psi}$$

$$B\ddot{\theta} + b\dot{\theta} - h\dot{\psi} = M_{\theta} \quad . \tag{48}$$

IV. SYSTEM SIMULATION

The guidance and control system block diagram pitch/yaw channels for the 6-DOF digital simulation is presented in Figure 3. Figure 3 shows how the signal generated by the seeker is used to drive the vanes. The seeker signal is routed to the gyroscope and damping network before going to the guidance filter. It also goes directly to the guidance filter. The output from the guidance filter is then sent to the actuator which in turn drives the vanes. The only change between evaluation of the two types of gyro models would be in the torque gain terms and the block marked "Gyro Model" as shown in Figure 3. The 6-DOF computer program listings are given in Appendices A and C. A Continuous System Simulation Language (CSSL) program is given in Appendix B. The CSSL program was utilized to analyze only the motion of the dynamic gyro prior to implementation in the 6-DOF simulation.

In this section, the CSSL program results are given for the dynamic gyro model. The 6-DOF digital missile trajectory results are given for both the idealized and the dynamic gyro models. In addition, comparison analyses of the two trajectory simulation results are made.

A. 6-DOF Digital Simulation with Ideal 2-DOF Gimballed Gyro Model

A detailed block diagram of the ideal gyro model is shown in Figure 4; of the dynamic gyro model in Figure 5. The gyro system equations of motion are presented for pitch/yaw channels as follows:

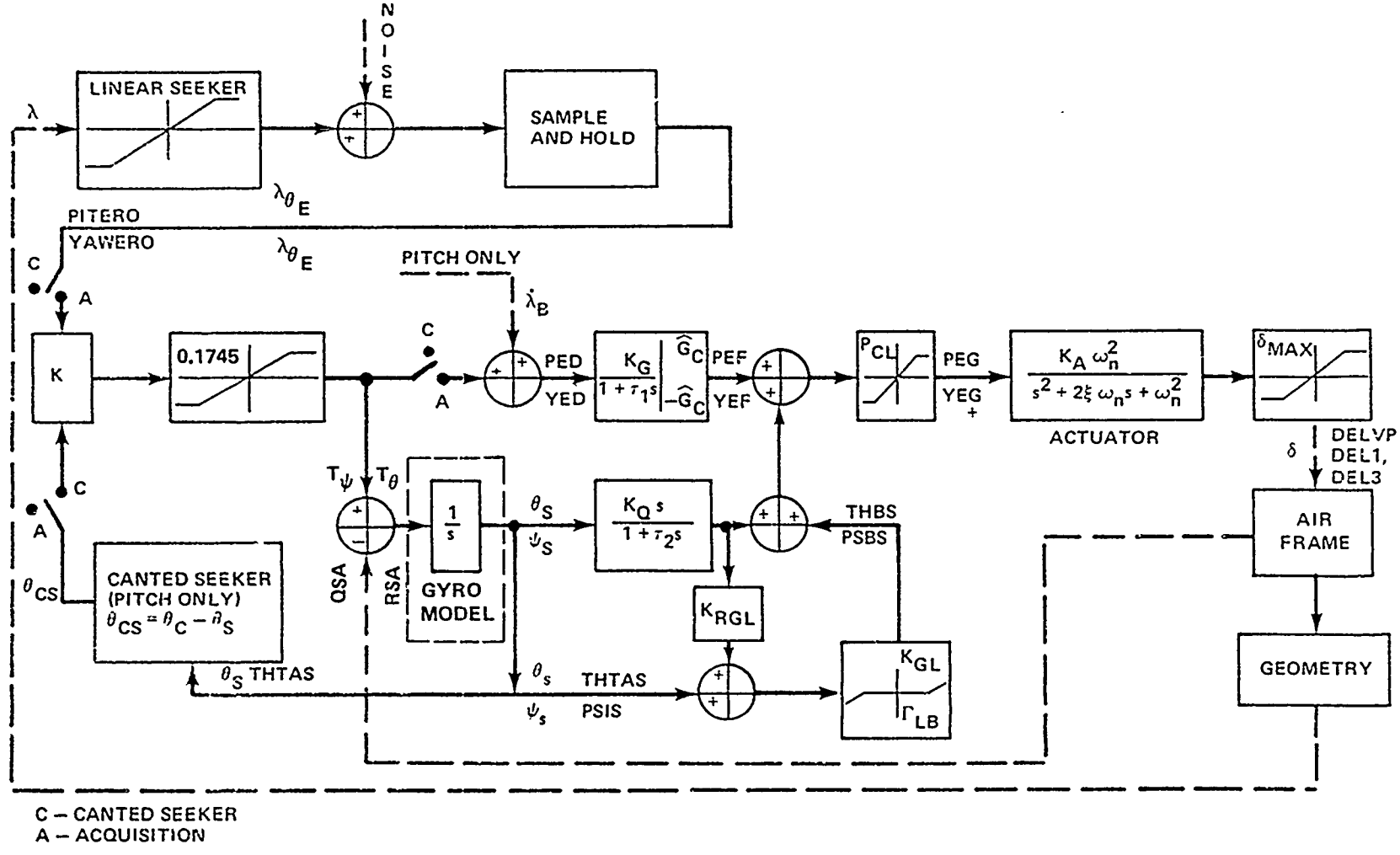


Figure 3. Guidance and control system block diagram pitch/yaw channels.

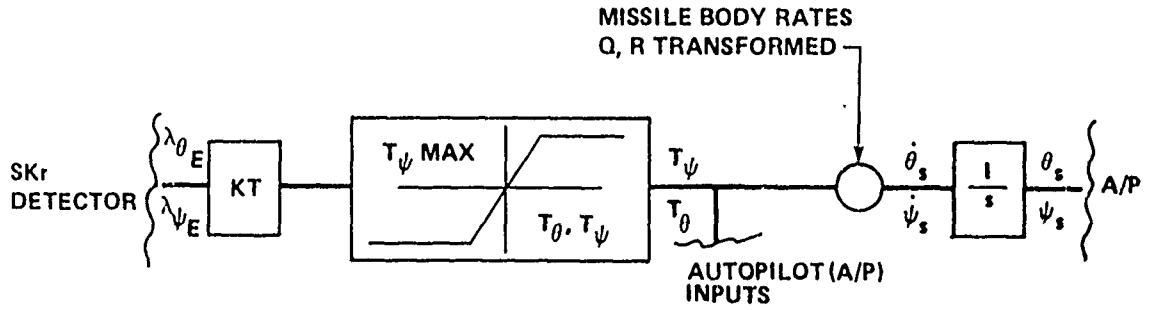


Figure 4. Ideal gyro model.

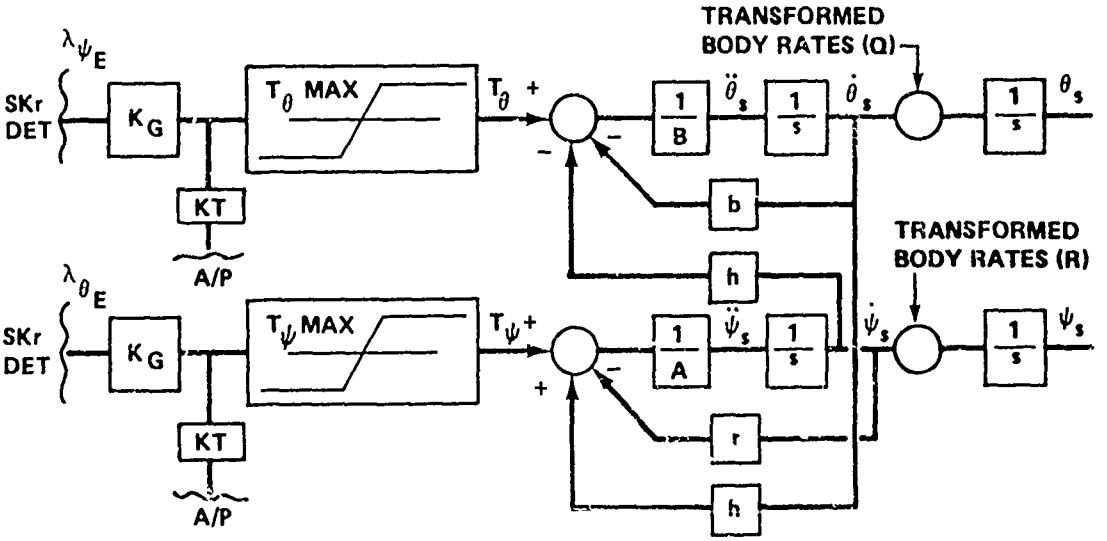


Figure 5. Gyro model in the 6-DOF simulation.

$$T_\psi = \dot{\theta}_s \cos \psi_s + QSA$$

$$T_\theta = \dot{\psi}_s + RSA \qquad (49)$$

where QSA and RSA are transformed of missile body rates, Q, R; respectively, and $\dot{\theta}_s \cos \psi_s$ and $\dot{\psi}_s$ are M_z and M_y, respectively, as taken from Equation (9). Table 1 gives the units, symbols, and names of the missile parameters used for all plots with respect to the time presented in this report. The 6-DOF digital trajectory simulation program and tabulated results are presented in Appendix A. Plots of

the missile parameters are given in Figures 6 through 55. Figures 6 through 14 represent the results of the missile (translational and angular velocities) and body Euler angles. Figures 15 through 20 show the missile position and missile to target displacements. Figures 21 through 35 represent the autopilot and actuator parameters during flight. Figures 36 through 39 show the seeker input-output values in flight. Gyro parameters are given in Figures 40 through 55. Results indicated that when an ideal gyro is utilized, the missile to target RSS accuracy is 0.215 ft at impact for a 4-km (13,120-ft) target in 14.922 sec. X, Y, Z missile error components at impact are 0, -0.0183, and -0.2, respectively. The signs on the error components mean the missile hit to the left and above the target.

B. Dynamic (Realistic) 2-DOF Gimballed Gyro

In order to obtain a more realistic assessment of a 2-DOF gimballed gyro performance, efforts were made to model the dynamics of the gyro more accurately. The equations of this model are given in Section III.B.

When considering Equation (48) for the 6-DOF digital simulation, the signs on the precession rates ($h\dot{\theta}$, $h\dot{\psi}$) will change because of different coordinate systems, i.e., a positive T_ψ will give a negative $h\dot{\theta}$ precession rate and positive T_θ will give a positive $h\dot{\psi}$ precession rate.

Thus,

$$A\ddot{\psi} + r\dot{\psi} - h\dot{\theta} = T_\psi$$

$$B\ddot{\theta} + b\dot{\theta} + h\dot{\psi} = T_\theta$$

where

A and B = moments of inertia

r, b = gimbal bearing friction

h = angular momentum

T_ψ, T_θ = moments or torques .

The preceding typical parameter values of this gyro, which has to exhibit a 10-deg/sec tracking rate and 160-Hz nutation frequency, is given in Table 2.

TABLE 1. PROGRAM VARIABLES AND DEFINITIONS

Time		Time of missile trajectory (sec)
U		Missile velocity in body coordinate system (BCS) (X-comp) (ft/sec)
V		Missile velocity in BCS (Y-comp) (ft/sec)
W		Missile velocity in BCS (Z-comp) (ft/sec)
P		Angular velocity of missile (about X-axis, roll rate) (rad/sec)
Q		Angular velocity of missile (about Y-axis, pitch rate) (rad/sec)
R		Angular velocity of missile (about Z-axis, yaw rate) (rad/sec)
PHI	ϕ	Euler angle transforming earth coordinate system (ECS) to BCS (rad)
THTA	θ	Euler angle transforming ECS to BCS (rad)
PSI	ψ	Euler angle transforming ECS to BCS (rad)
X		Position of missile in ECS (X-component) (ft)
Y		Position of missile in ECS (Y-component) (ft)
Z		Position of missile in ECS (Z-component) (ft)
DELXS		Missile to target displacement in seeker coordinate system (SCS) (X-direction) (ft)
DELYS		Missile to target displacement in SCS (Y-direction) (ft)
DELZS		Missile to target displacement in SCS (Z-direction) (ft)
THRBS		Output of the differentiator (rate damping) of pitch autopilot (A/P) (rad)
PSRBS		Output of the differentiator (rate damping) of yaw A/P (rad)
THBS		Output of the dead band zone limiter pitch A/P (rad)
PSBS		Output of the dead band zone limiter pitch A/P (rad)
PED		Input to guidance filter (pitch plane) (rad/sec)
YED		Input to guidance filter (yaw plane) (rad/sec)
PEF		Output of guidance filter (pitch plane) (rad/sec)
YEF		Output of guidance filter (yaw plane) (rad/sec)

TABLE 1. (CONCLUDED)

PEG		Output of pitch A/P (rad)
YEG		Output of yaw A/P (rad)
PHIG		Input to shaping filter of roll A/P
REG		Output of roll A/P (rad)
DELVP		Equivalent vane deflection (pitch plane) (rad)
DEL1		Deflection of Vane 1 (rad)
DEL3		Deflection of Vane 3 (rad)
PITERR		Seeker input - LOS error in pitch plane (rad)
PITERO		Seeker output - LOS error in pitch plane (rad)
YAWERR		Seeker input - LOS error in yaw plane (rad)
YAWERO		Seeker output - LOS error (rad)
DTHTAS	$\dot{\theta}_s$	Time derivative of THTAS (rad/sec)
THTAS	θ_s	THETA angle of gyro seeker (rad) - pitch angle between the body and seeker axis
DPSIS	$\dot{\psi}_s$	Time derivative of PSIS (rad/sec)
PSIS	ψ_s	PSI angle of gyro seeker (rad) - yaw angle between the body and seeker axis
OMEGZ		Gyro torque input from seeker (rad/sec)
OMEGY		Gyro torque input from seeker (rad/sec)
QSA		Transformation of P, Q, R into the SCS for gyro (pitch plane)
RSA		Transformation of P, Q, R into the SCS for gyro (yaw plane)
DTHASD	$\ddot{\theta}_s$	Time derivative of THASD [(rad/sec)/sec]
THASD	$\dot{\theta}_s$	State variable - time derivative of THATS (rad/sec)
DPSISD	$\ddot{\psi}_s$	Time derivative of PSISD [(rad/sec)/sec]
PSISD	$\dot{\psi}_s$	State variable time derivation of PSIS (rad/sec)

1. CSSL Program

The gyro model with parameters (Table 2) was incorporated into the CSSL simulation. The results, presented in Figure 56 with use of the typical CSSL program listing given in Appendix B, indicated the gyro behaved as expected with step inputs, that is, it exhibited the 10-deg/sec tracking rate and the 160-Hz nutation frequency. At this point, the gyro model was incorporated into the 6-DOF digital missile trajectory simulation. Section IV.B.2 gives the results of implementing the dynamic gyro model in the 6-DOF simulation.

2. 6-DOF Digital Simulation with Dynamic 2-DOF Gimballed Gyro Model

The idealized gyro model was replaced by the dynamic gyro model and successfully implemented in the 6-DOF simulation. A detailed block diagram of the dynamic gyro model is described in Figure 5 and the second order differential equations of motions for the gyro are shown for the pitch/yaw channels.

$$A\ddot{\psi}_s + r\dot{\psi}_s - h\dot{\theta}_s = T_\psi$$

$$B\ddot{\theta}_s + b\dot{\theta}_s + h\dot{\psi}_s = T_\theta$$

The 6-DOF digital trajectory simulation program and tabulated results are shown in Appendix B. Again plots of the missile parameters are presented in Figures 57 through 120. Figures 57 through 65 give the results of the missile translational and angular velocities and body Euler angles in flight. Plots of the missile position and target displacements are shown in Figures 66 through 73. Figures 74 through 88 give autopilots and actuator parameters plots. Plots of seeker input-output values are shown in Figures 89 through 92. Gyro parameters are given in Figures 93 through 120. The missile to target RSS accuracy is 1.68 ft at impact for the 4-km target in 14.936 sec. X, Y, Z missile error components at impact are 2.00, -0.154, and 0.1, respectively. The signs on the error components mean the missile hit in front, to the left, and above the target.

TABLE 2. DYNAMIC SEEKER — GYRO SPECIFICATIONS

Description	Notation	Eng. Units	Simulation Units	
			CSSL	6-DOF
Pitch Inertia	B	0.462 lb $in.^2$	0.0032083 lb-ft^2	0.00009972 slug ft^2
Yaw Inertia	A	0.390 lb $in.^2$	0.0027083 lb-ft^2	0.00008414 slug ft^2
Spin Momentum	h,H	17.7 in. oz-sec	0.0921875 ft lb-sec	0.0921875 ft lb-sec
Gimbal Axis Friction 1 per axis	r,b	0.033 oz-in.	0.00017192 lb-ft	0.00017192 lb-ft
Moments or Torques	T_ψ, T_θ	3.0 in.-oz 3.18 in.-oz*	0.015625 ft-lb	0.016562 ft-lb

*An updated gyro specification.

C. Comparative Analyses

When considering the dynamic gyro model without the damping terms ($r\dot{\psi}$, $b\dot{\theta}$), the gyro equations of motion become

$$B\ddot{\theta} + h\dot{\psi} = T_\theta$$

$$-h\dot{\theta} + A\ddot{\psi} = T_\psi \quad . \tag{50}$$

The Laplace transform is used for the equation of motion:

$$\begin{bmatrix} s^2 + \frac{h}{B}s \\ -\frac{h}{A}s + s^2 \end{bmatrix} \begin{bmatrix} \Theta \\ \Psi \end{bmatrix} = \begin{bmatrix} \frac{T_\theta(s)}{B} + s\theta(0^+) + \dot{\theta}(0^+) + \frac{h_\psi}{B}(0^+) \\ \frac{T_\psi(s)}{A} - \frac{h}{A}\theta(0^+) + s\psi(0^+) + \dot{\psi}(0^+) \end{bmatrix} \quad . \tag{51}$$

Therefore, the characteristic equation is given from the left-hand side of the preceding equation by

$$s^2\left(s^2 + \frac{h^2}{AB}\right) = 0 \tag{52}$$

the roots of which are $s = 0, 0$ and $s = \pm jh\sqrt{AB}$. The zero roots give "constant" motion. The imaginary roots give an oscillation at frequency $\omega = h/\sqrt{AB}$. To obtain a magnitude of ω, the gimbals are massless and B, A are diametral moments of inertia of the rotor. They are equal to one-half its polar moment of inertia, $B = A = I_{r/2}$. Since $h = I_r n$ where n = rotor speed, then

$$\omega = \frac{I_r n}{\sqrt{\frac{I_r^2}{4}}} = 2n \quad . \tag{53}$$

Therefore, the oscillation frequency is twice the spin speed. However, because real gimbals are not massless, the real gyro has an oscillation frequency somewhat less than 2n as is true in the dynamic gyro model. From the preceding characteristic equation, the oscillatory motion is undamped. Therefore, the rate-dependent terms ($h\dot{\theta}$, $h\dot{\psi}$) act only as the gyroscopic coupling terms and do not produce energy dissipation for damping. Therefore, all damping occurs from the $r\dot{\psi}$ and $b\dot{\theta}$ terms.

Figures 93 through 100 and Figures 105 through 112 demonstrate the oscillatory frequency with damping and precession of the dynamic gyro. Figures 96 and 108 exhibit the 160-Hz nutation frequency of the gyro and 10-deg/sec tracking rate. The ideal gyro model reflects only the 1/s characteristics as seen in Figures 40 through 49.

The velocity and rotational components (V, W, Q, and R) of a missile in flight with the dynamic gyro model (given in Figures 58, 59, 61, and 62) show a definite increase and oscillatory effect with damping in the velocity components as compared to the ideal gyro. The body Euler angles θ and ψ reflect this motion. The autopilot parameters also show the influence of the dynamic gyro response. Actuator output to the vanes (DELVP, DEL1, and DEL3) also reflect the differences between the ideal and dynamic gyro models.

Impact accuracy of the missile to target when utilizing an ideal gyro model or a dynamic gyro model in a 6-DOF digital simulation is shown in Table 3.

TABLE 3. IMPACT ACCURACY

	Time	X	Y Error	Z	RSS Miss Distance
Ideal Gyro	14.922	13120	-0.01832	-4000.2	0.2146
Dynamic Gyro	14.936	13118	-0.15455	-4000.1	1.6799

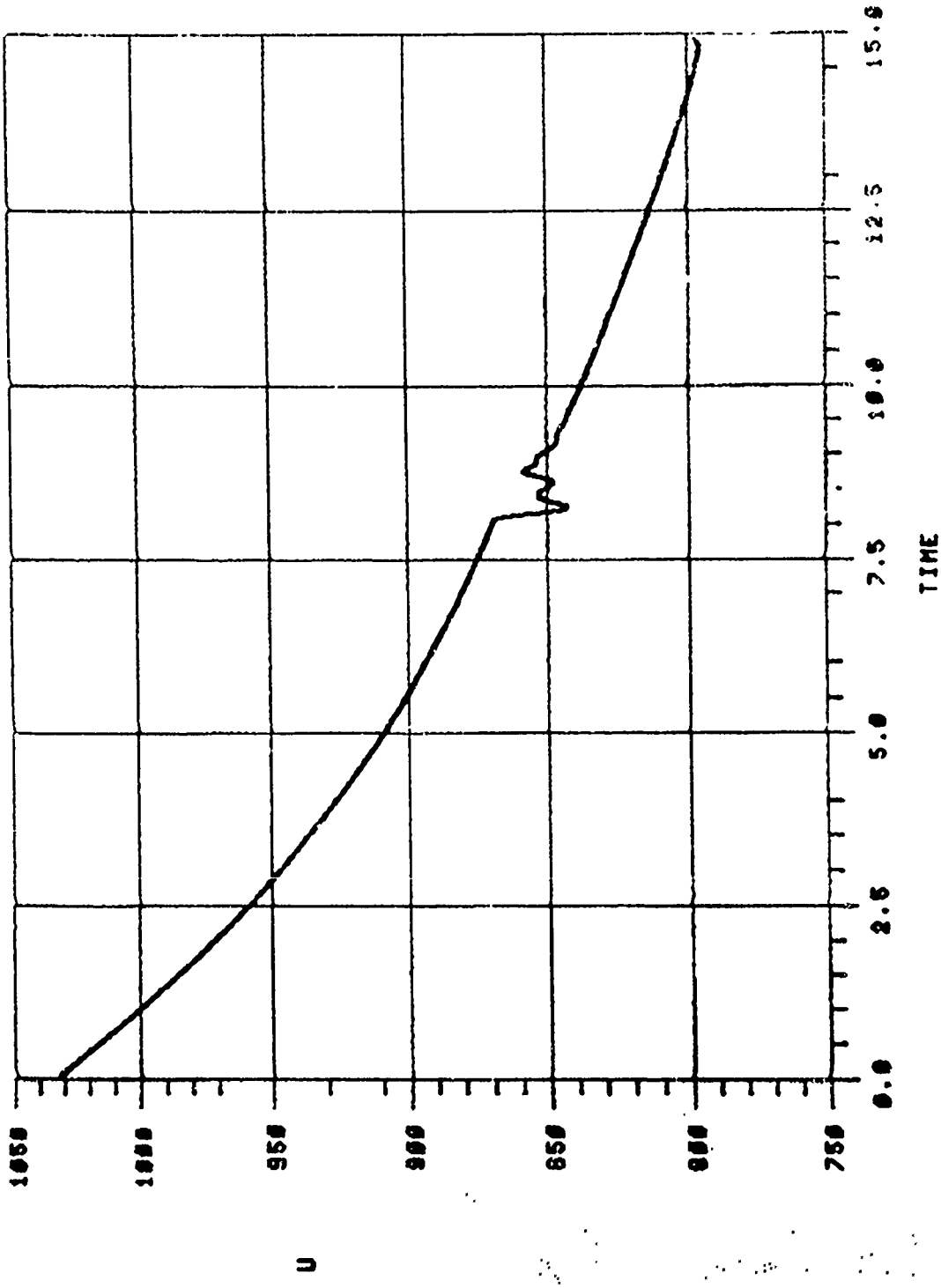
NOTES: X indicates range of target at 13,120 (4 km).
Y indicates crossrange error (minus left of target).
Z indicates vertical error (launched at -4000 ft above sea level.

As can be seen in Table 3, the dynamic model will produce a better assessment of the missile accuracy at impact because a more realistic gyro model is used in the simulation.

The primary 6-DOF programming difference between the ideal and dynamic gyro models as seen in Appendices A and C, respectively, is in the subroutine EDSKRGYRO. This subroutine reflects the change in gyro models.

V. CONCLUSION

This report has demonstrated that a dynamic gyro model, when utilized in a 6-DOF digital missile trajectory simulation, will give a more realistic assessment of a seeker gyro than an ideal gyro model. Most 6-DOF digital simulations in the past have used primarily the 2-DOF ideal gyro model. No efforts were made to change the autopilot or seeker characteristic in this study to accommodate the dynamic model. Reasonable results were obtained without change. However, considerations should be given to the use of the 2-DOF dynamic model based on results of this report. More accurate autopilot design and seeker interface design would probably result in the use of the dynamic gyro model for digital simulations.



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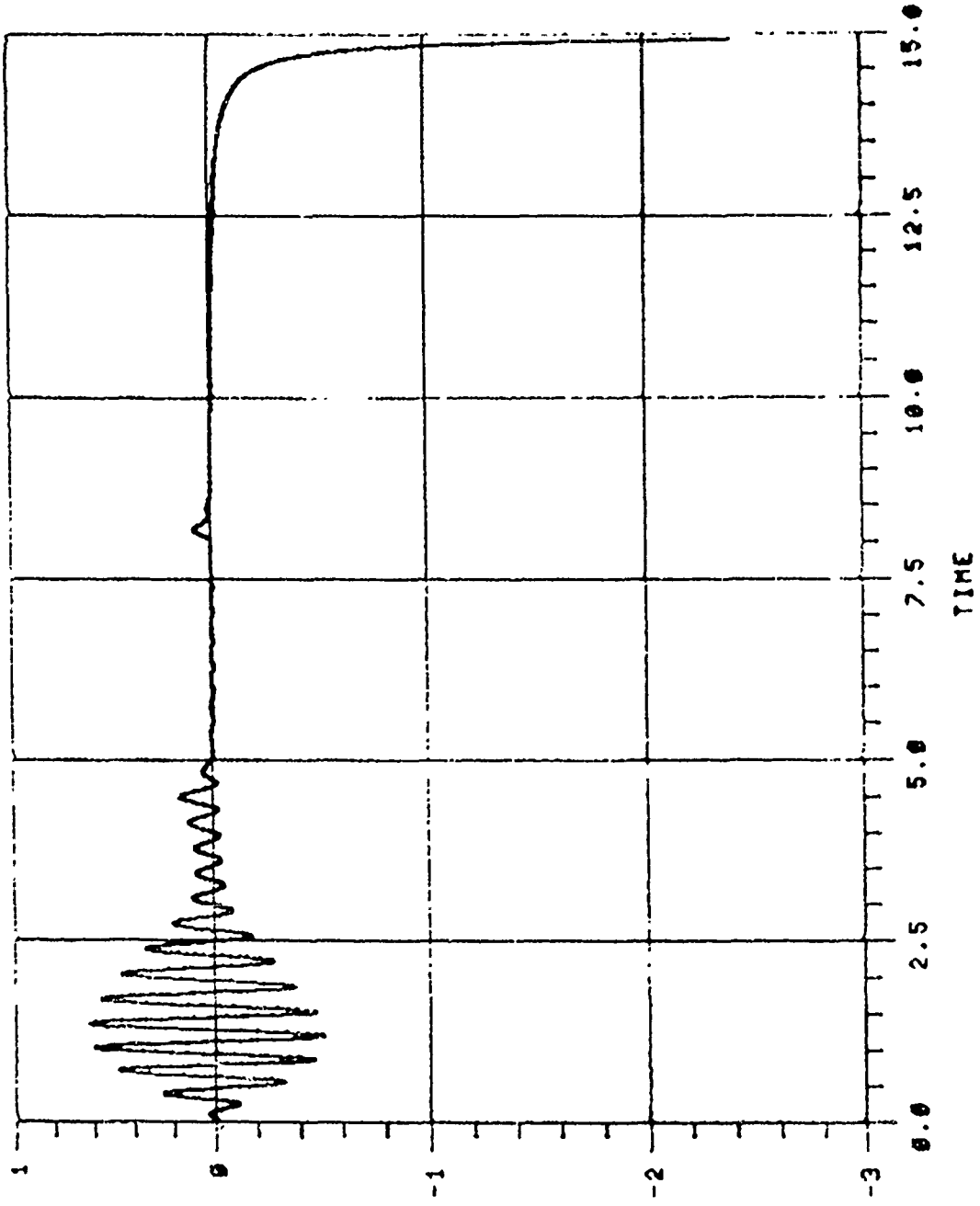

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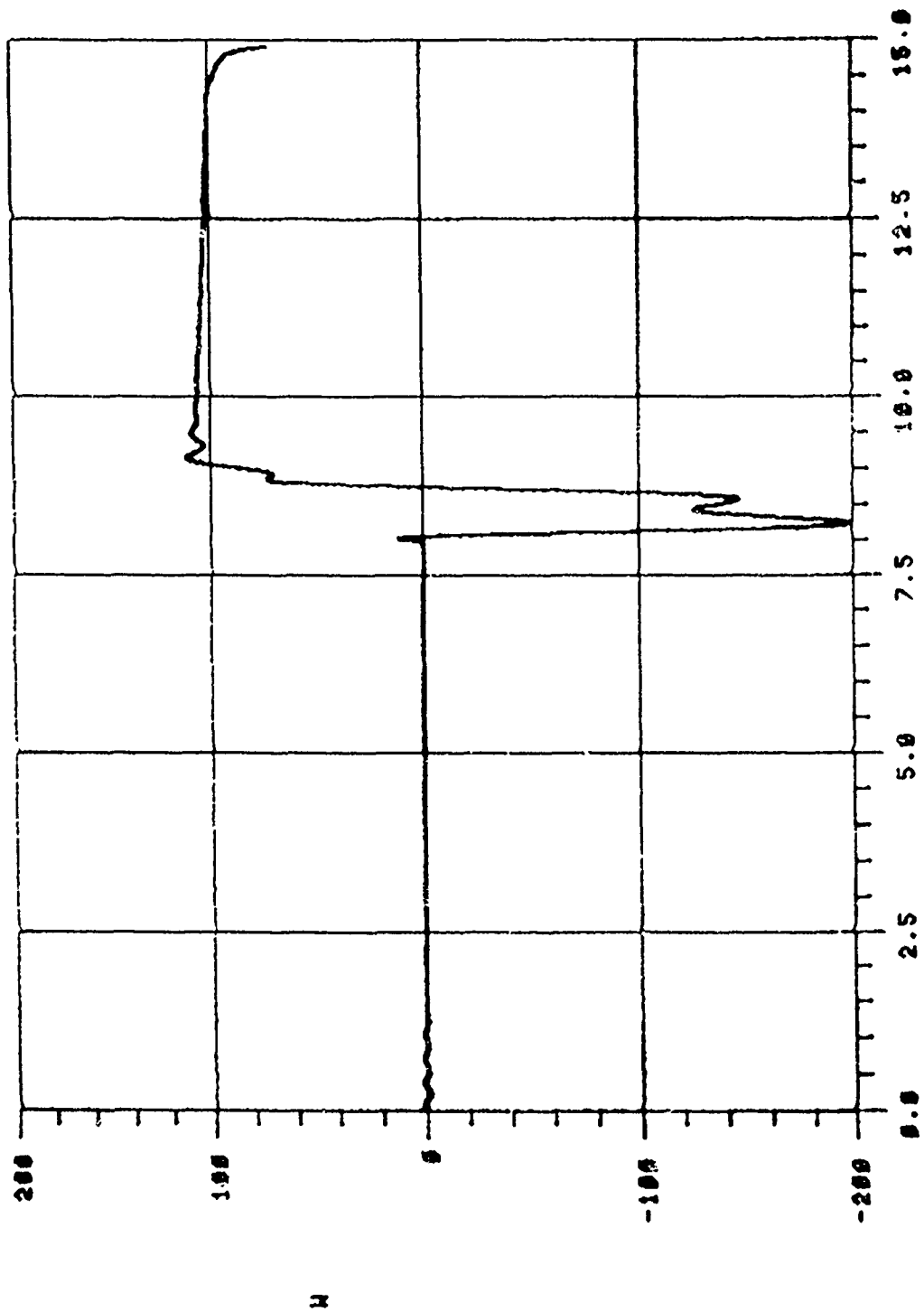

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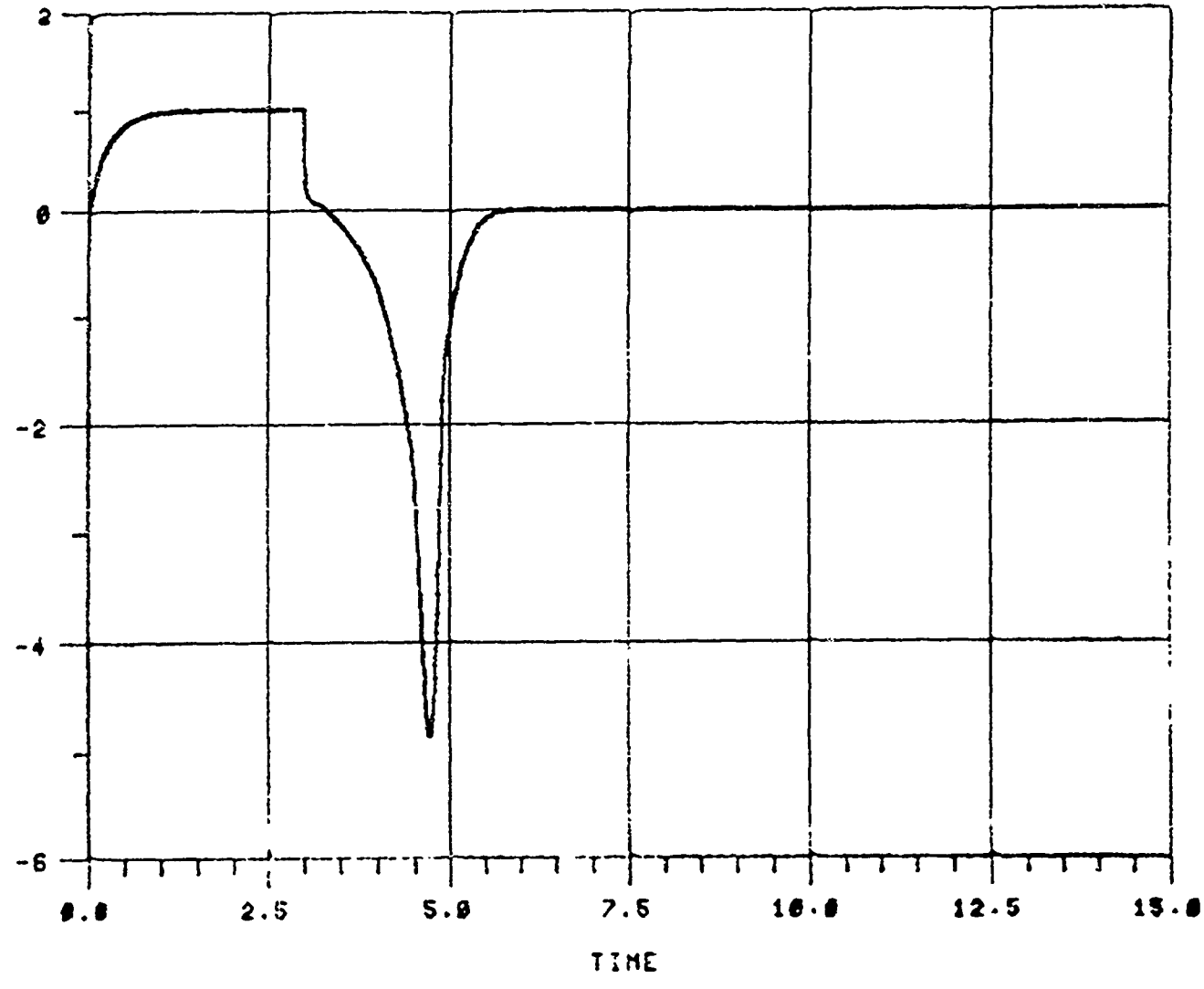

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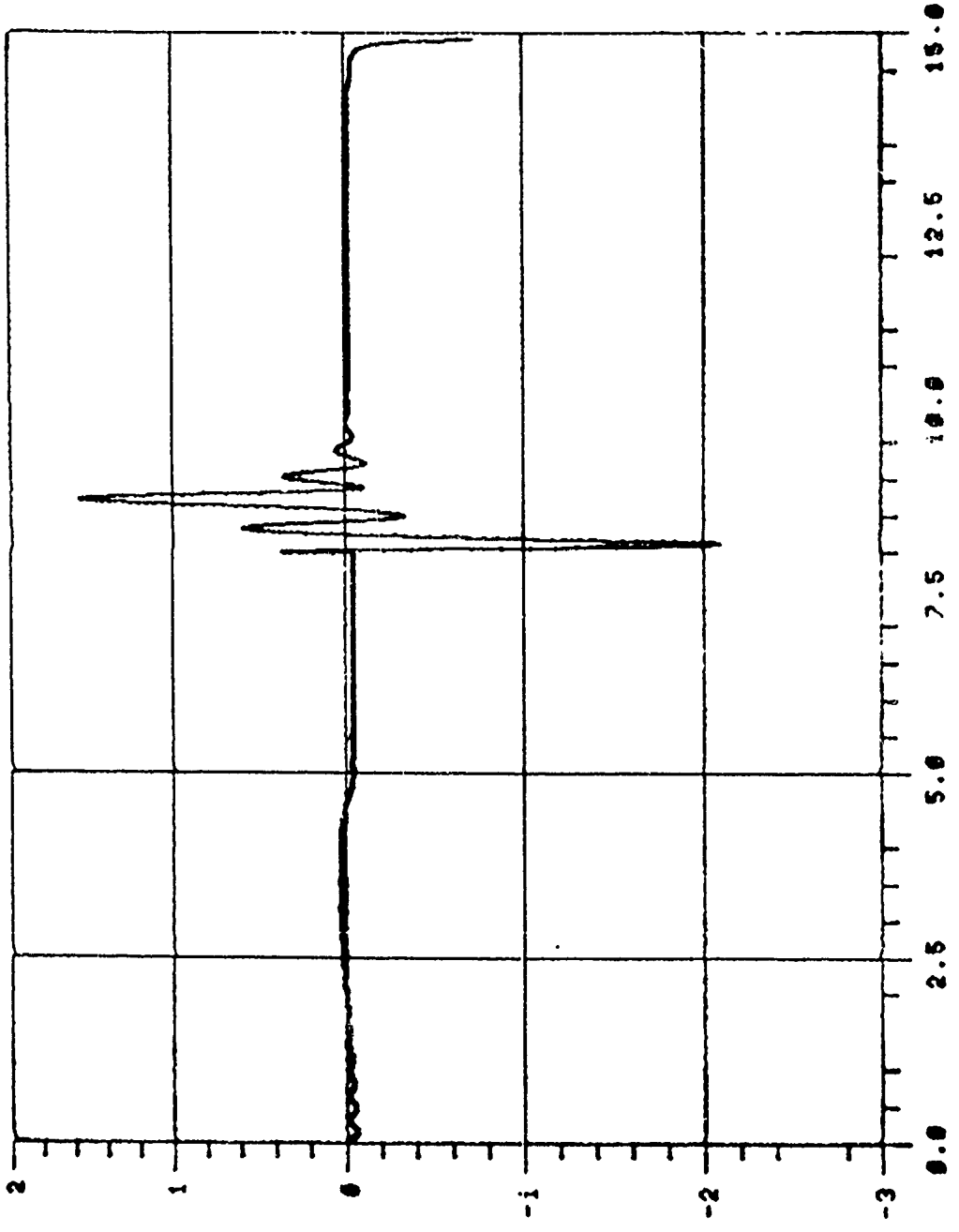

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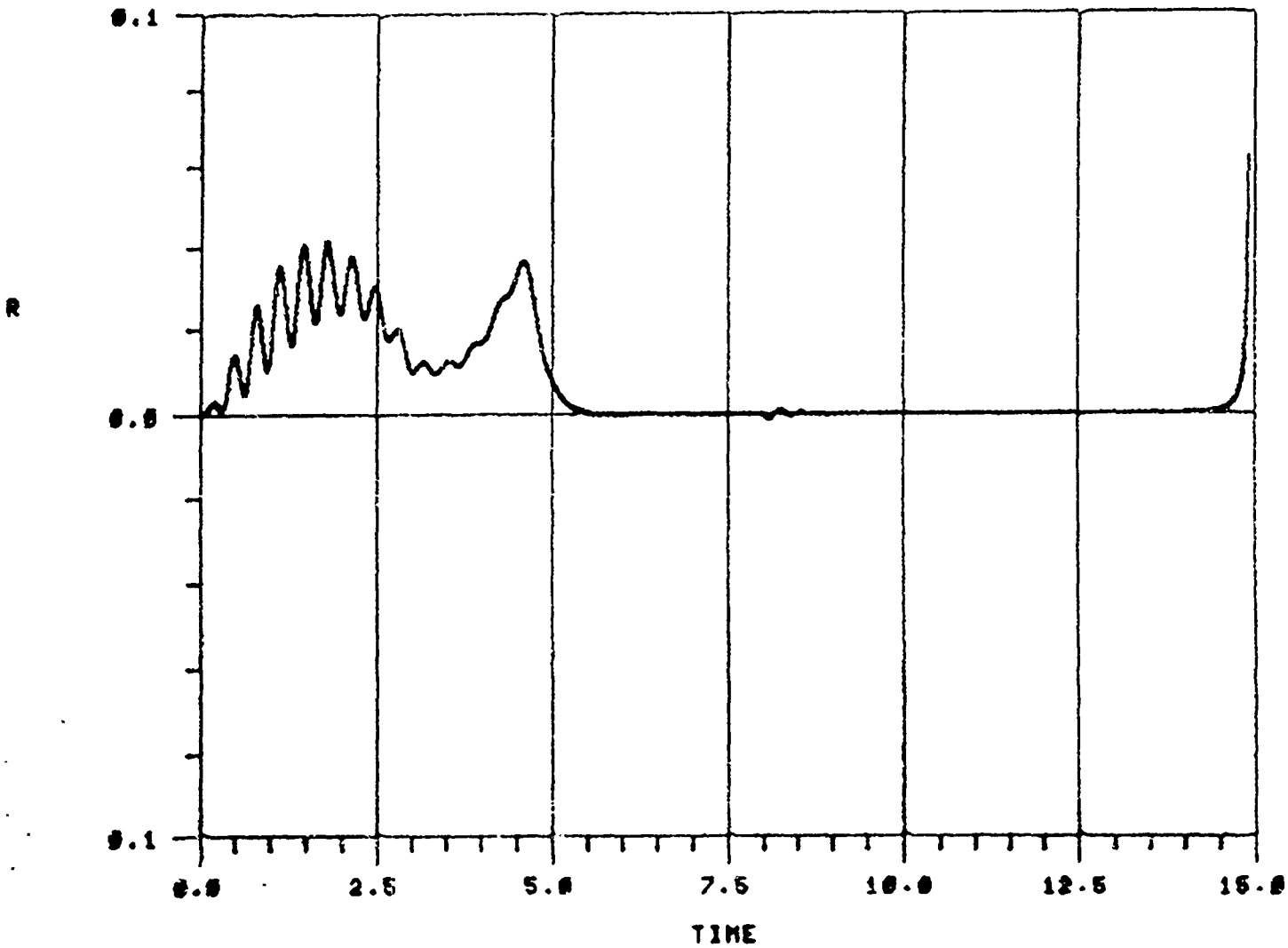

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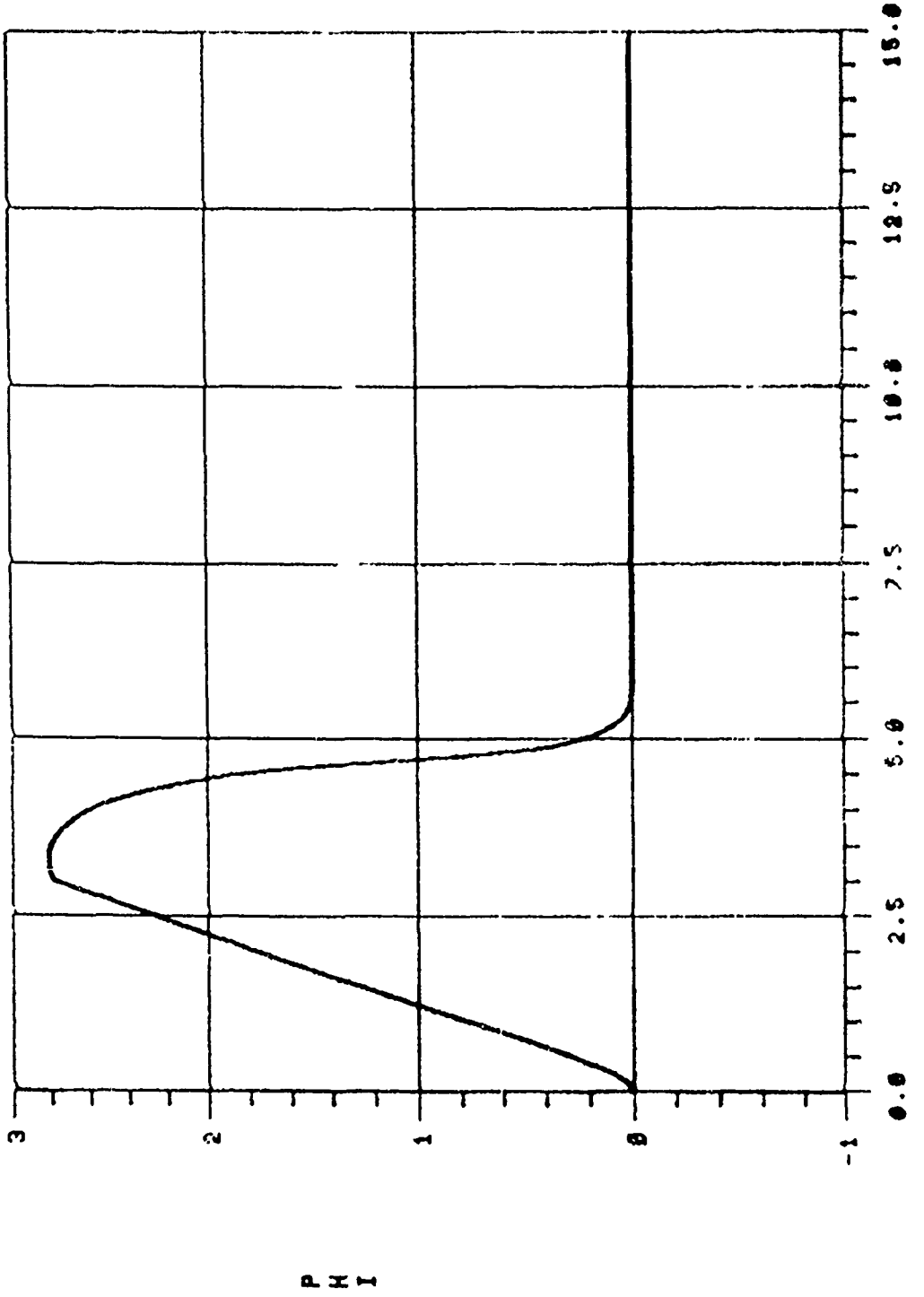

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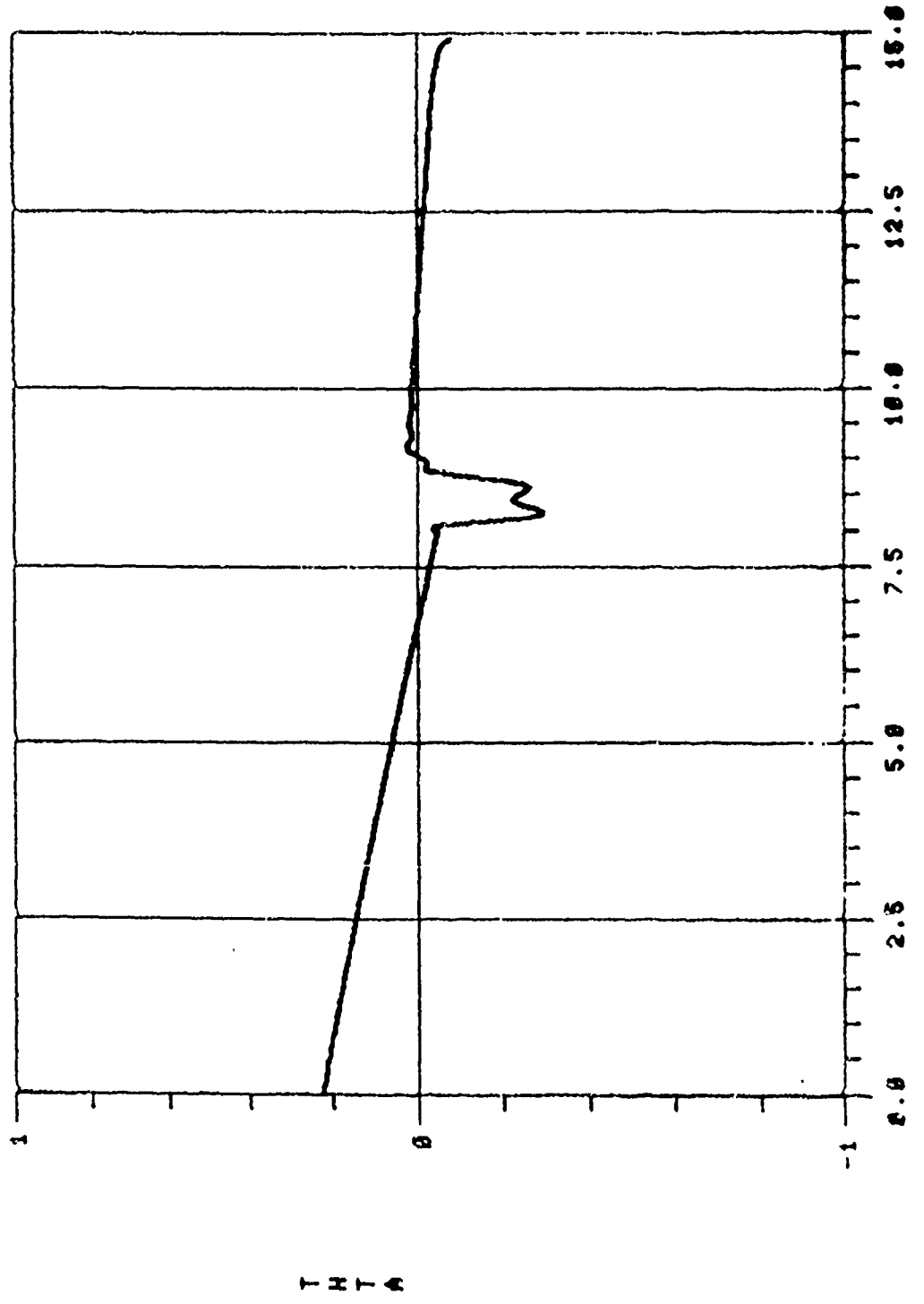

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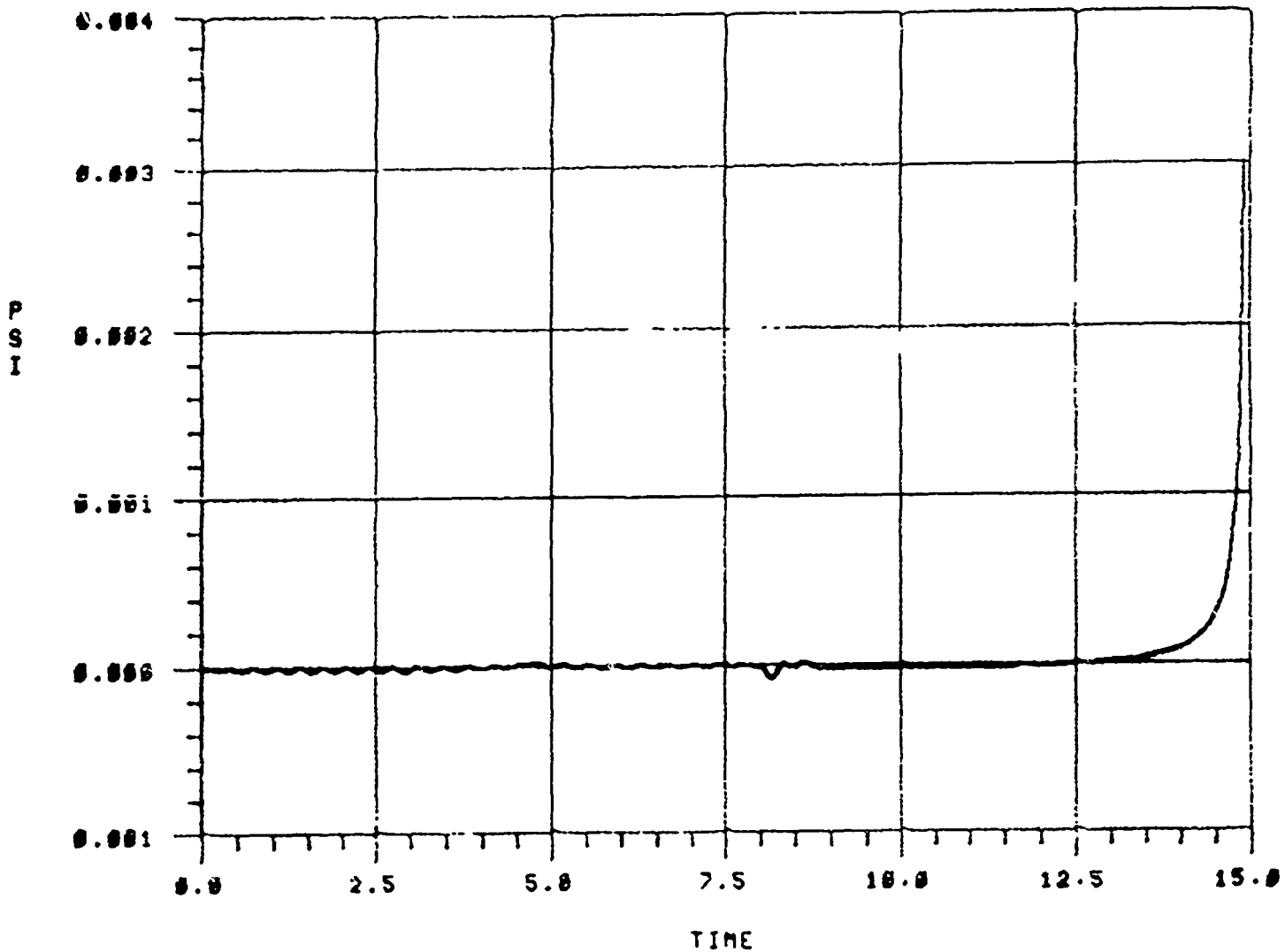

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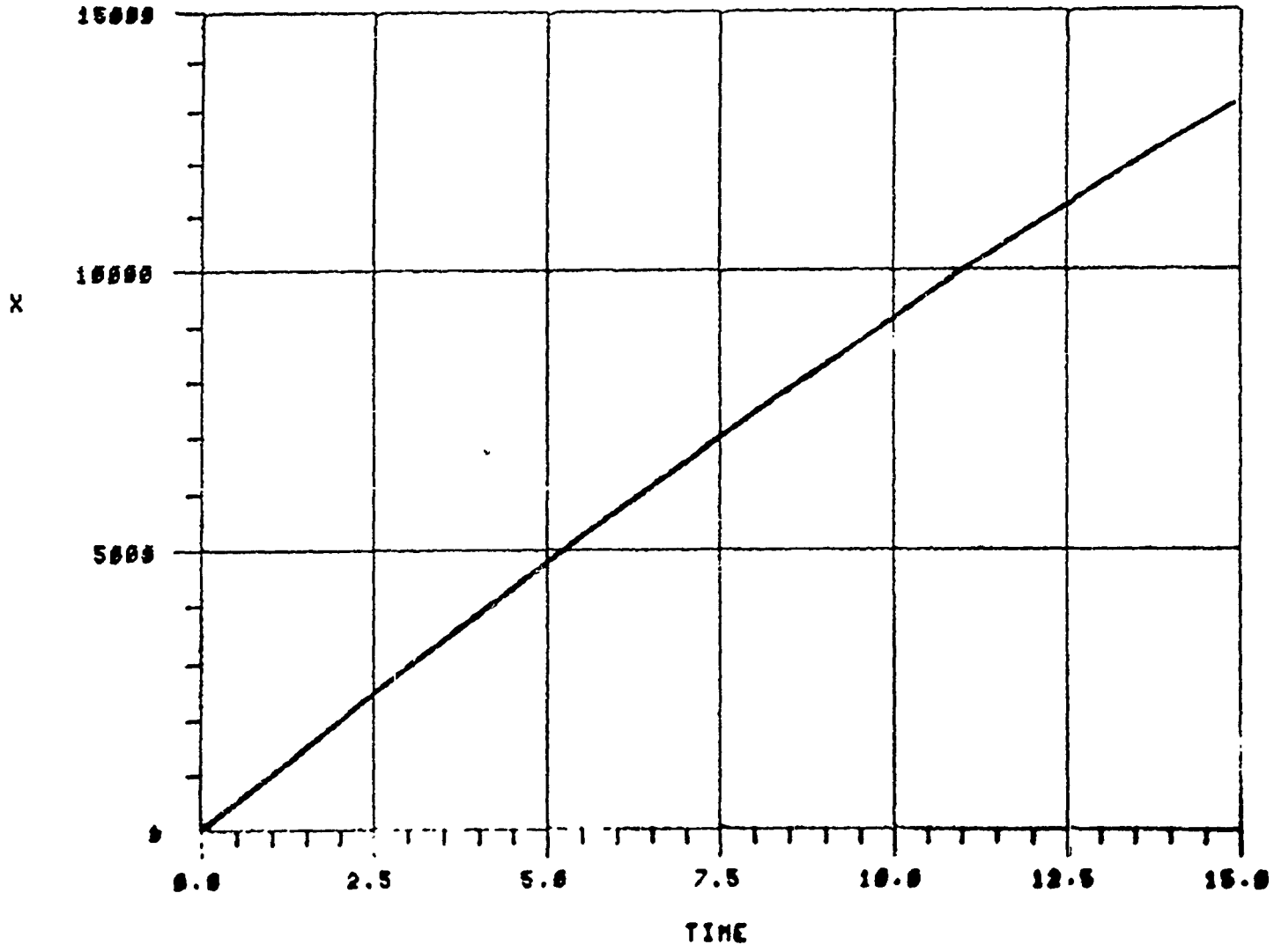

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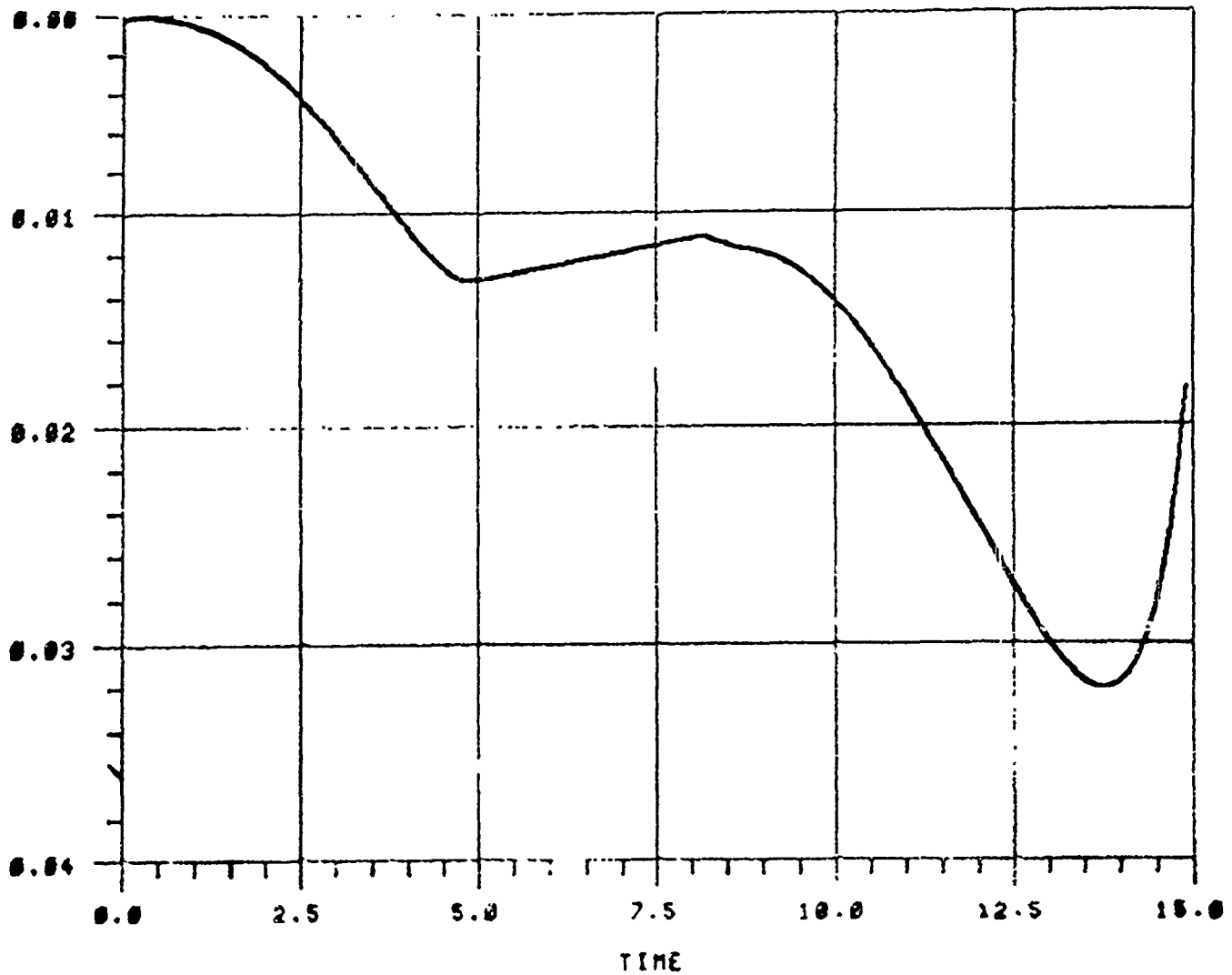

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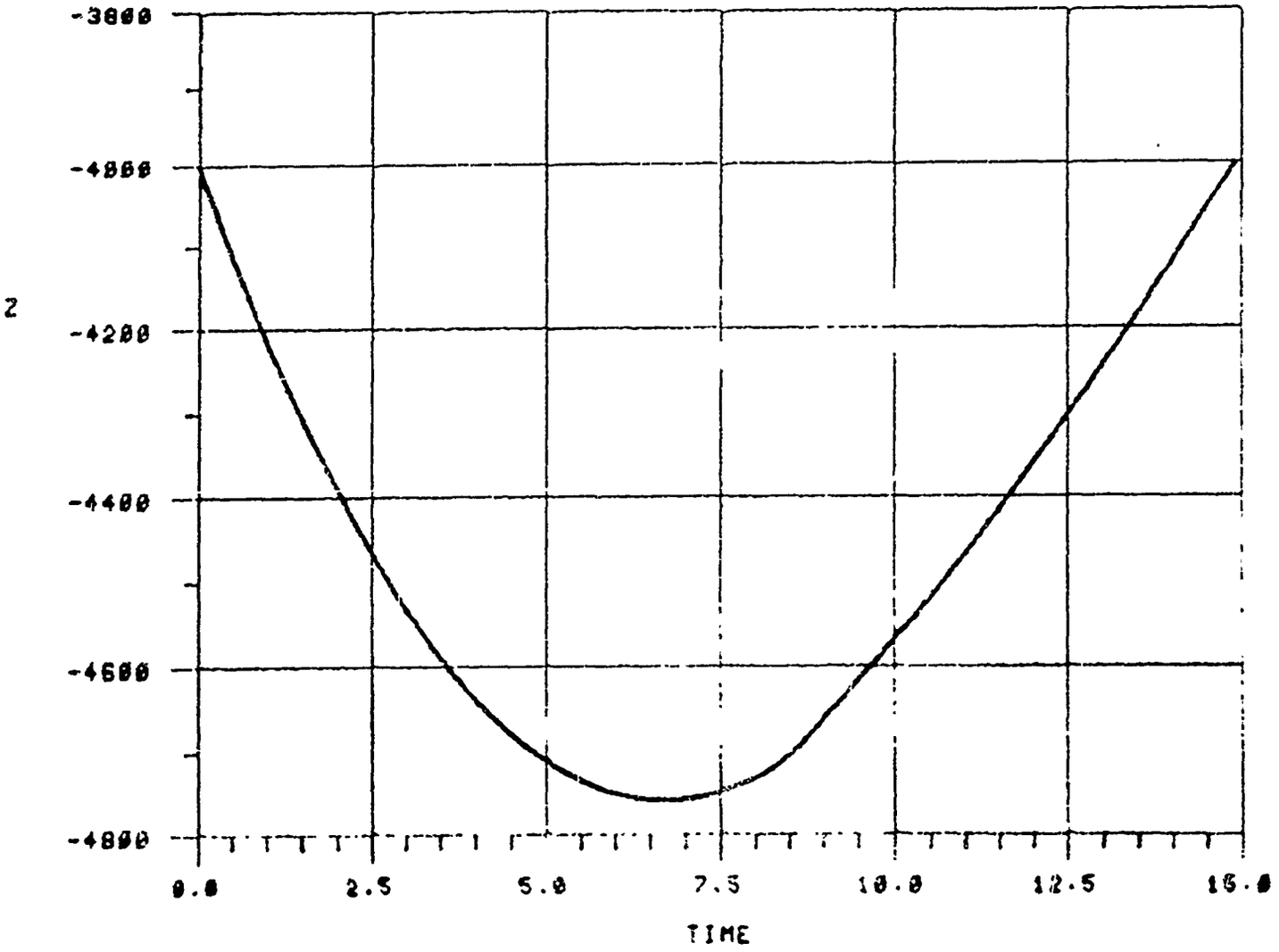

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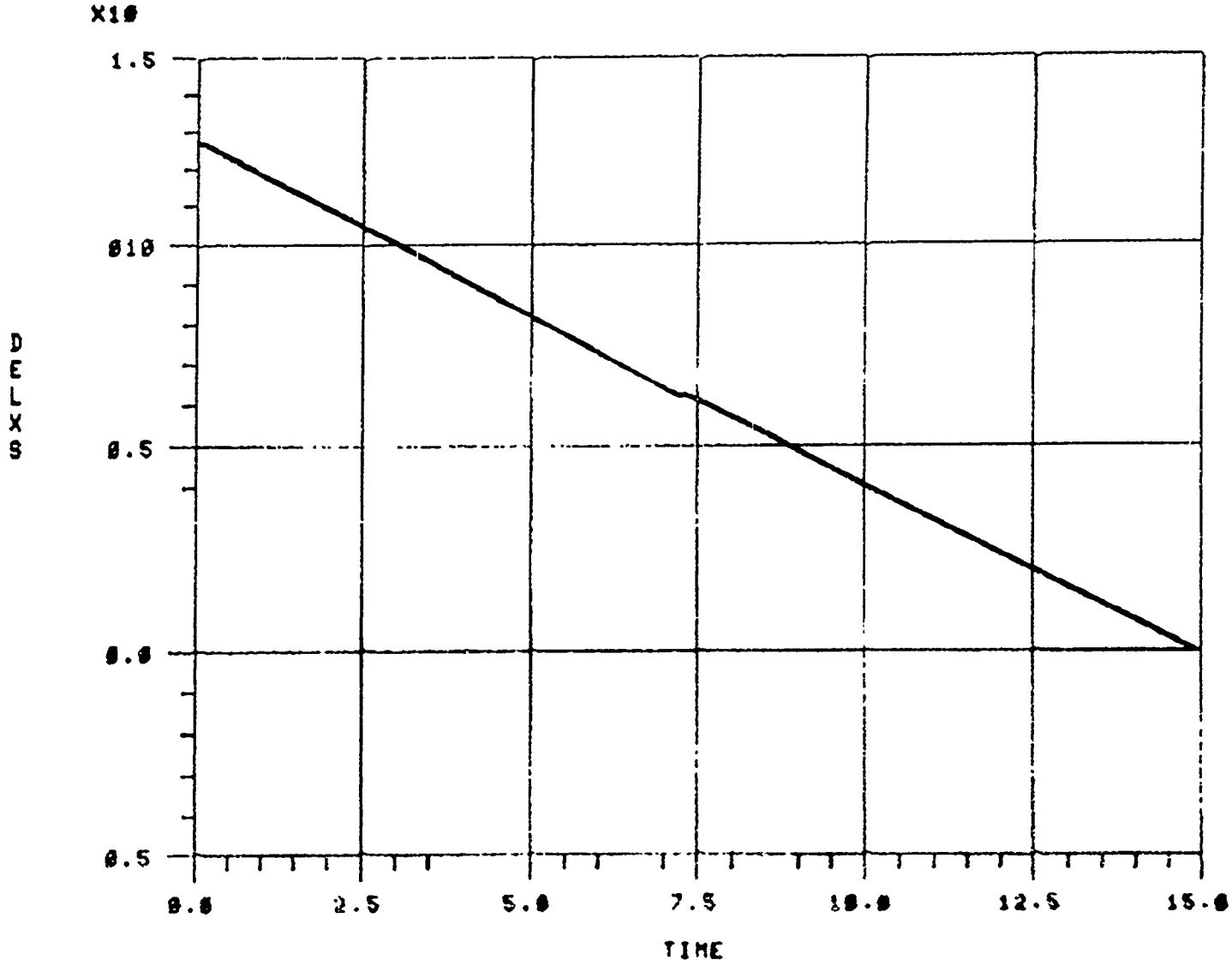

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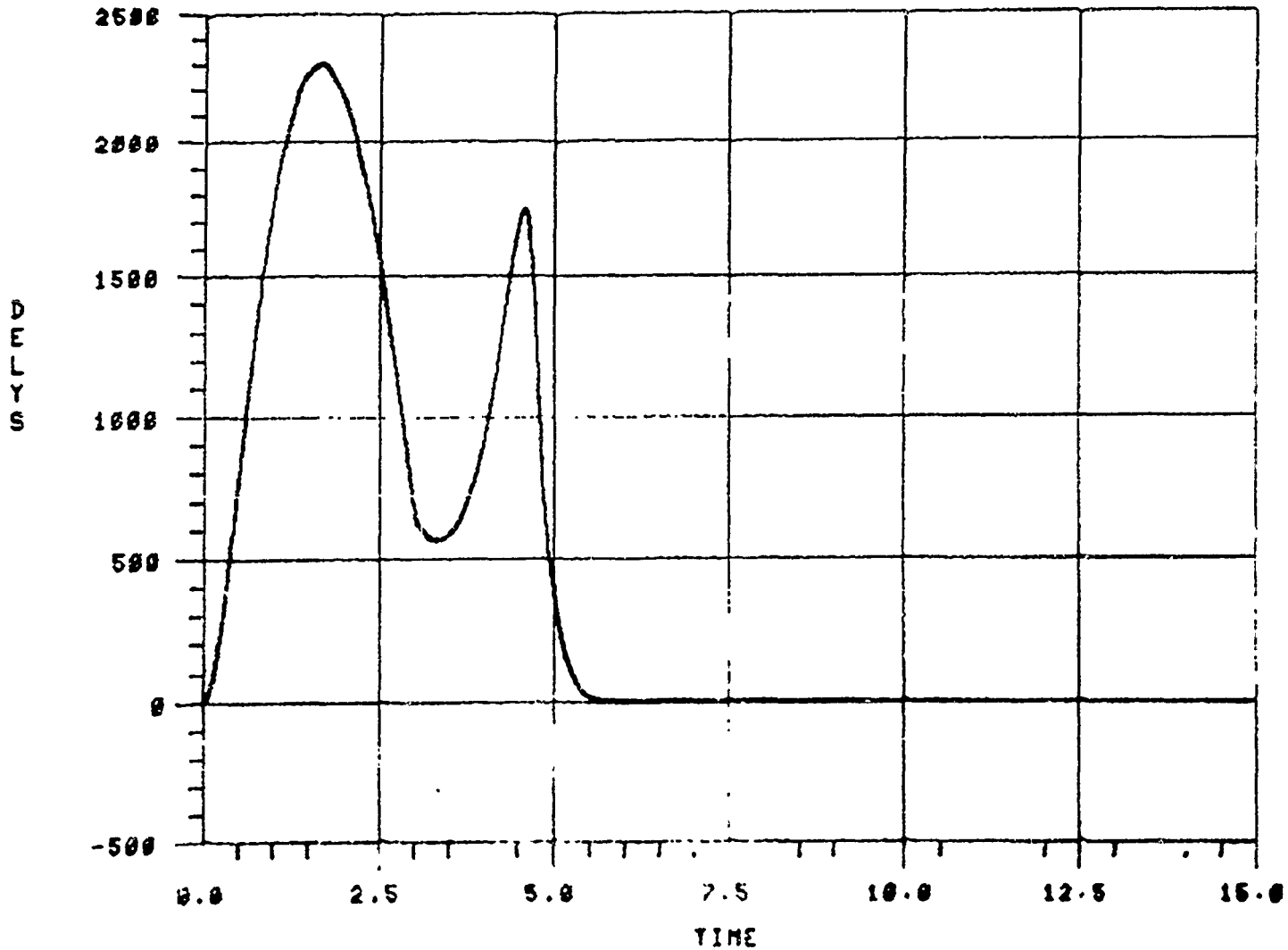

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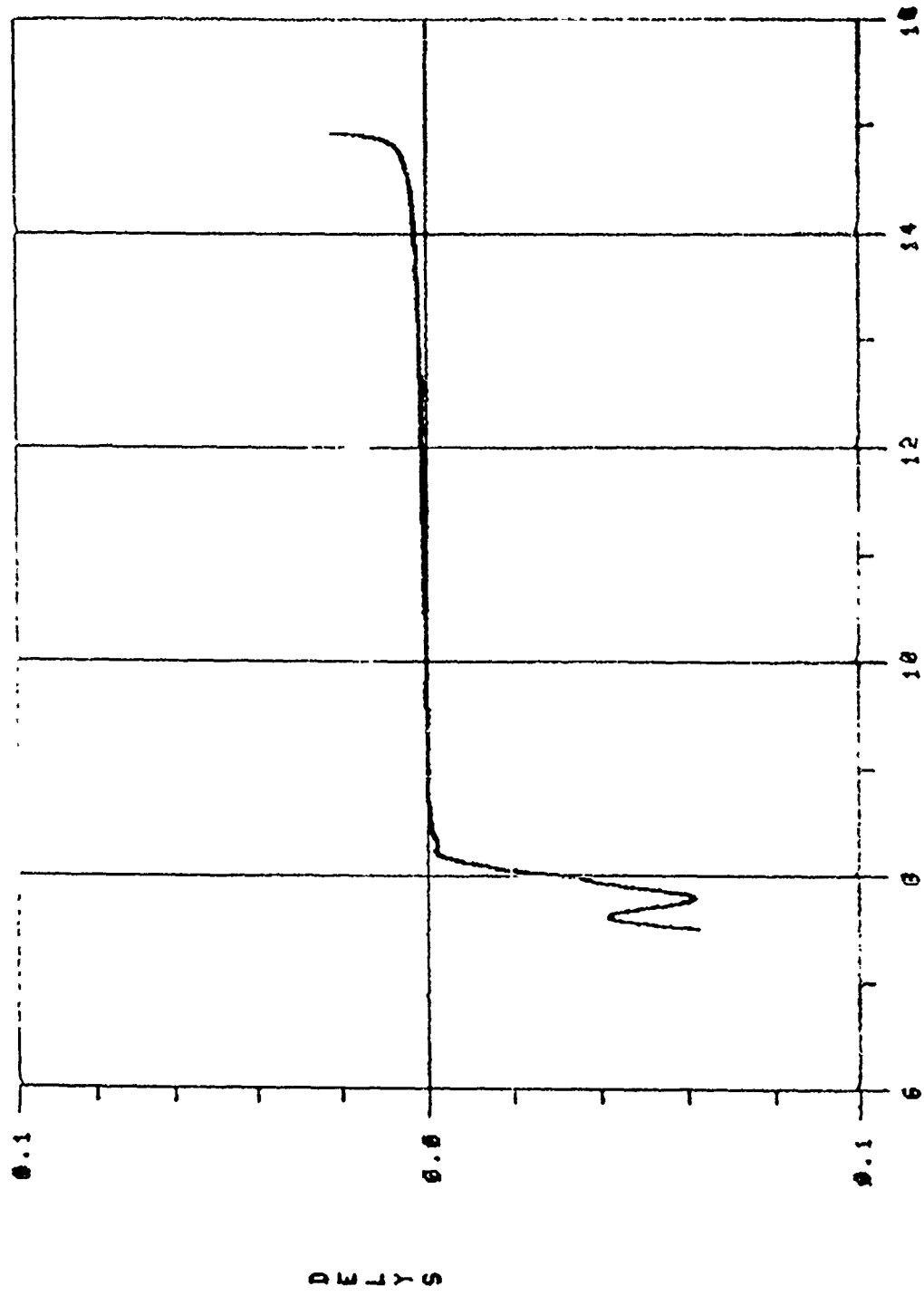

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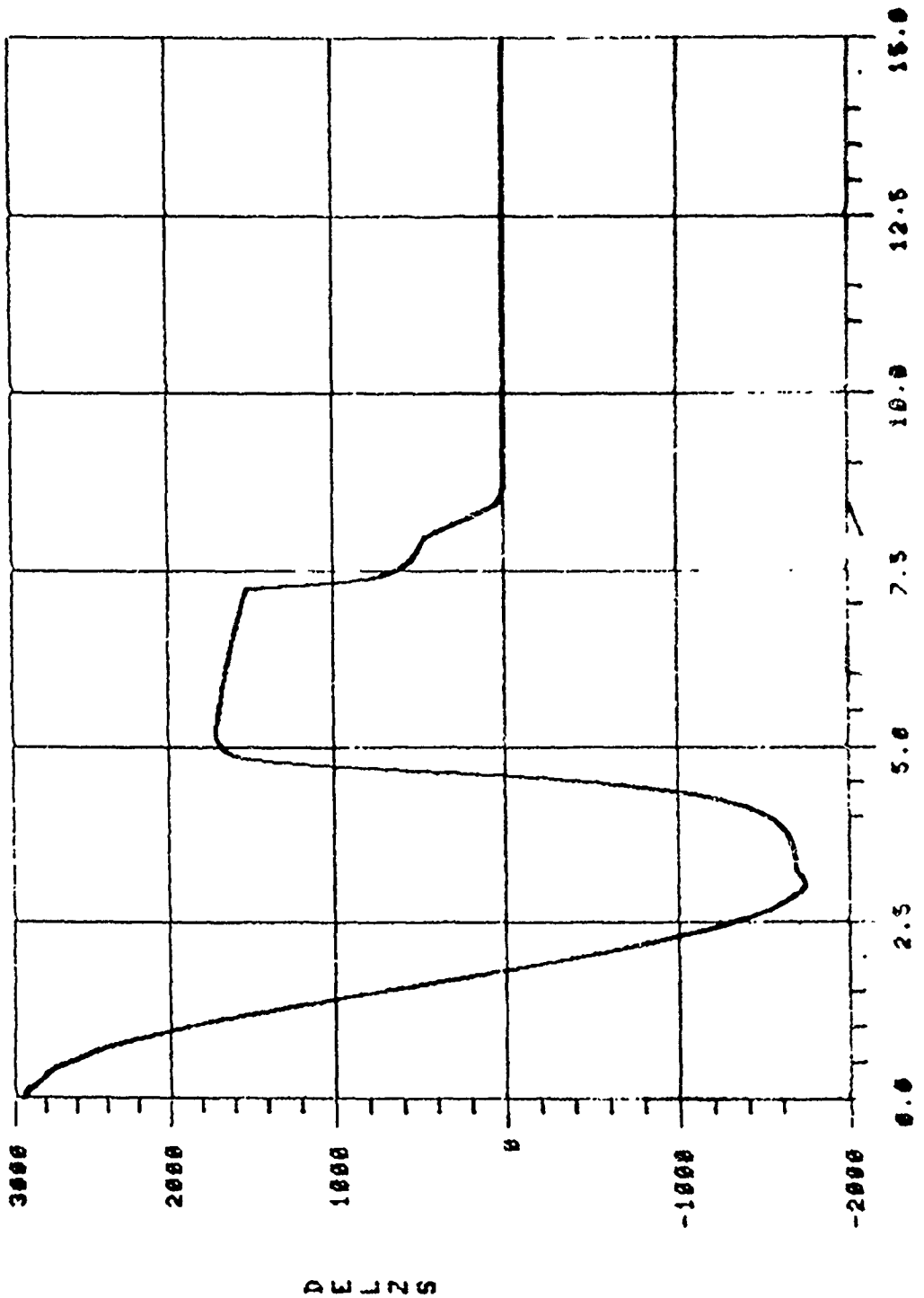

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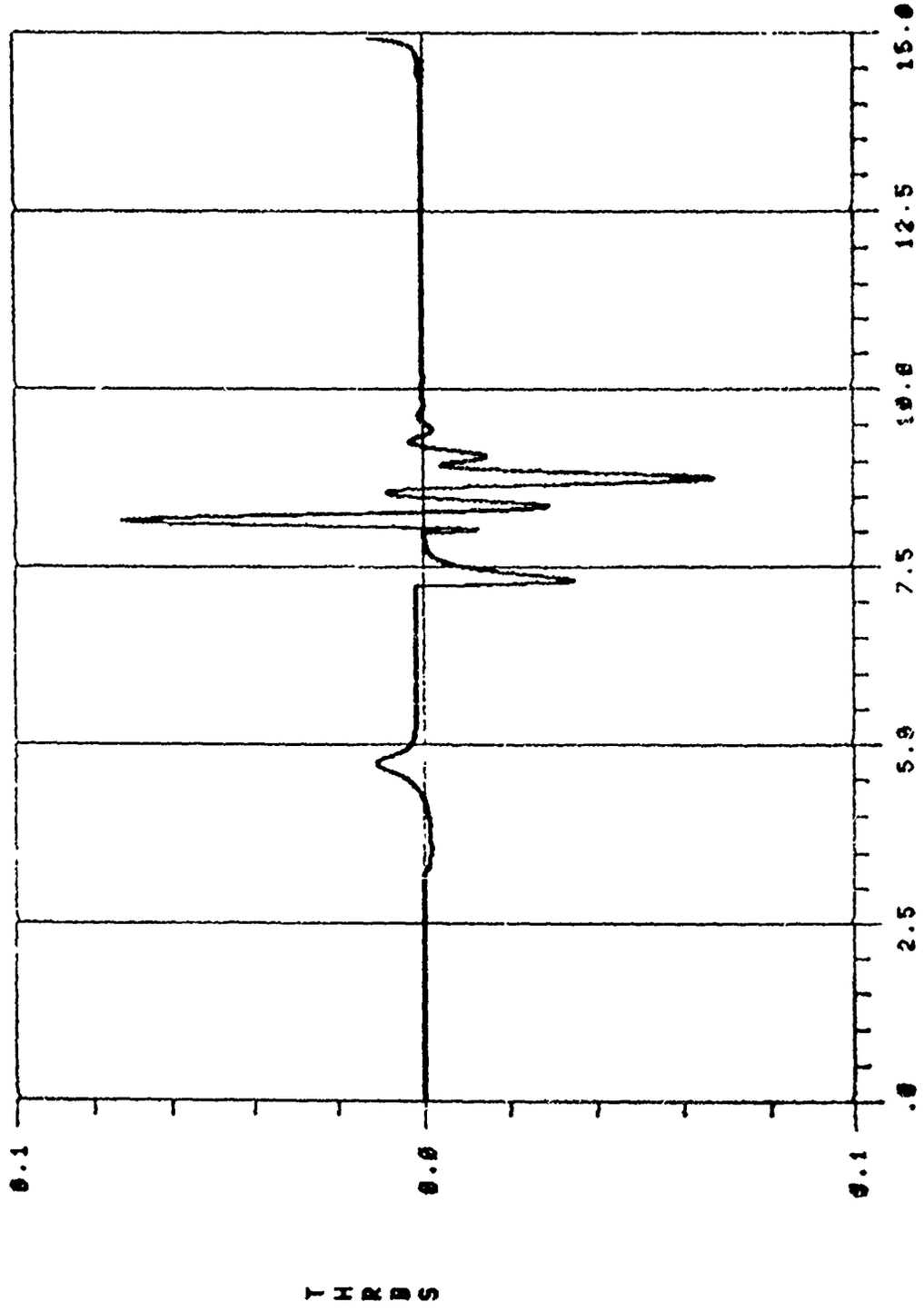

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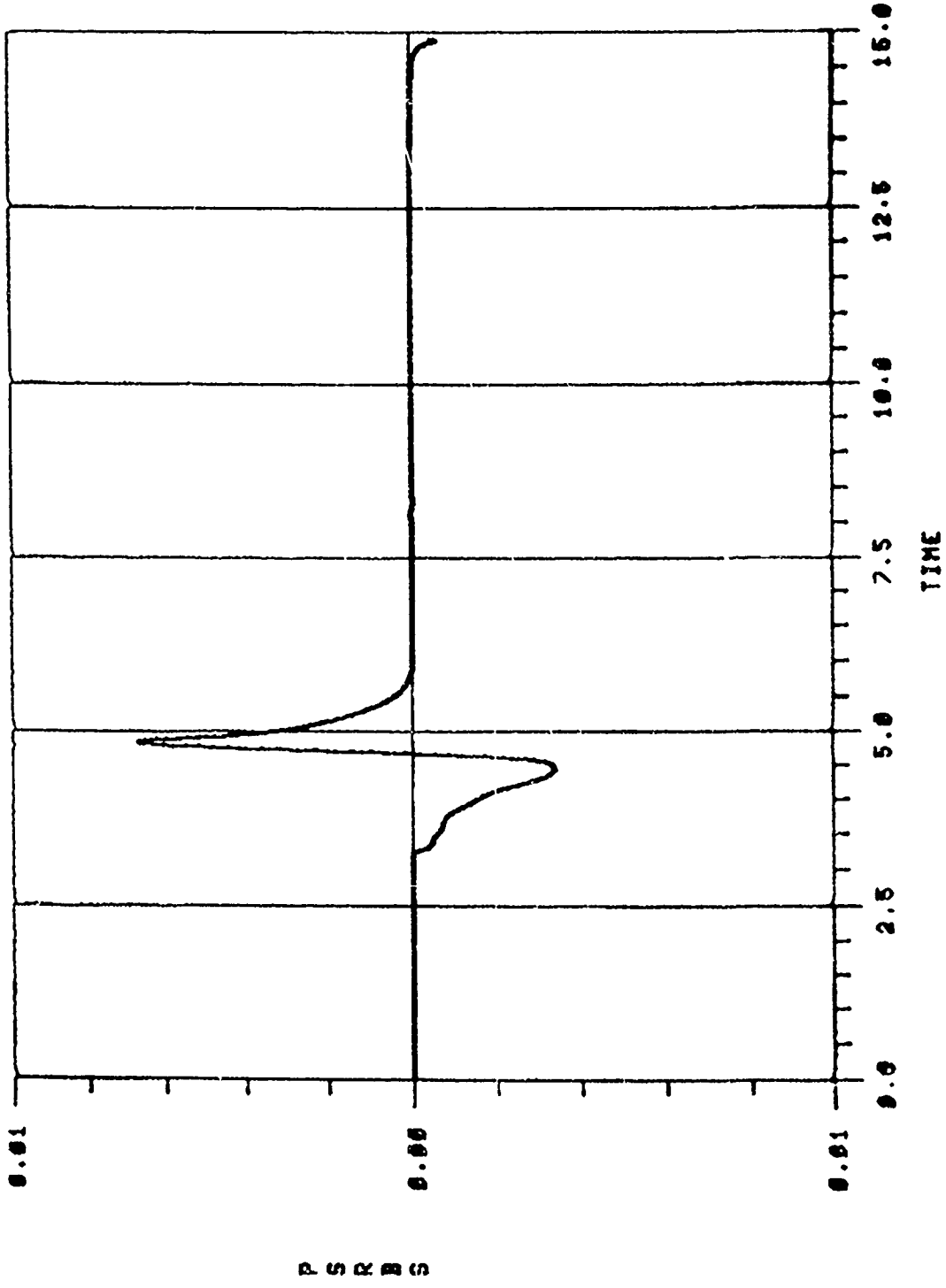
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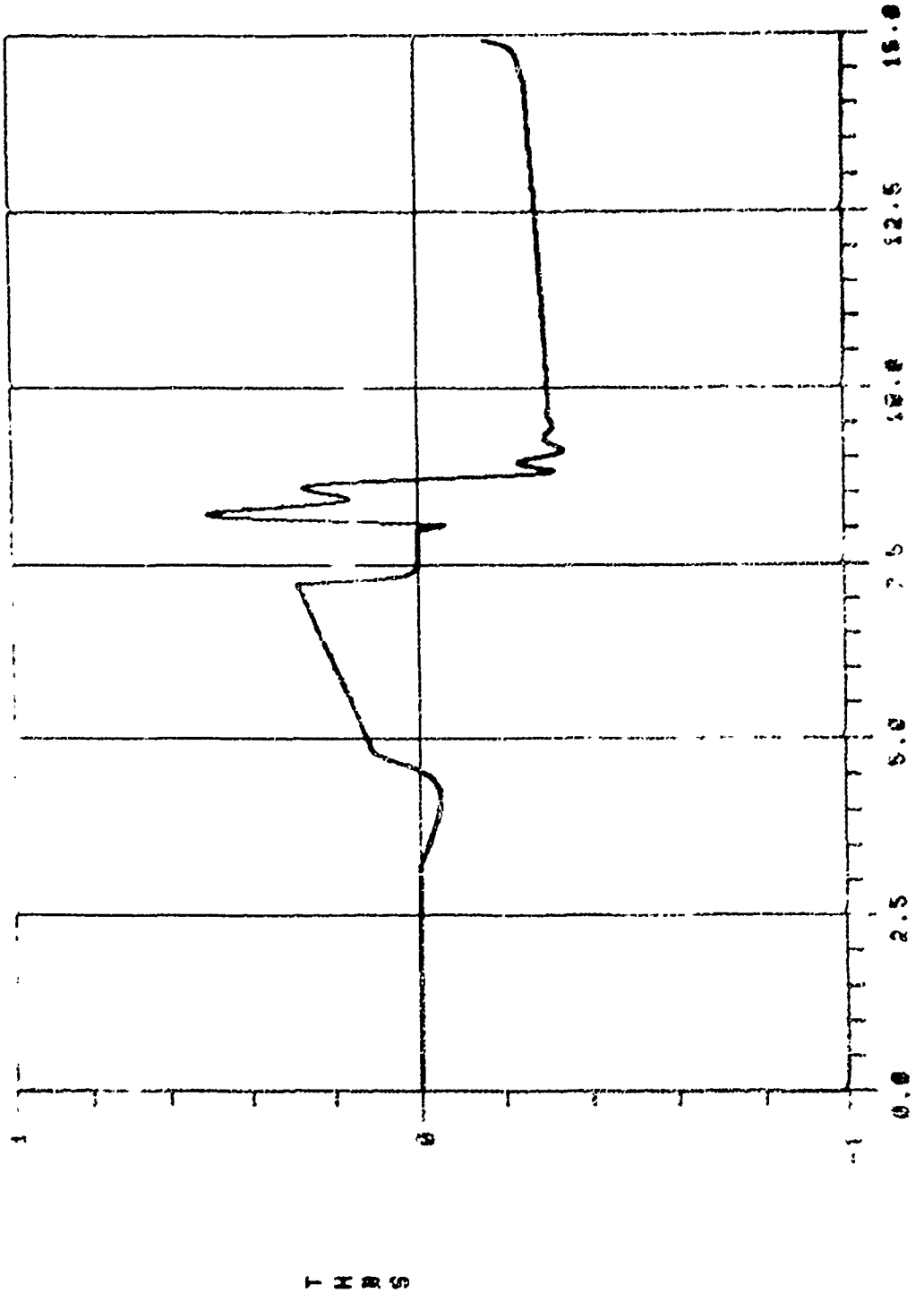

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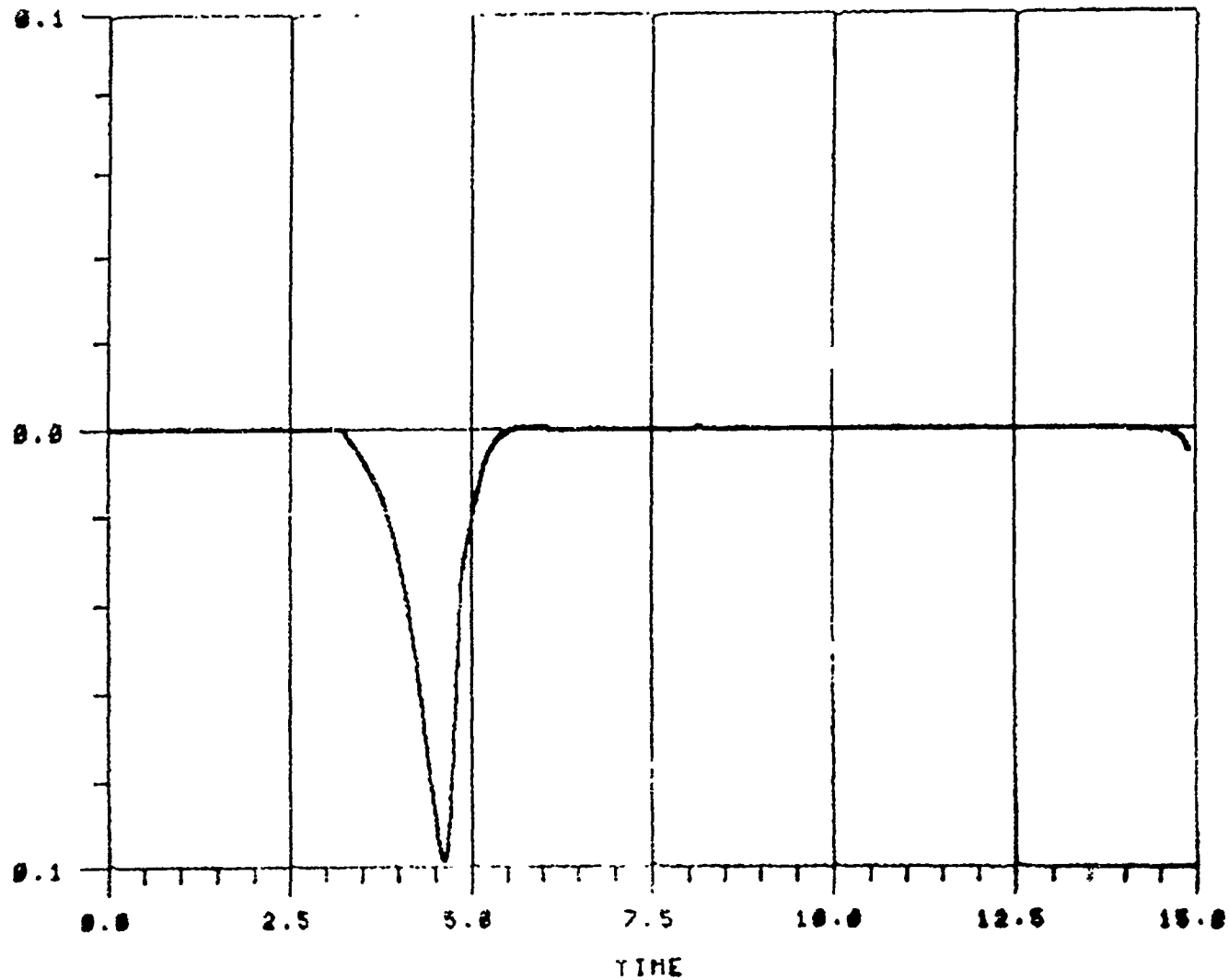

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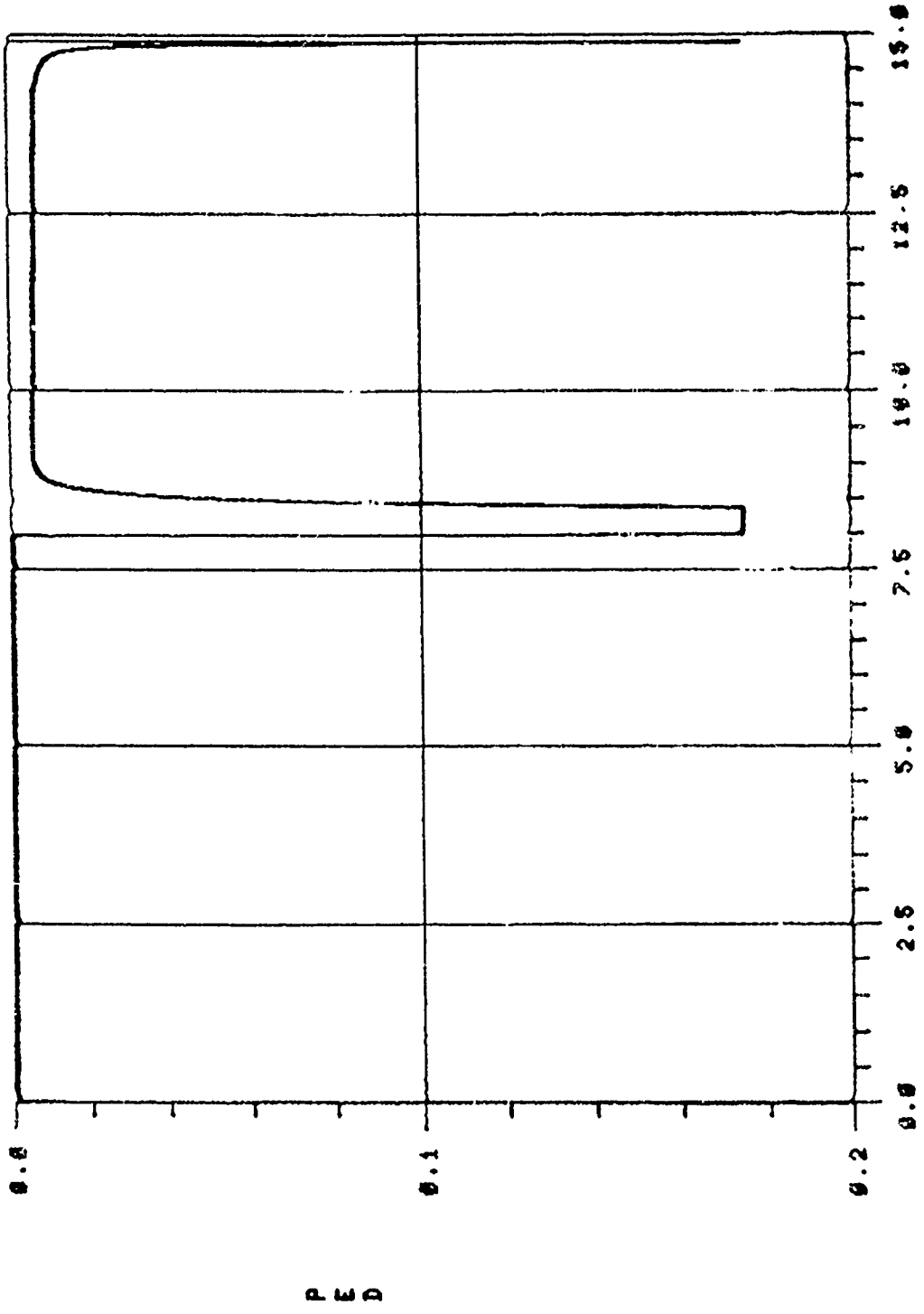

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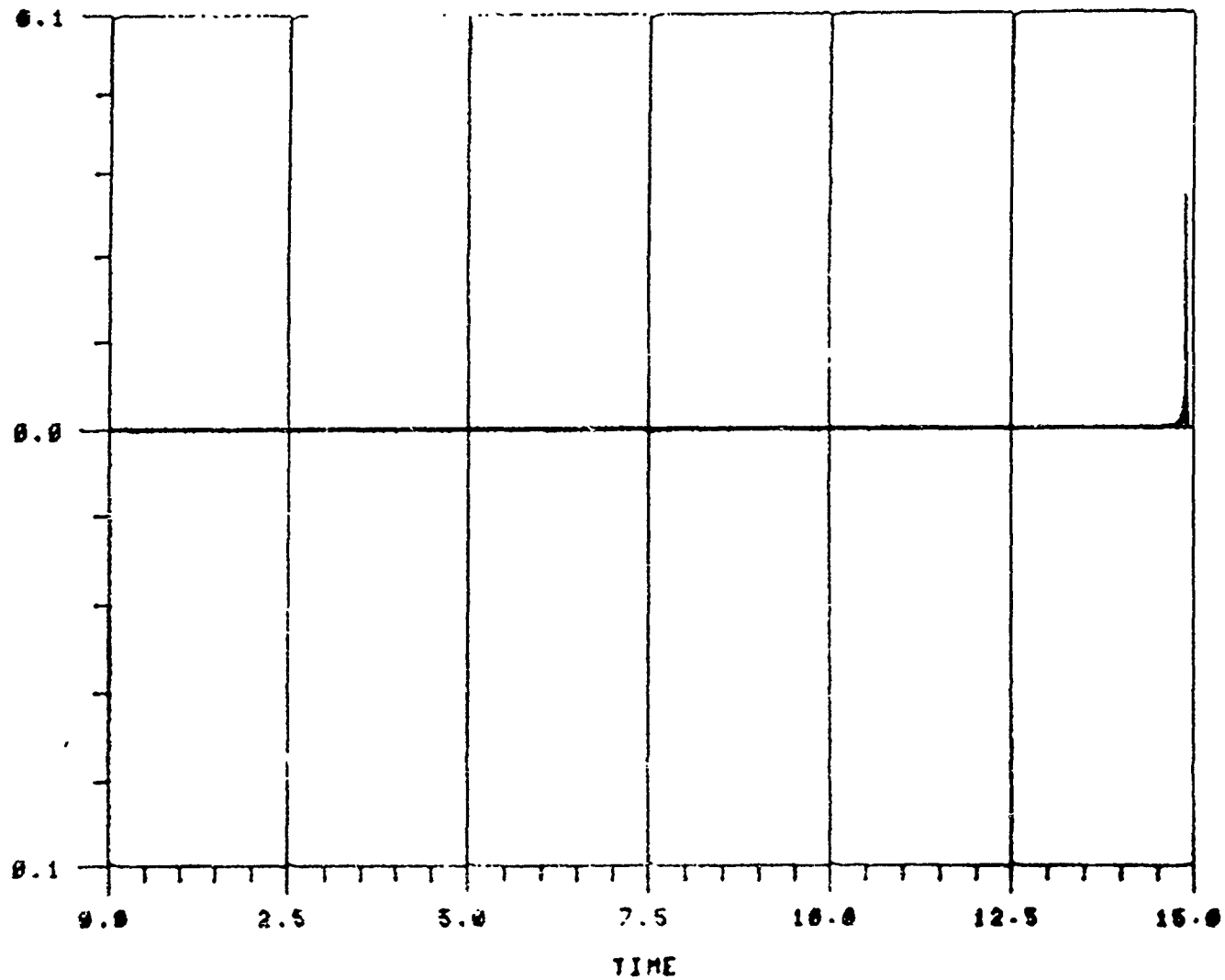

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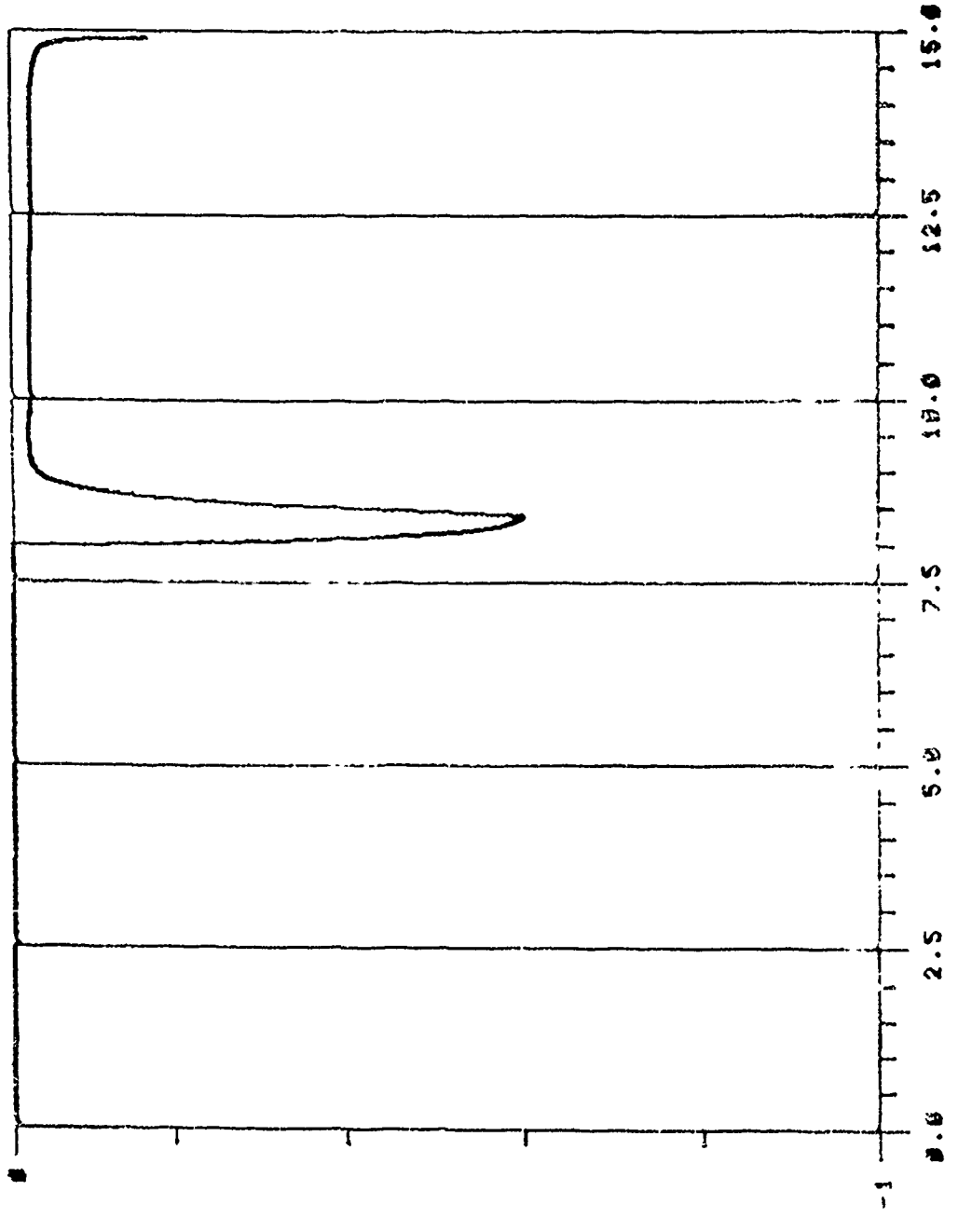

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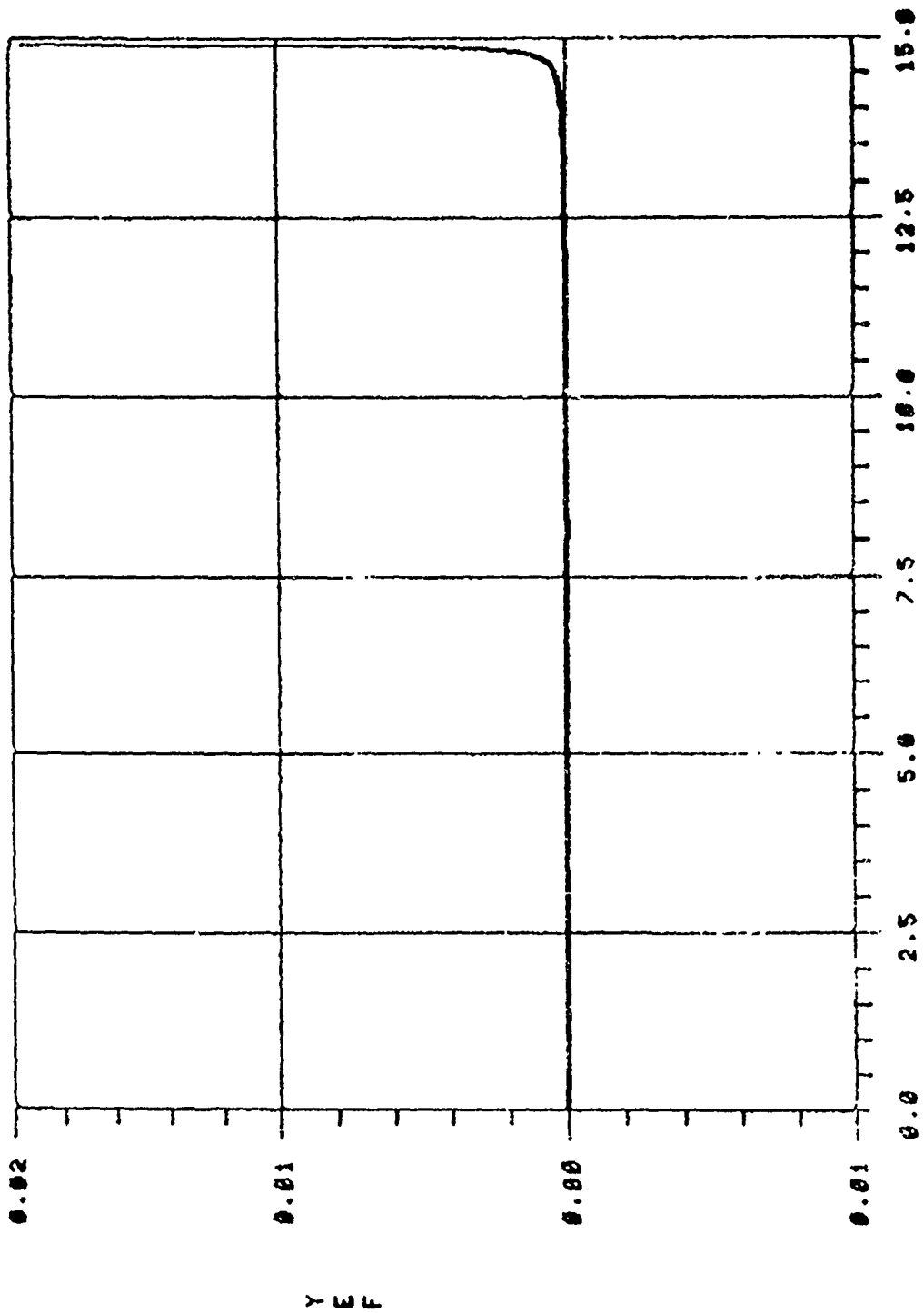

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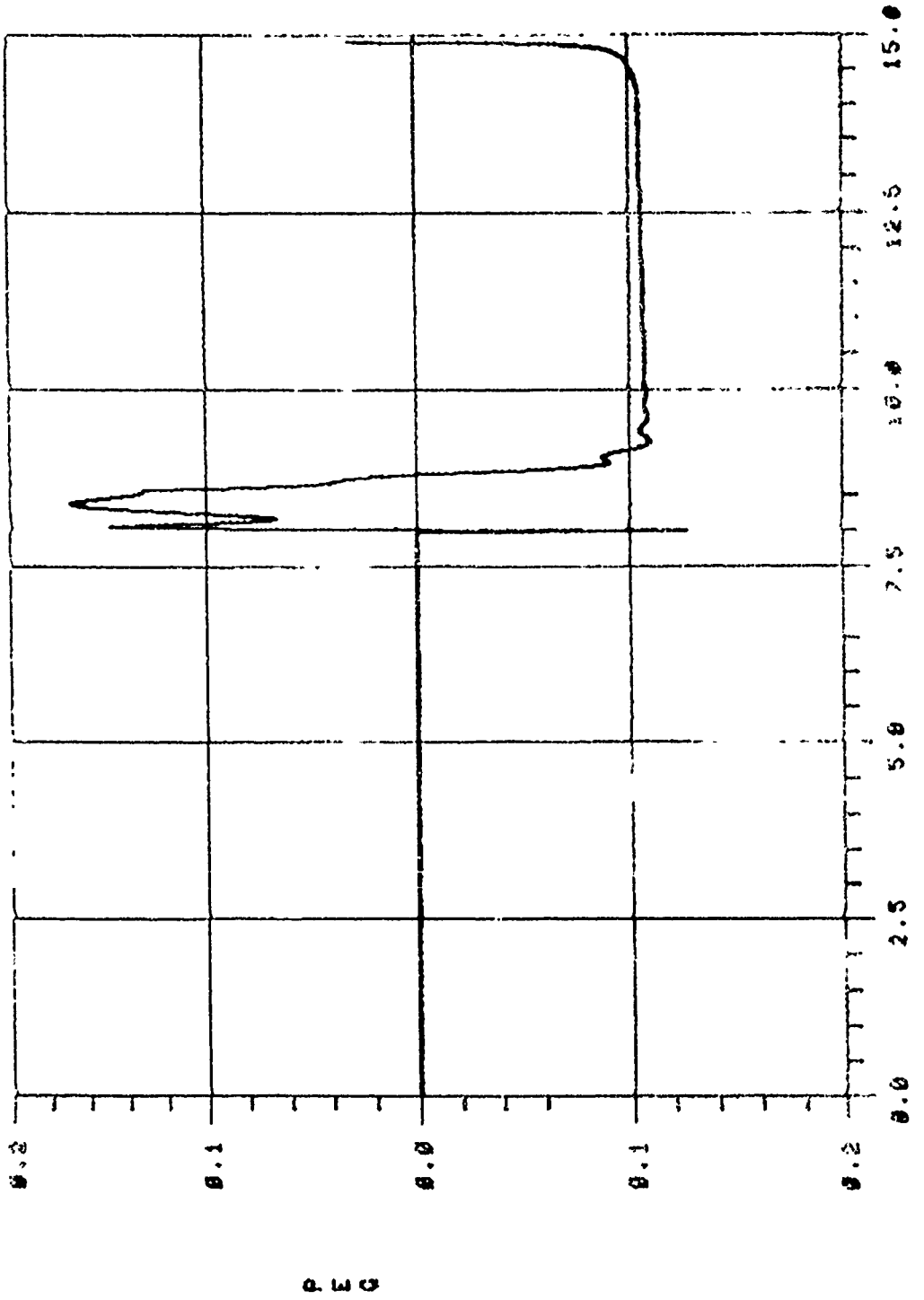

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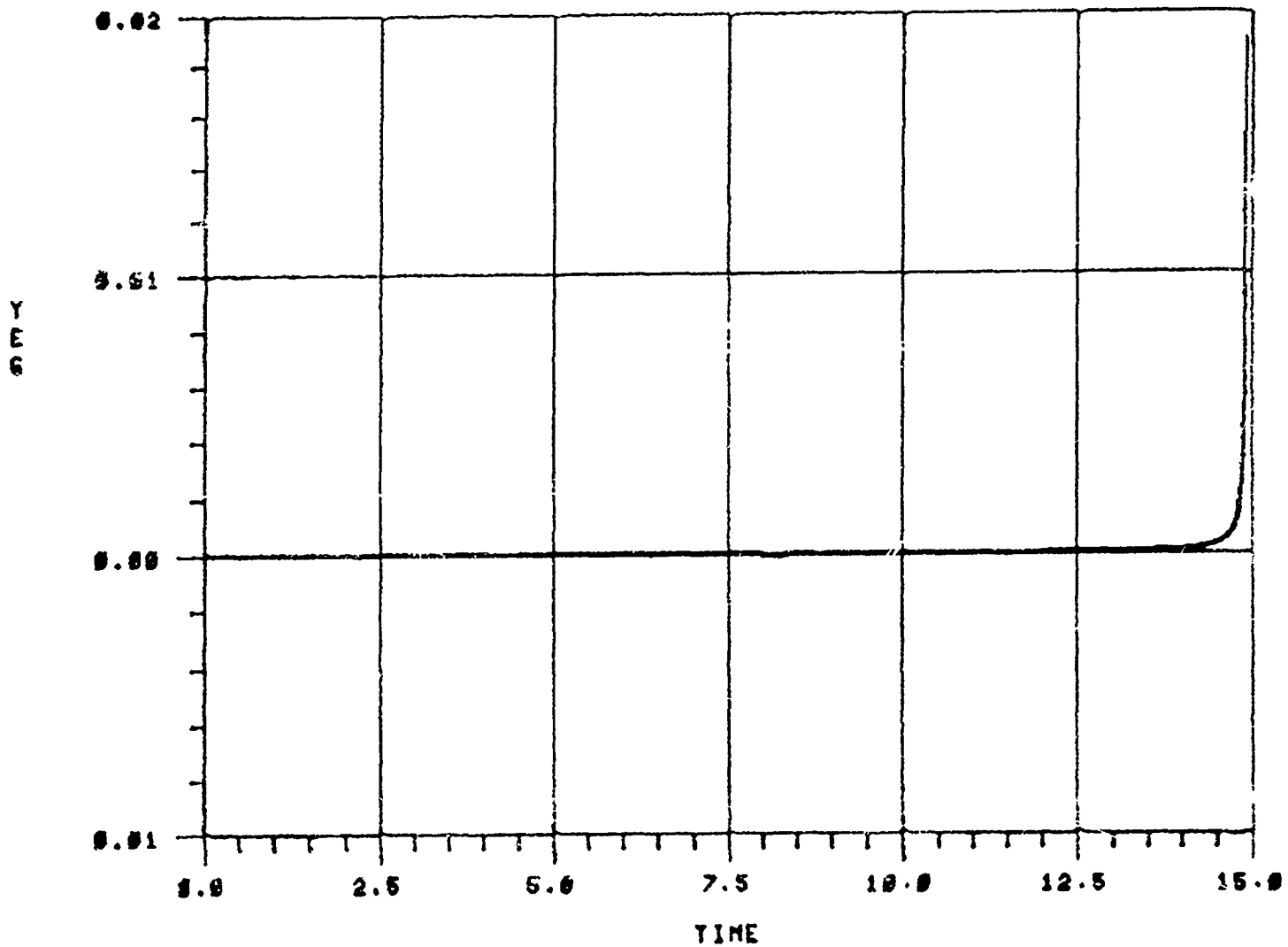

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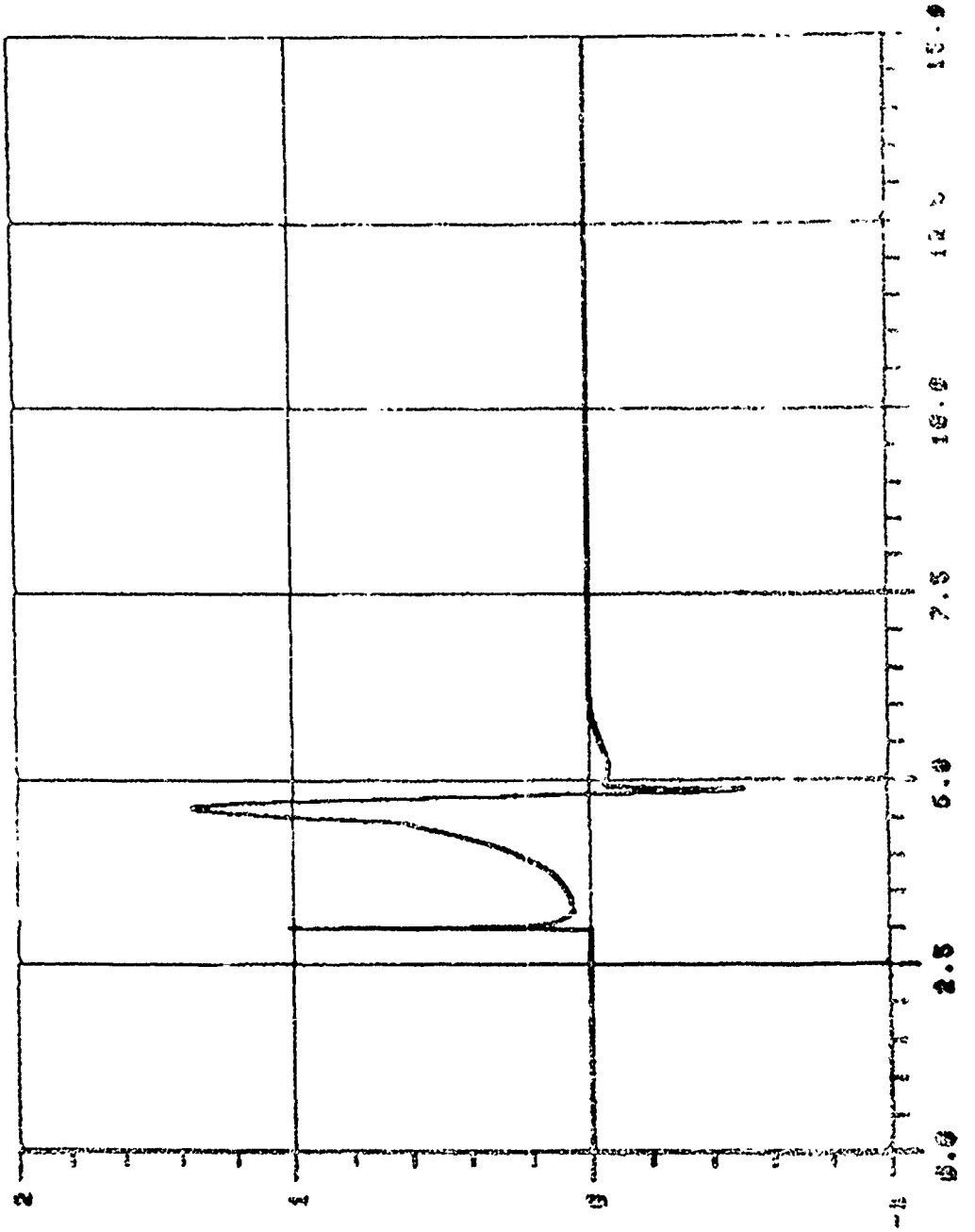

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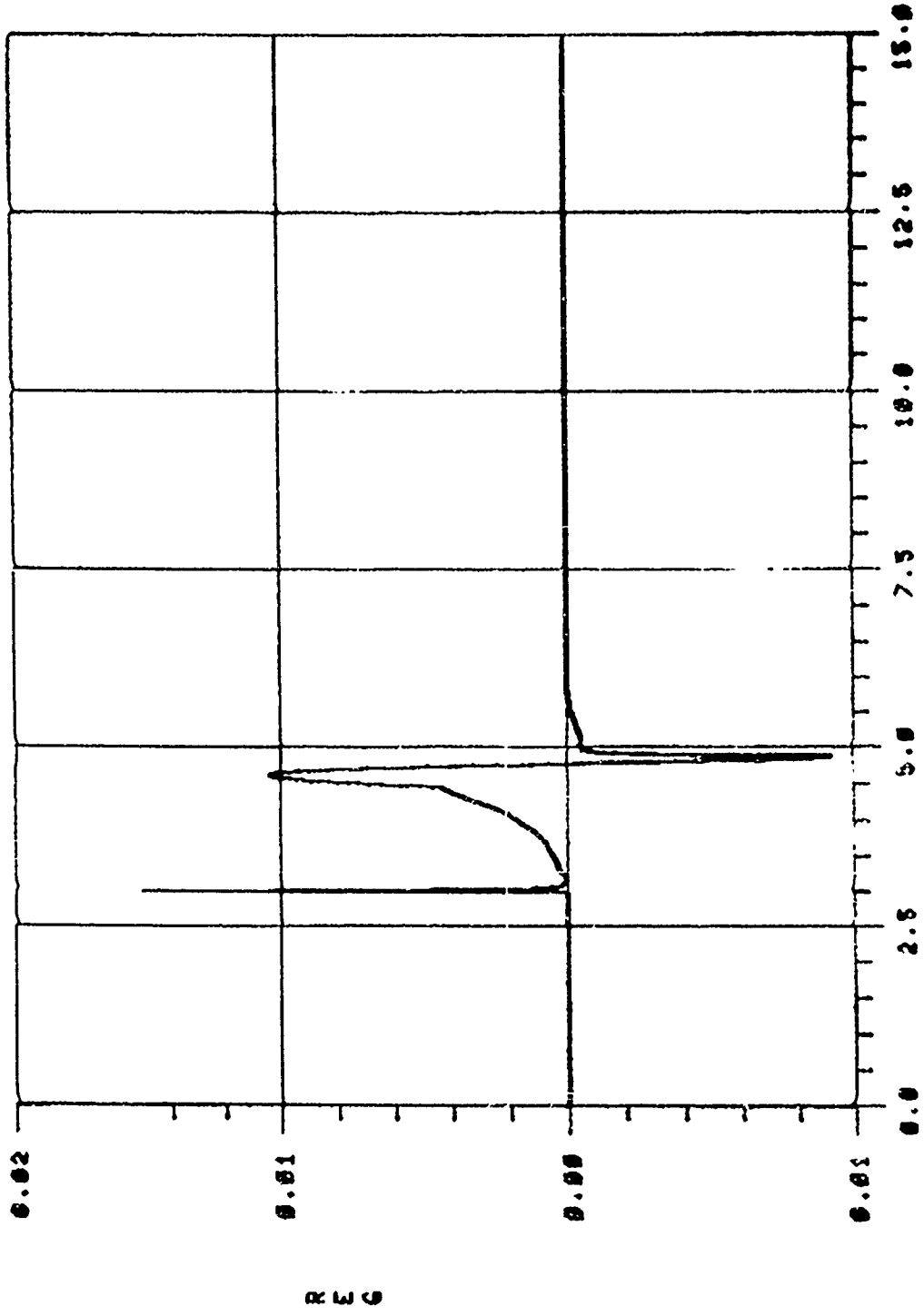

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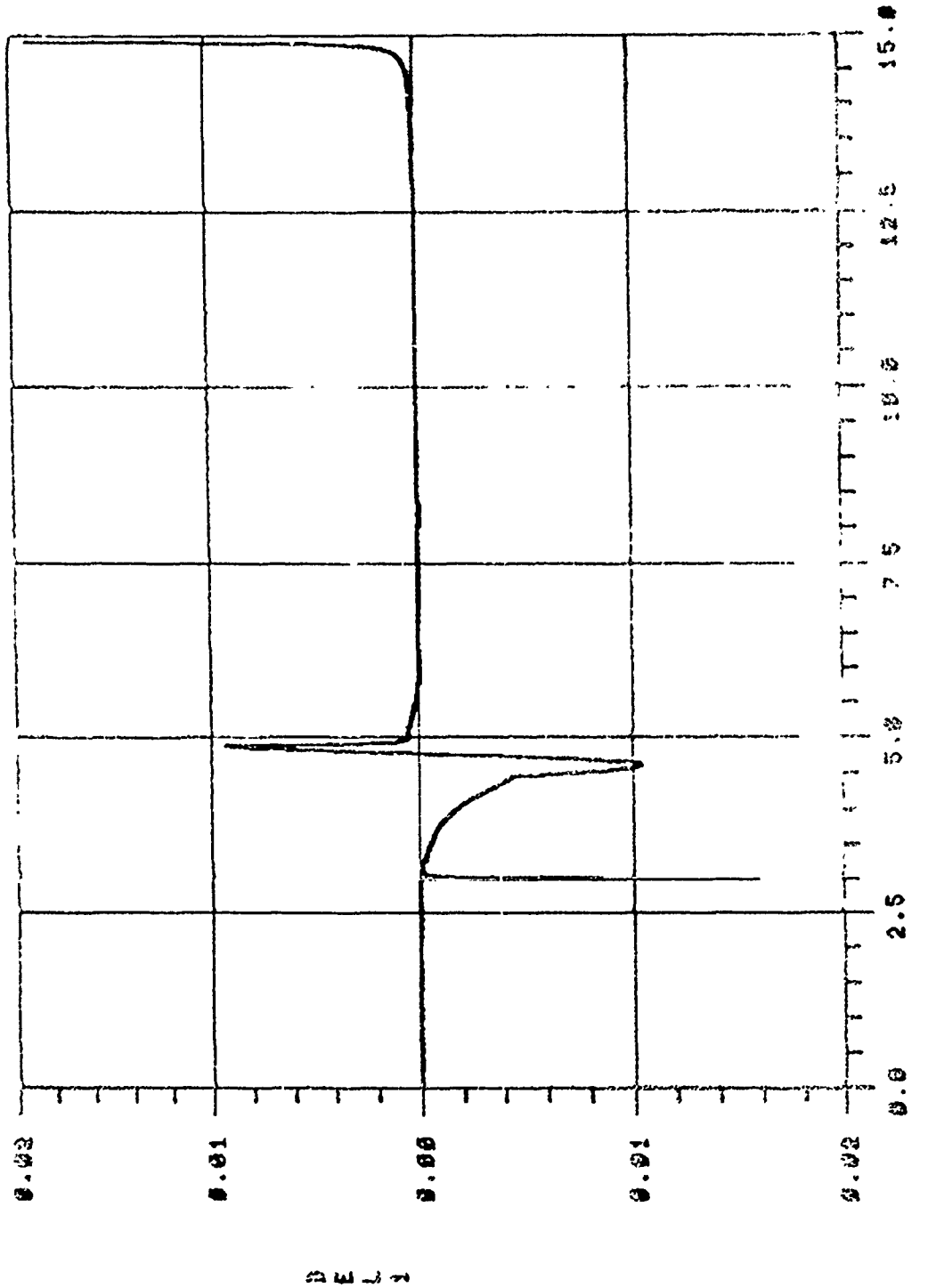

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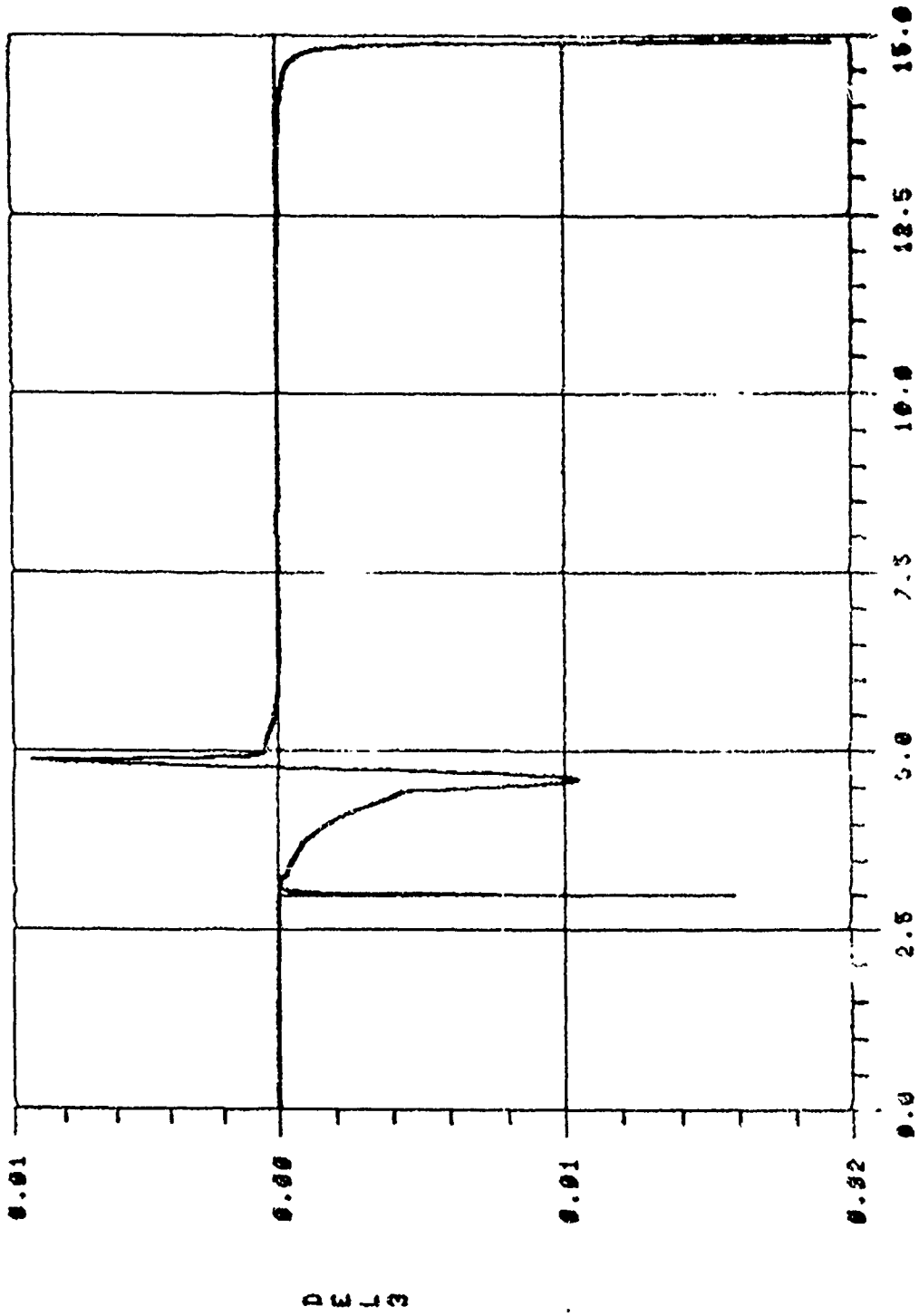

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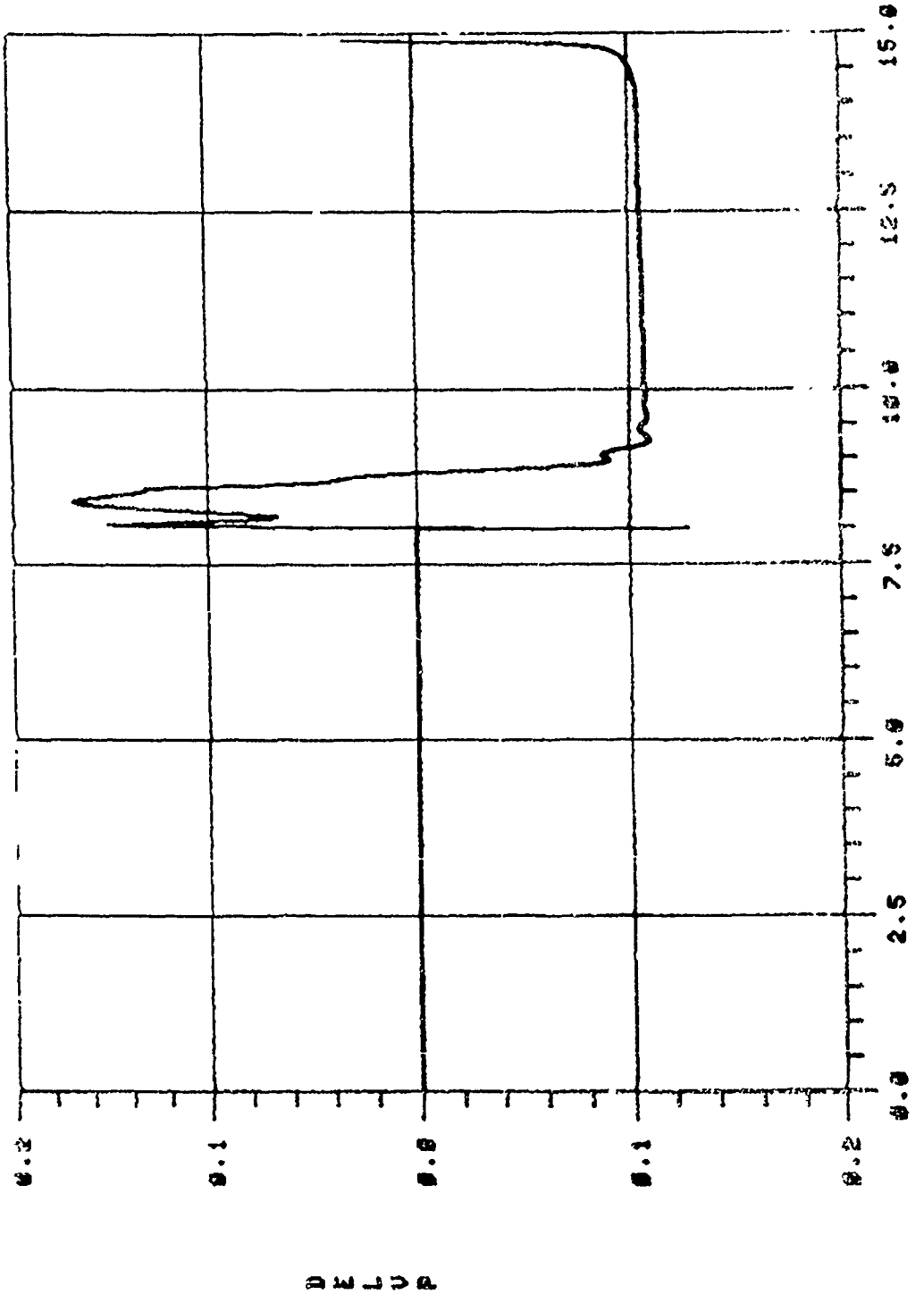

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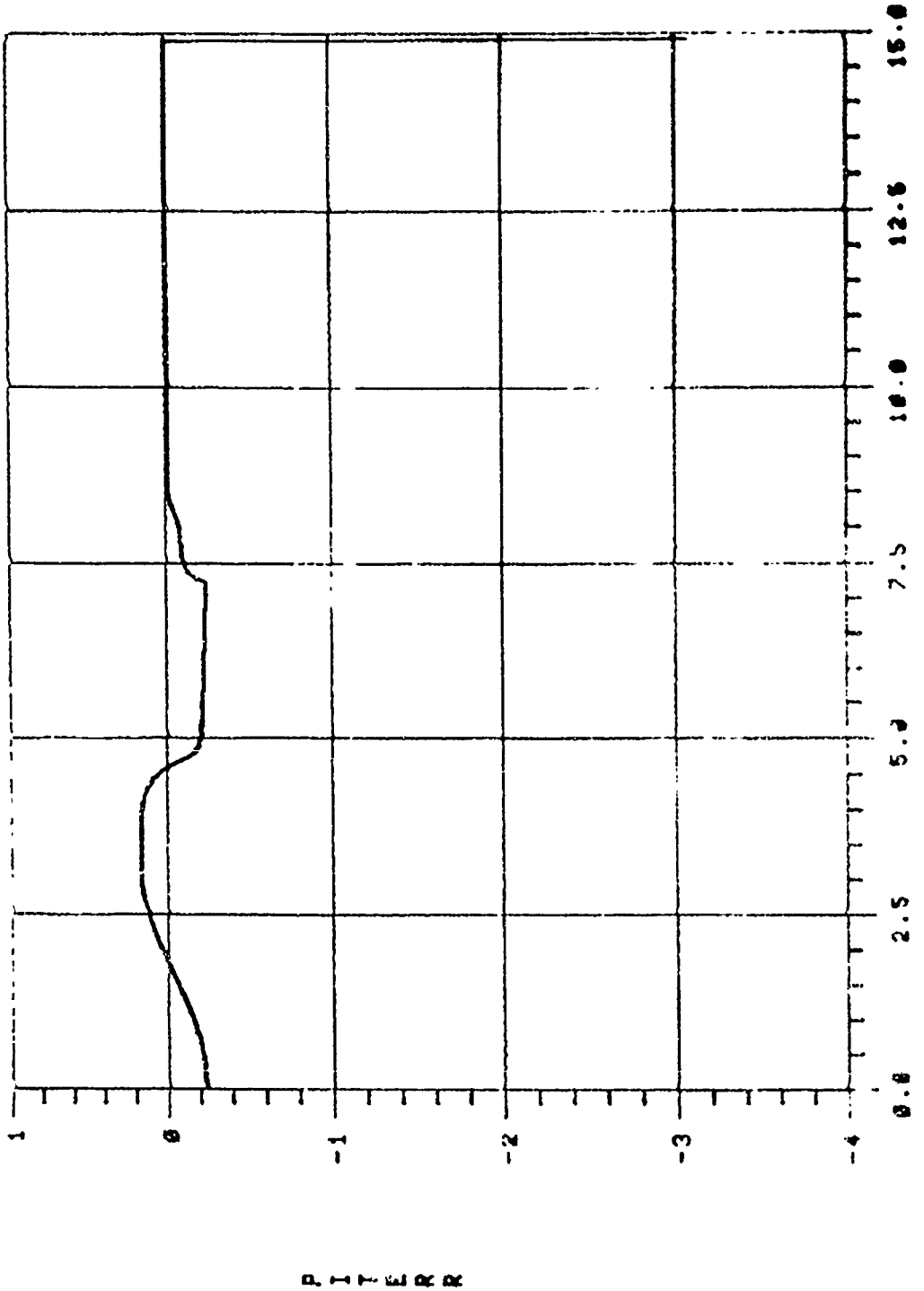

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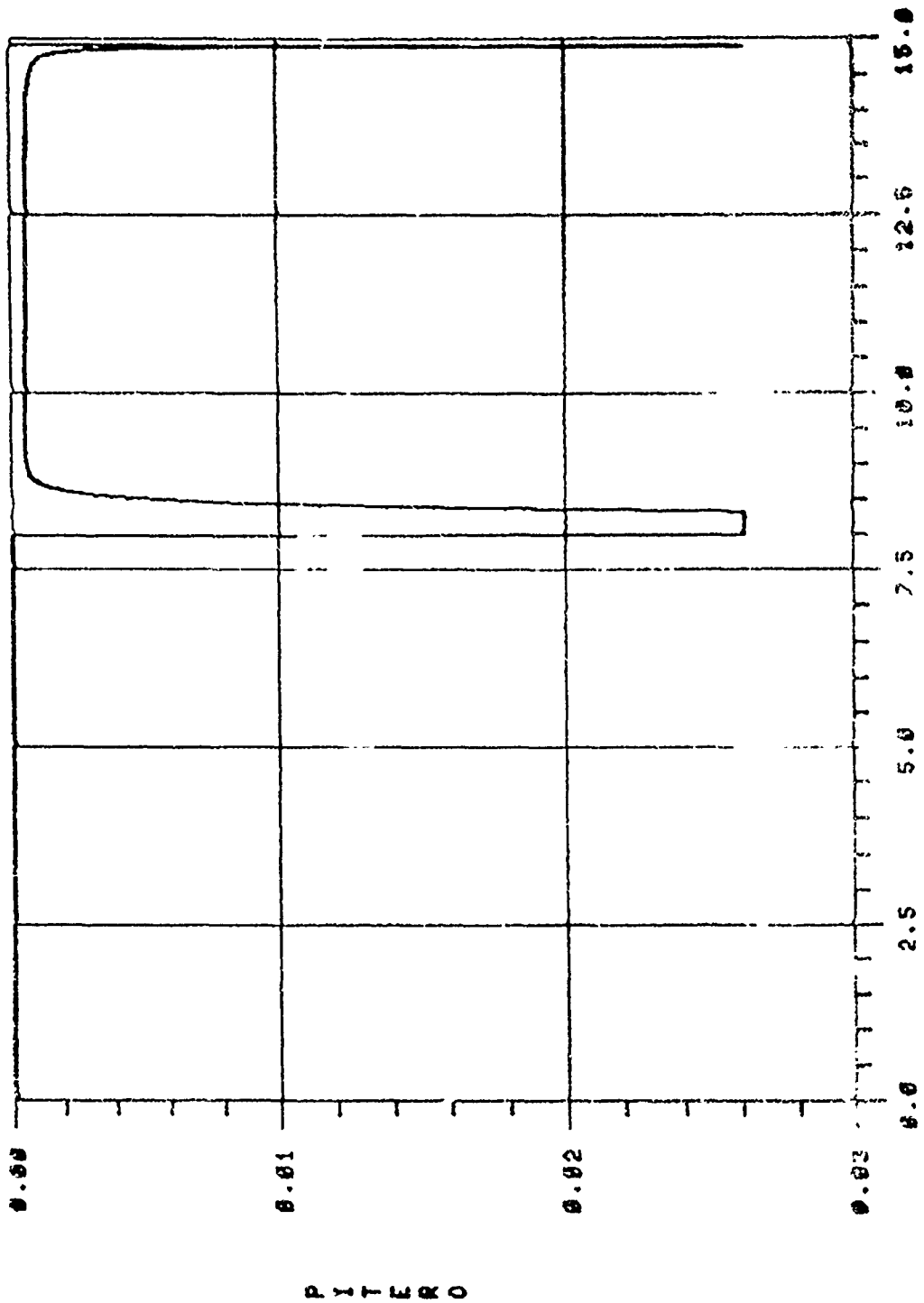

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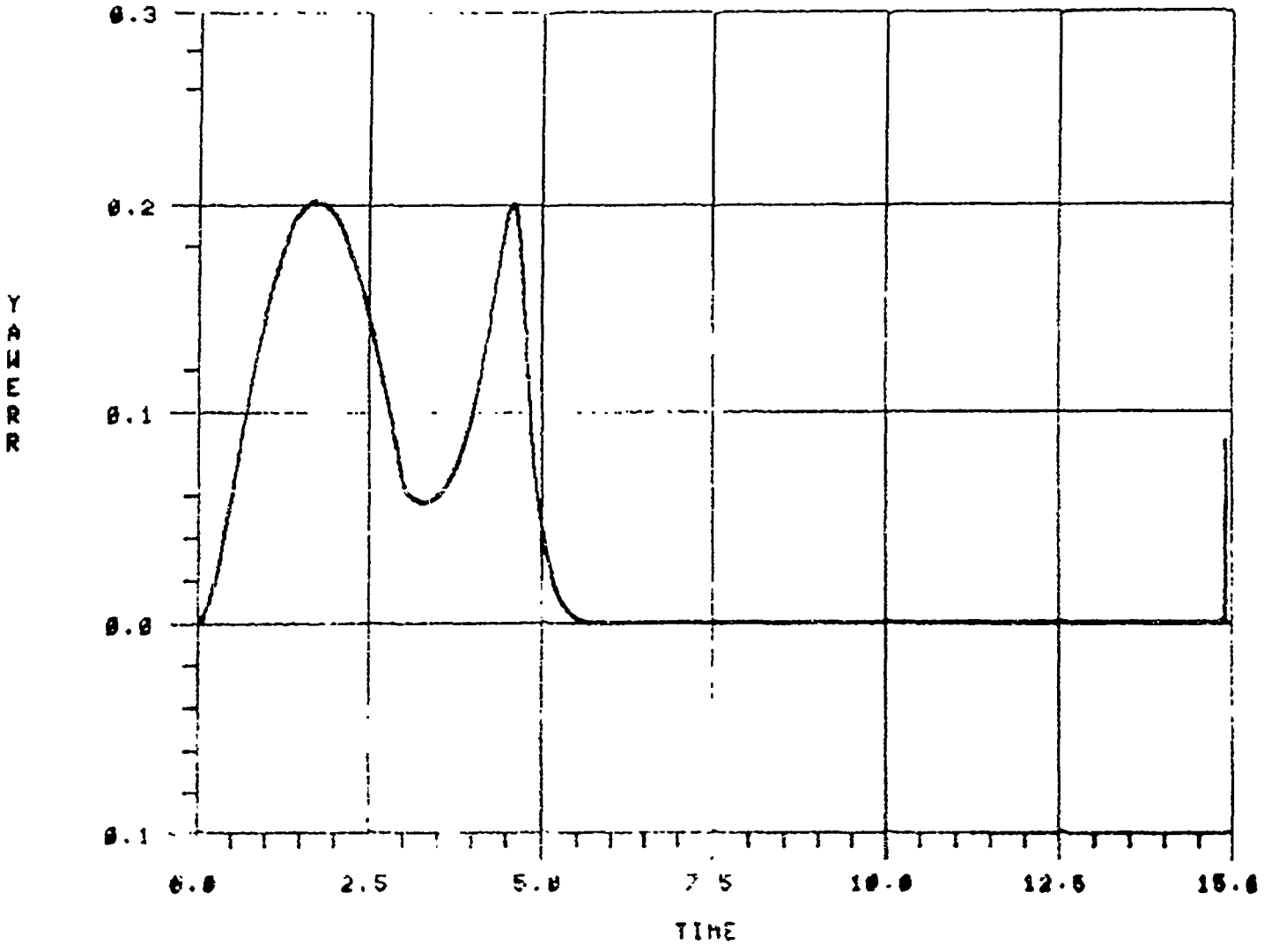

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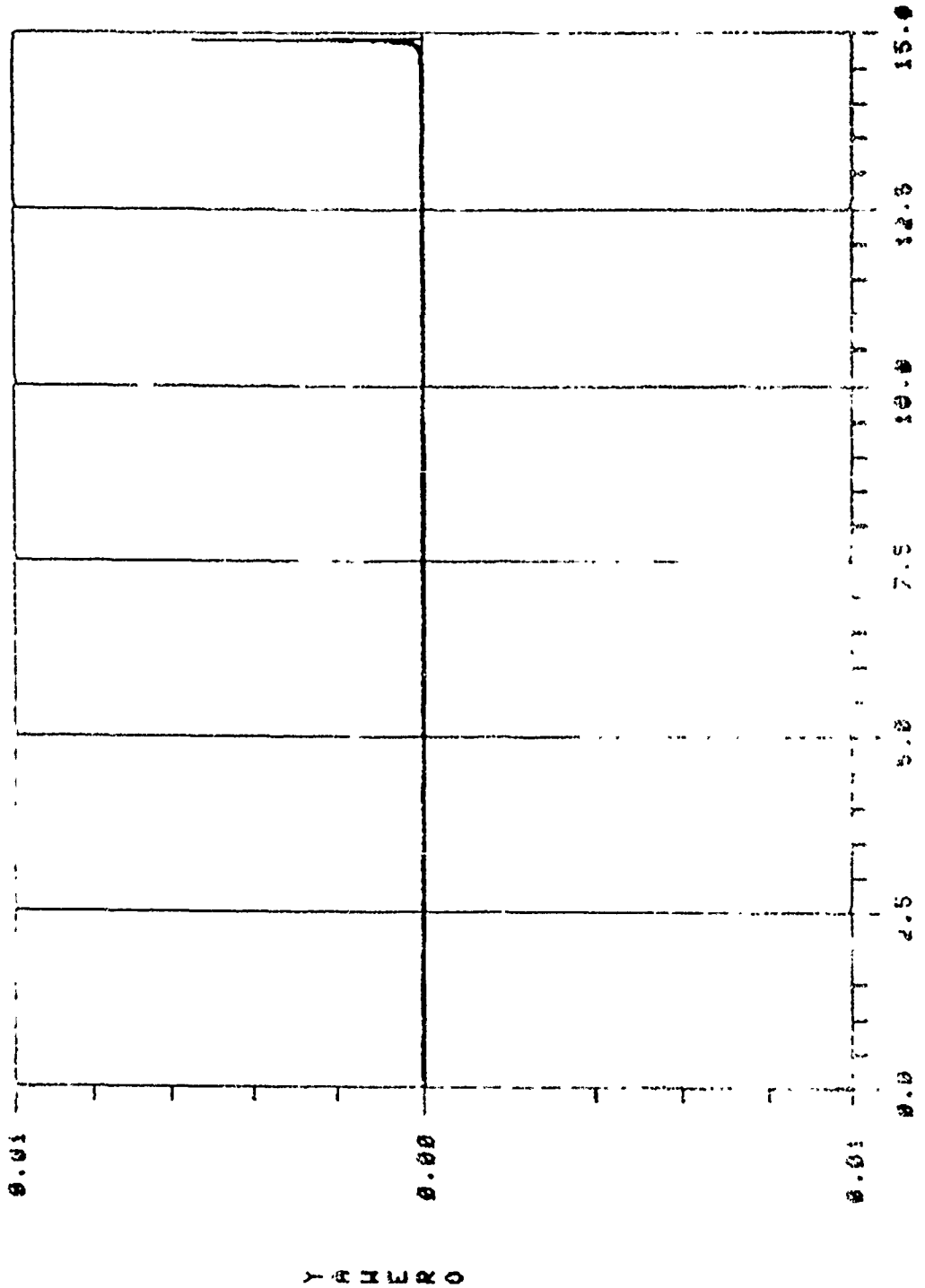

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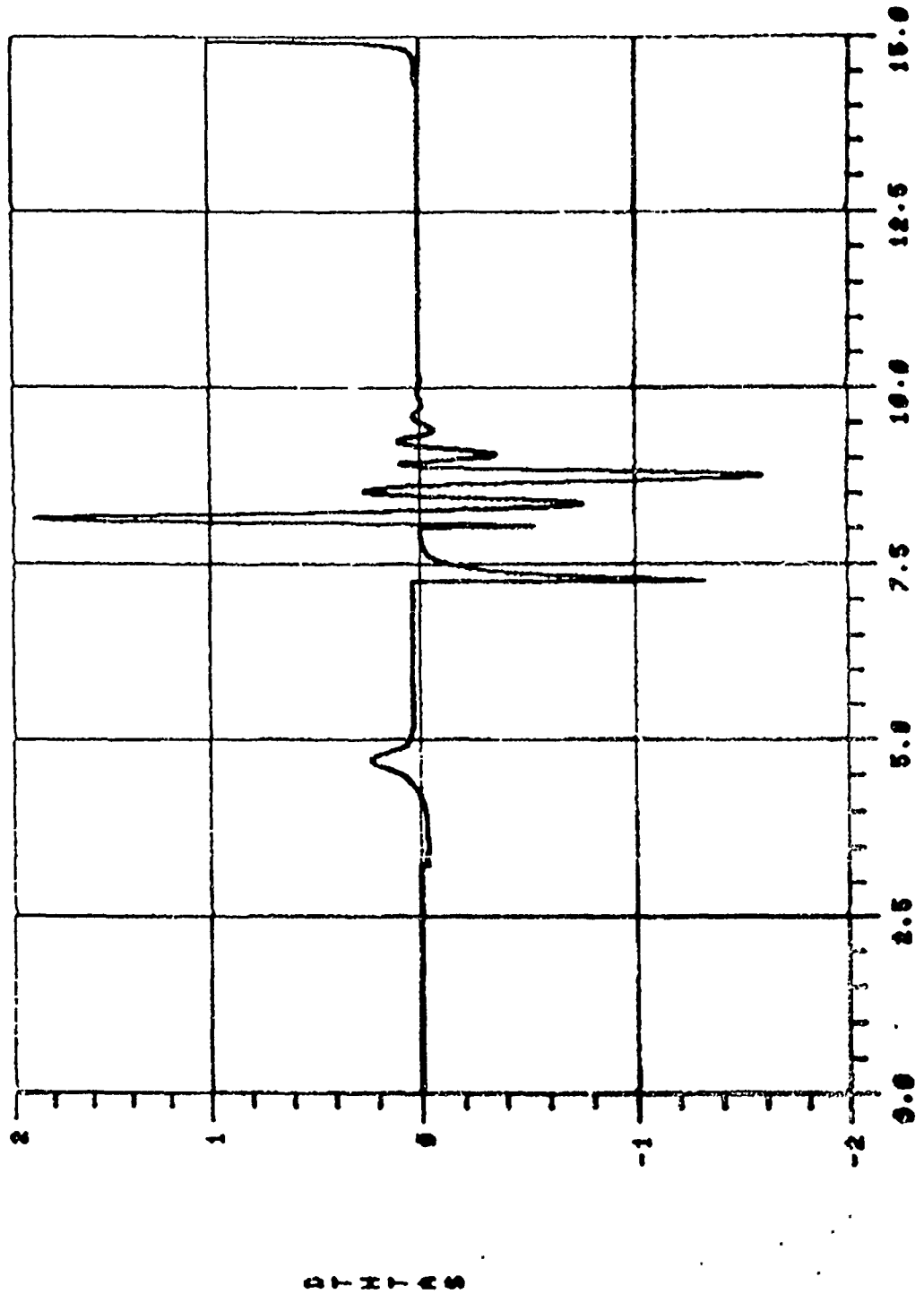

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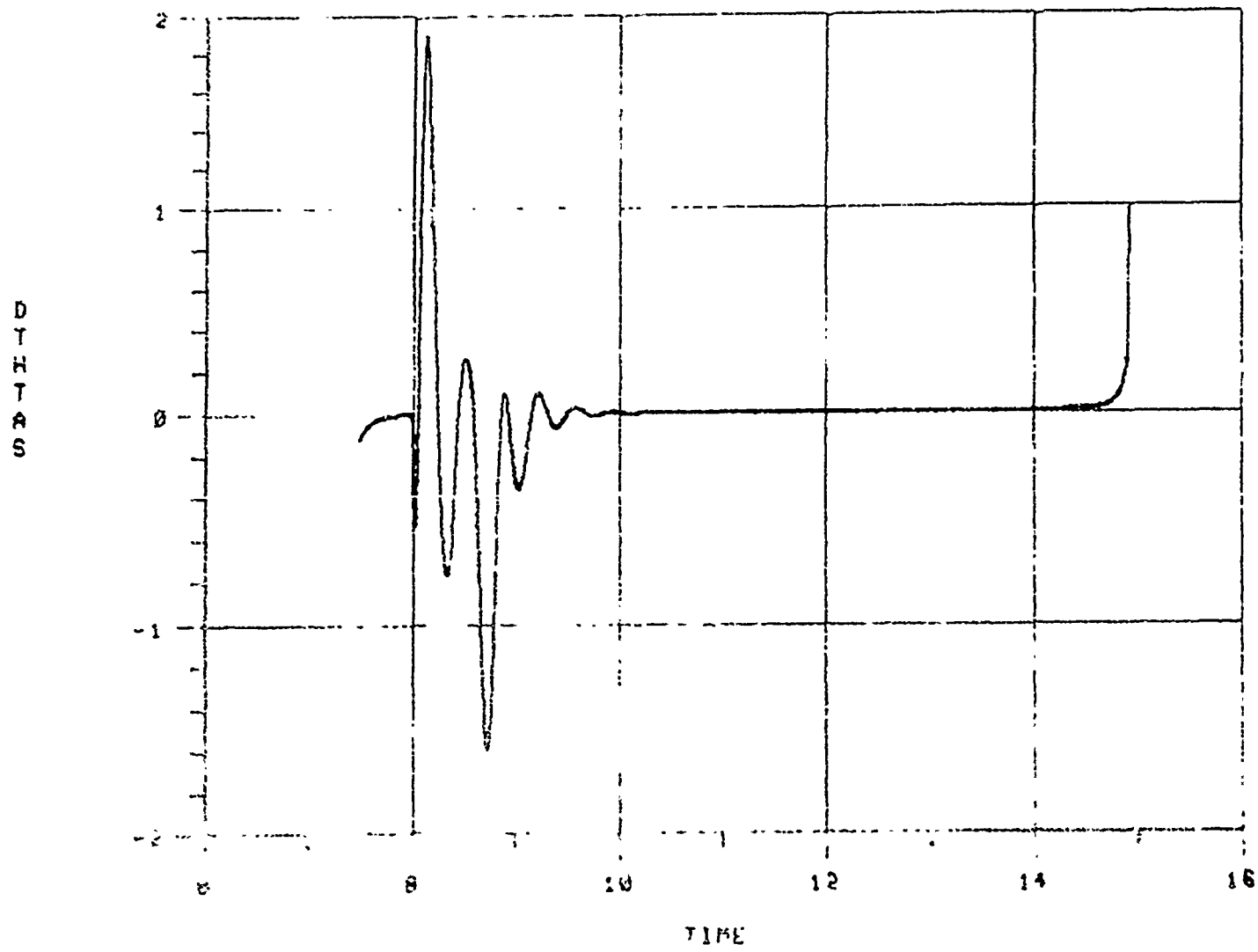

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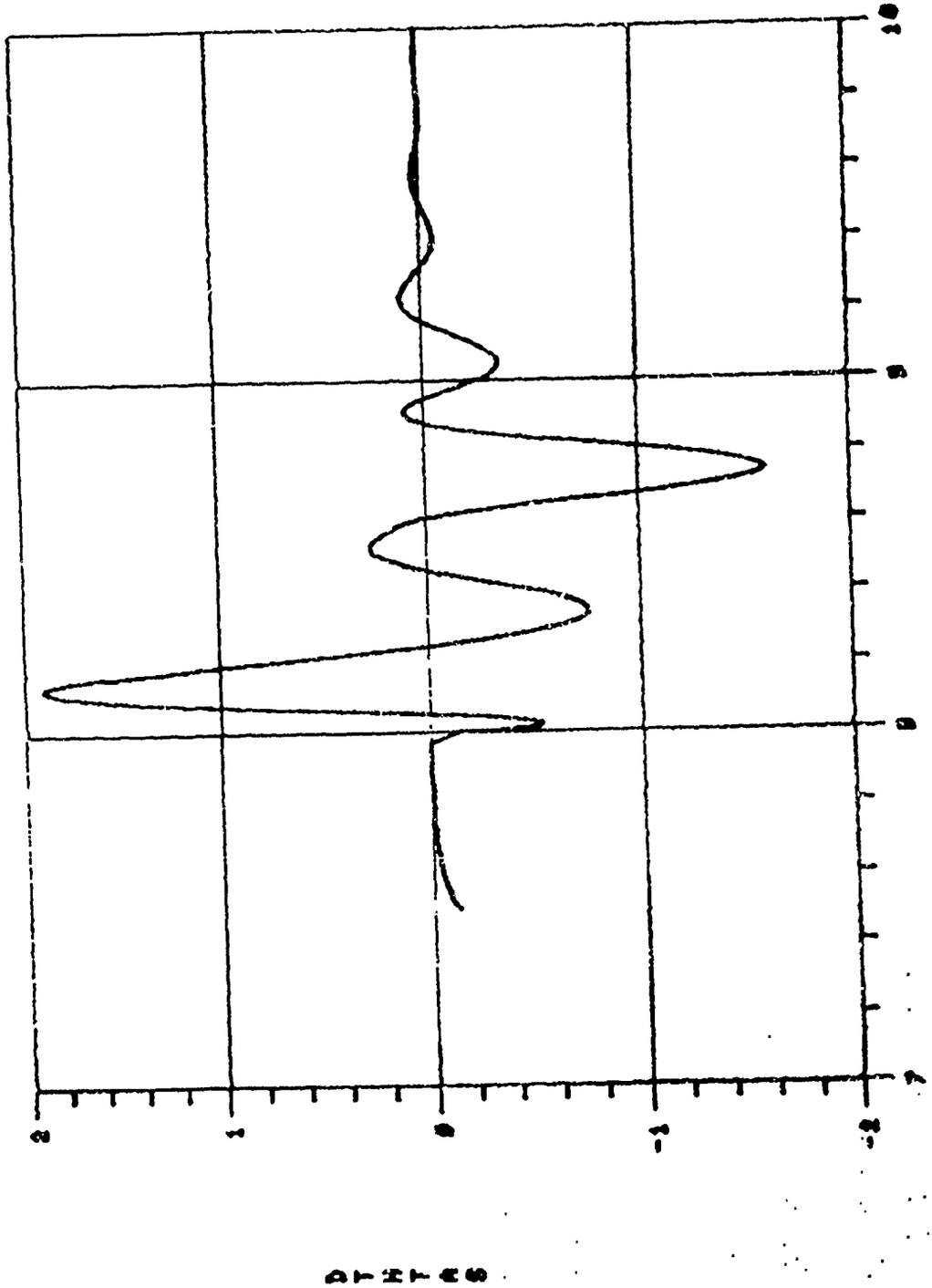

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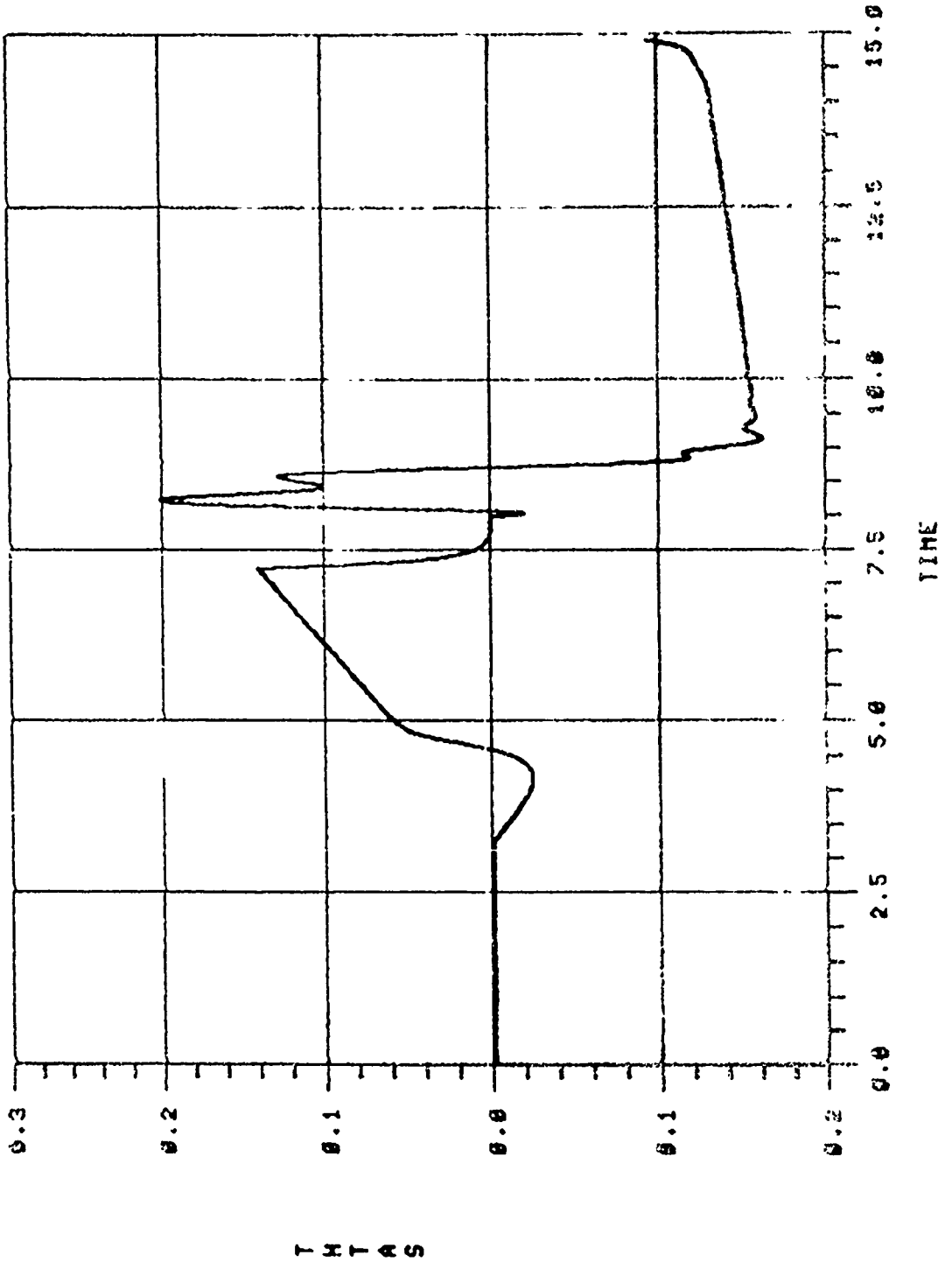

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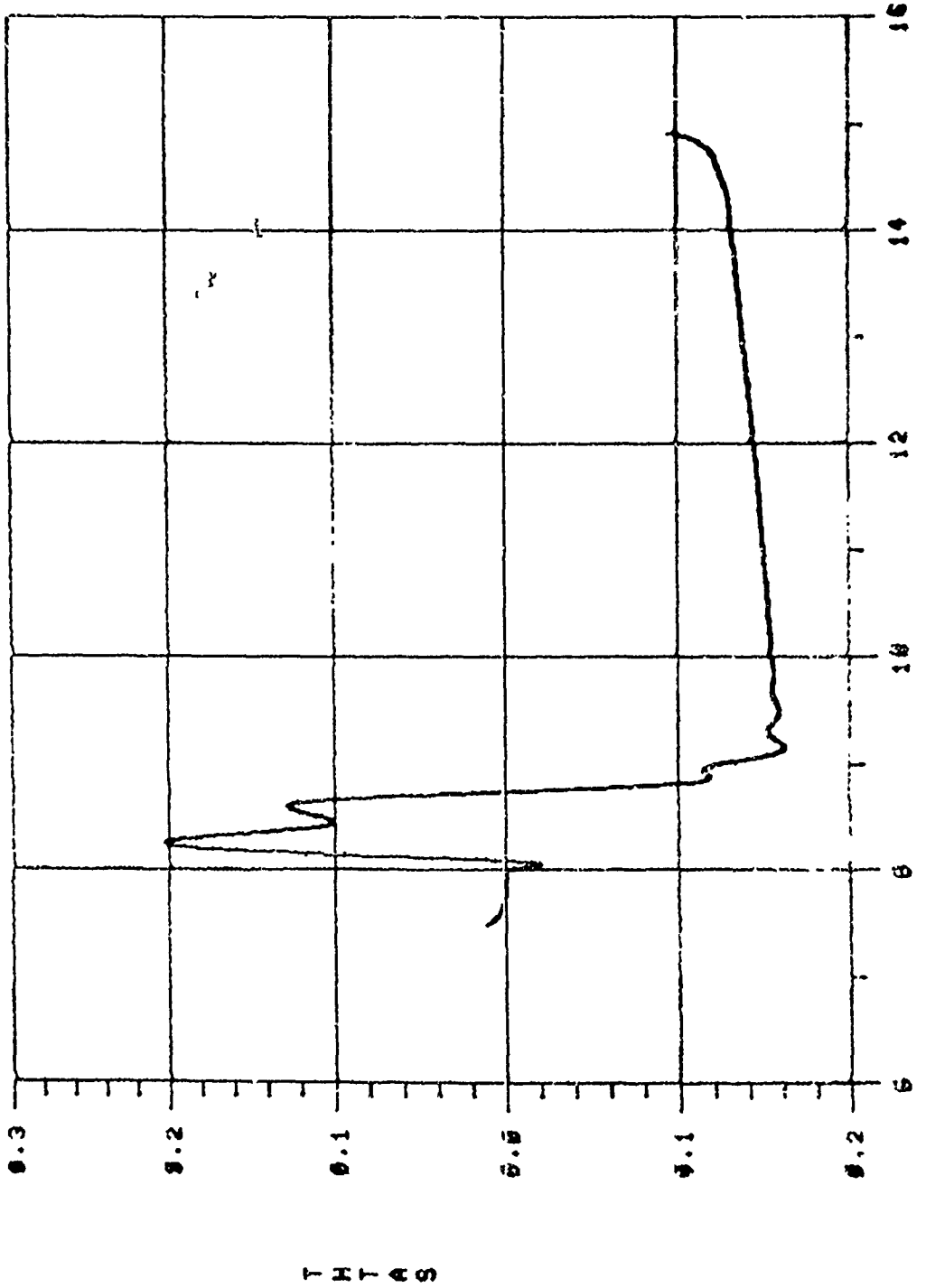

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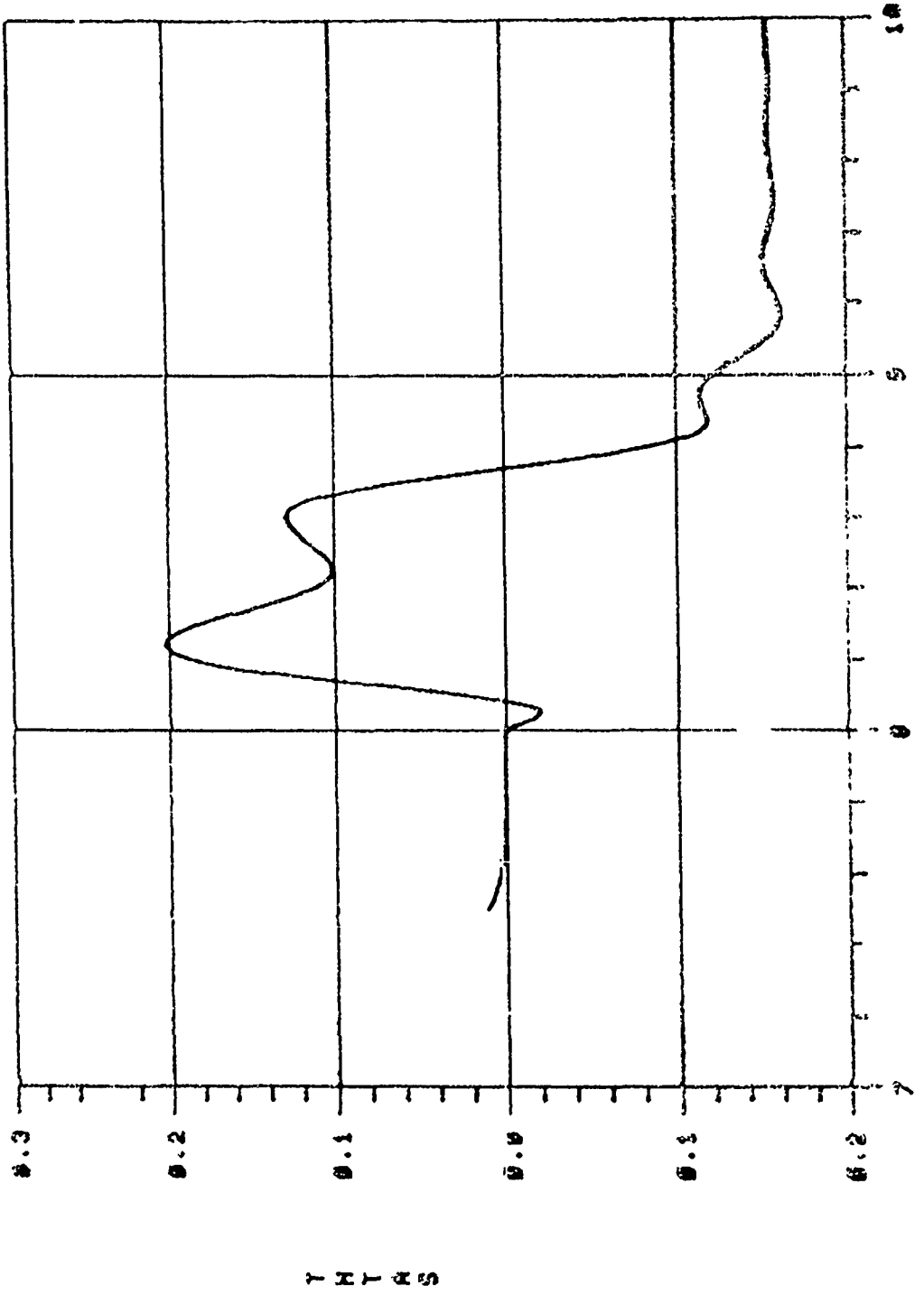

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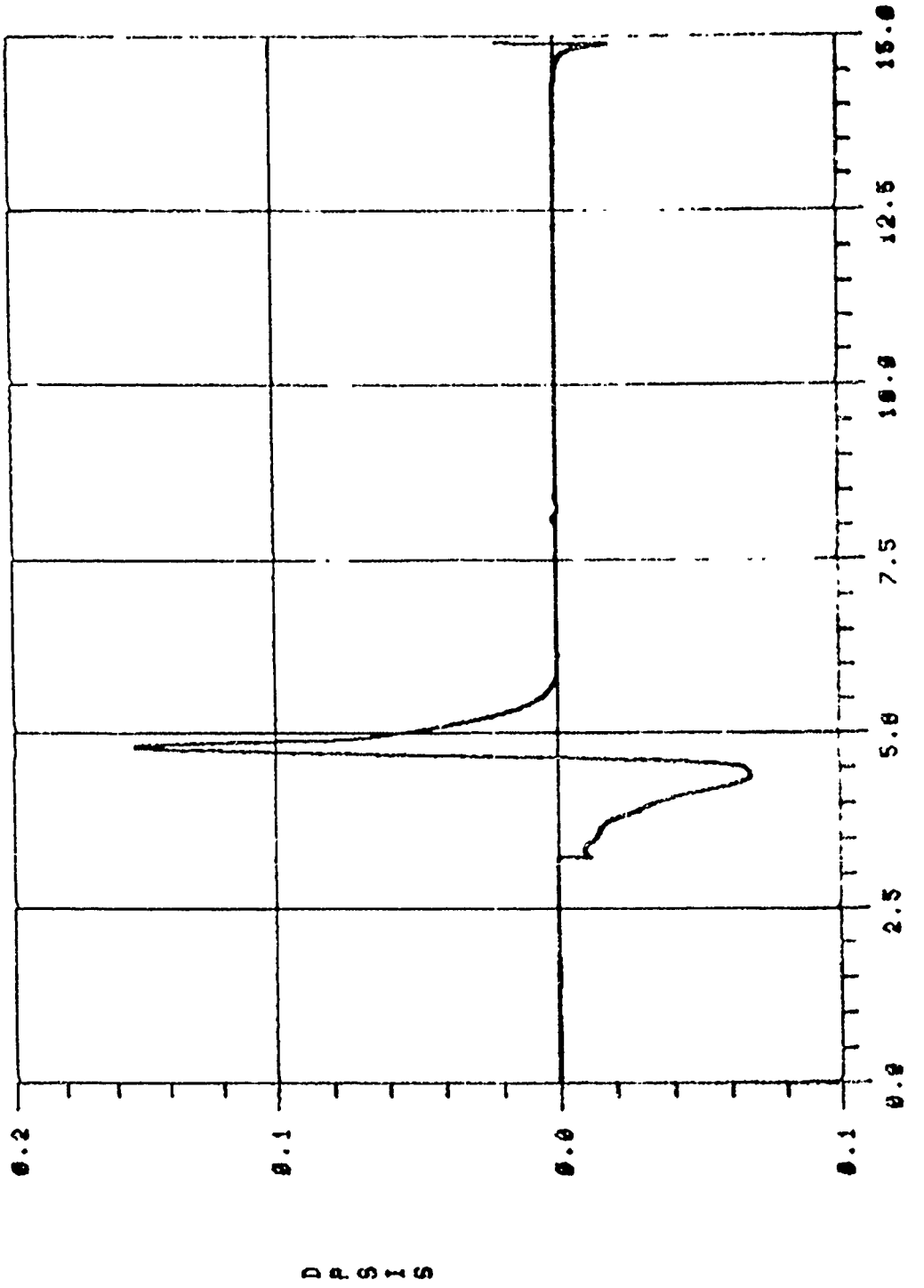

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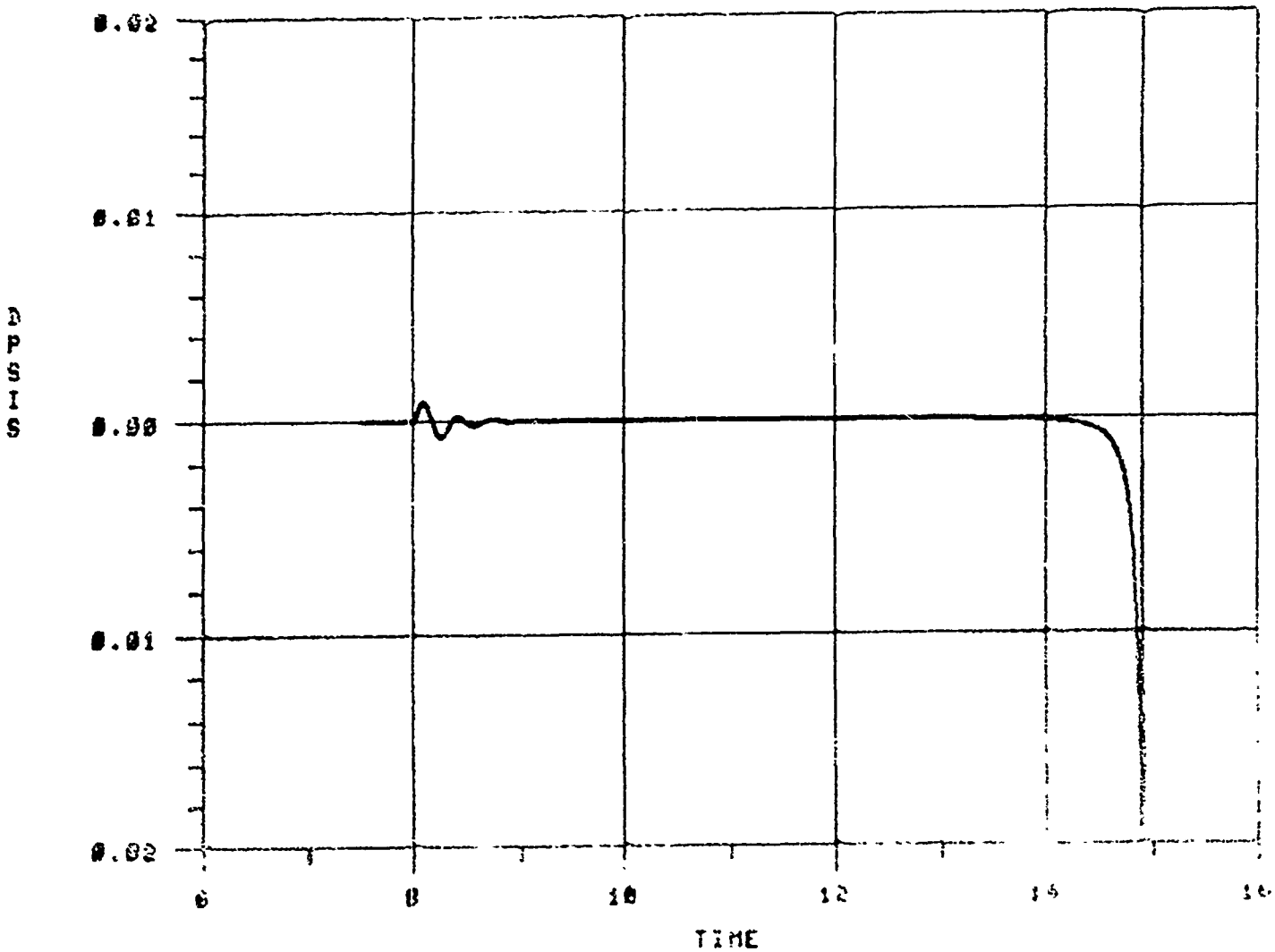

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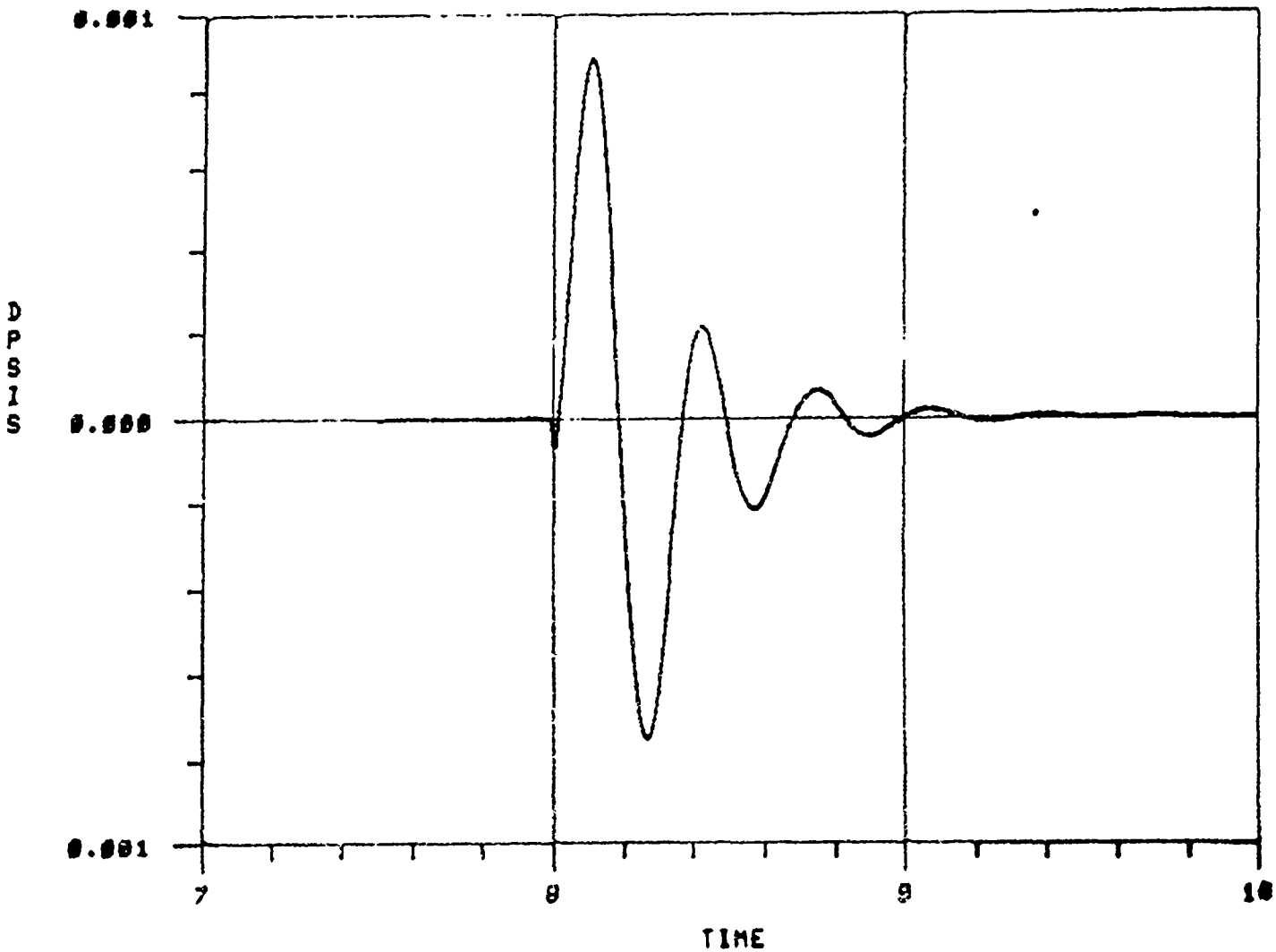

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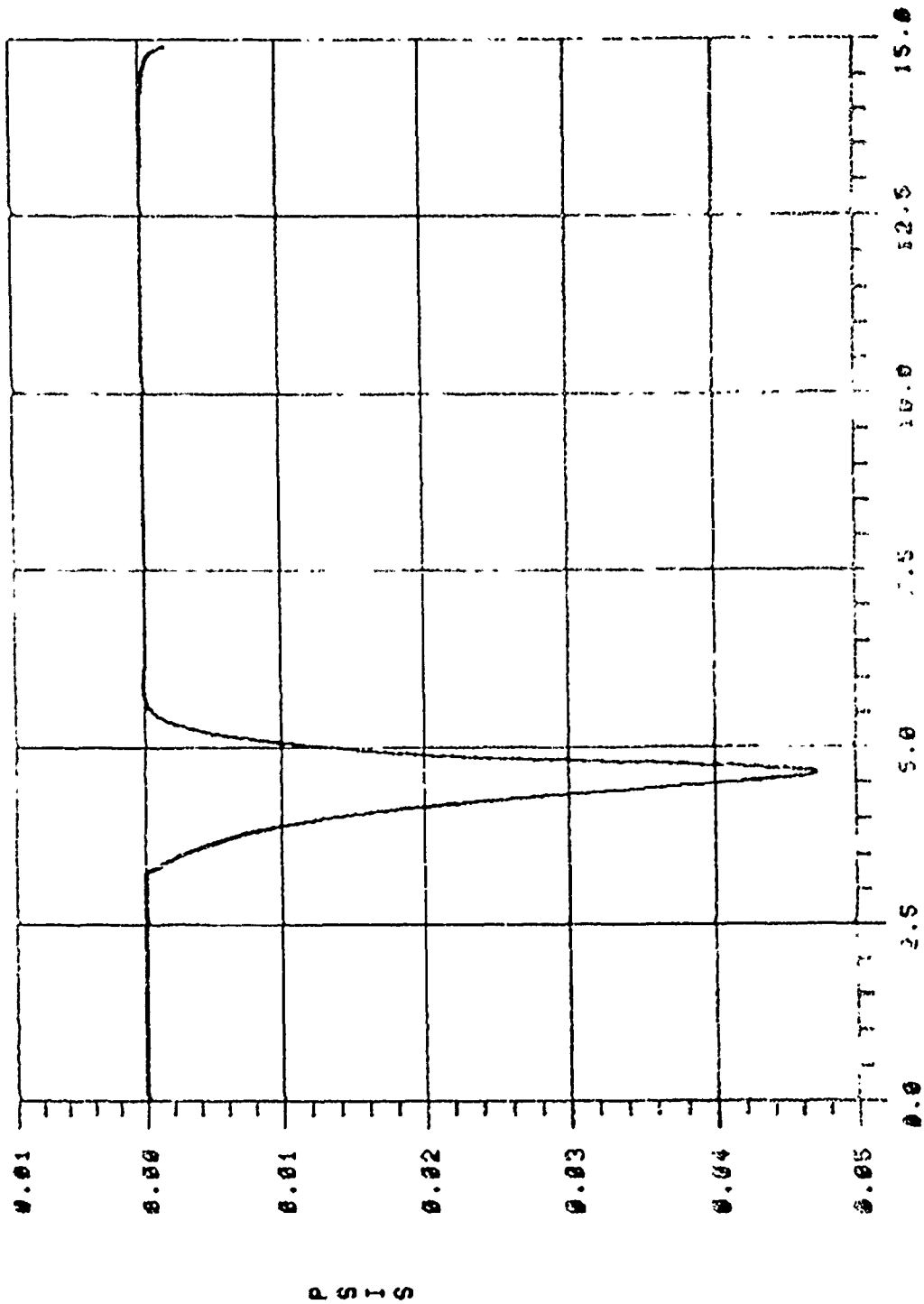

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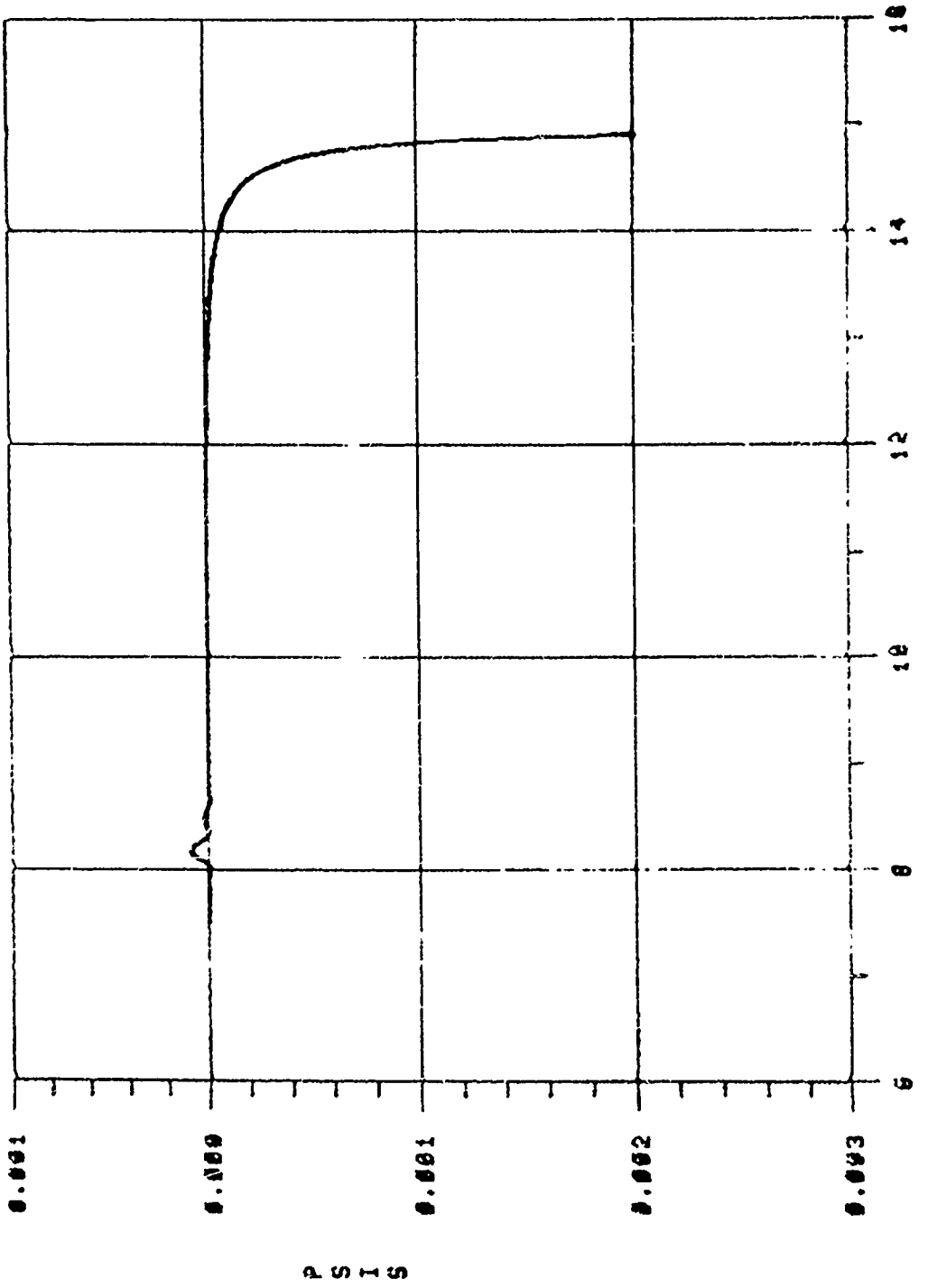

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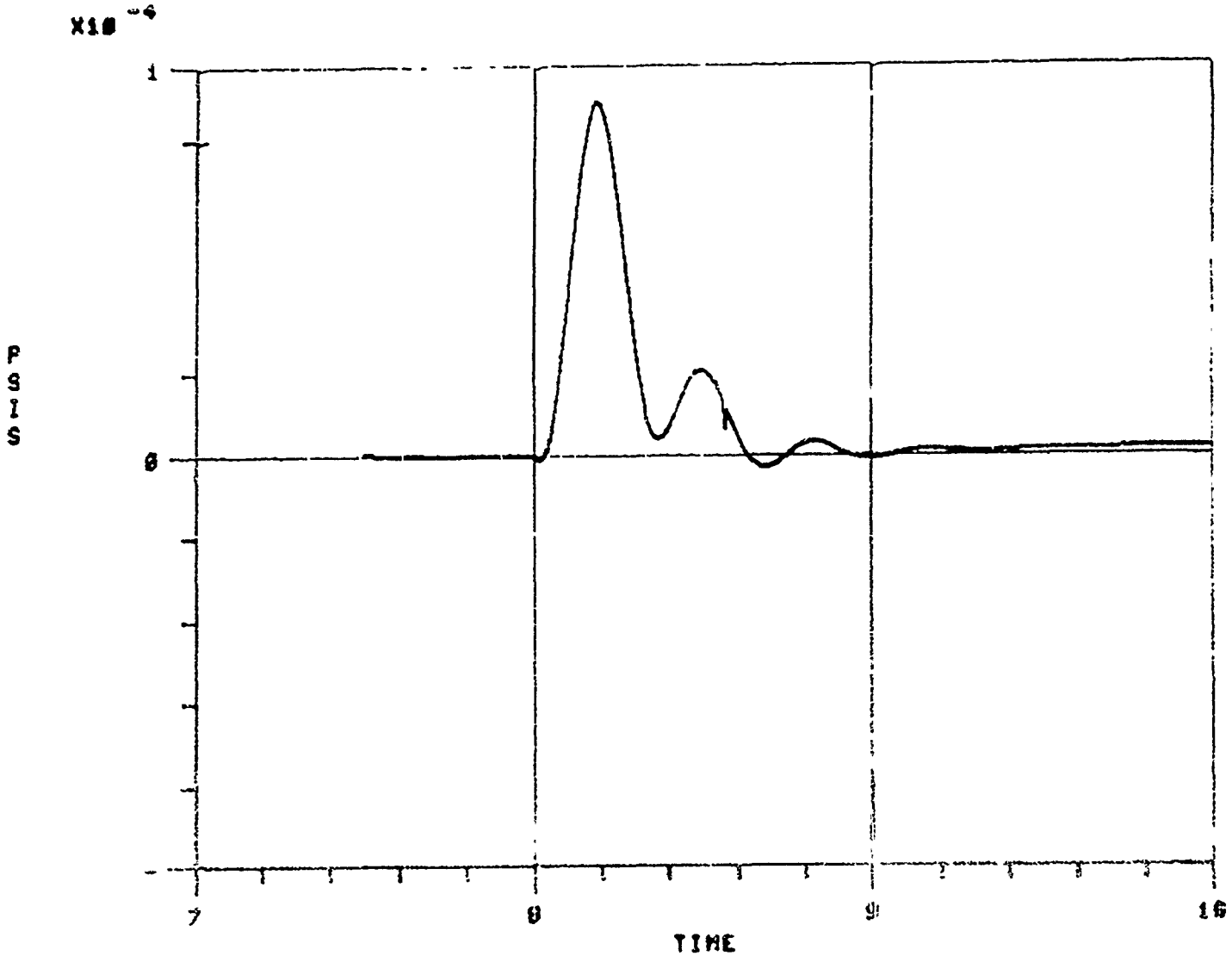

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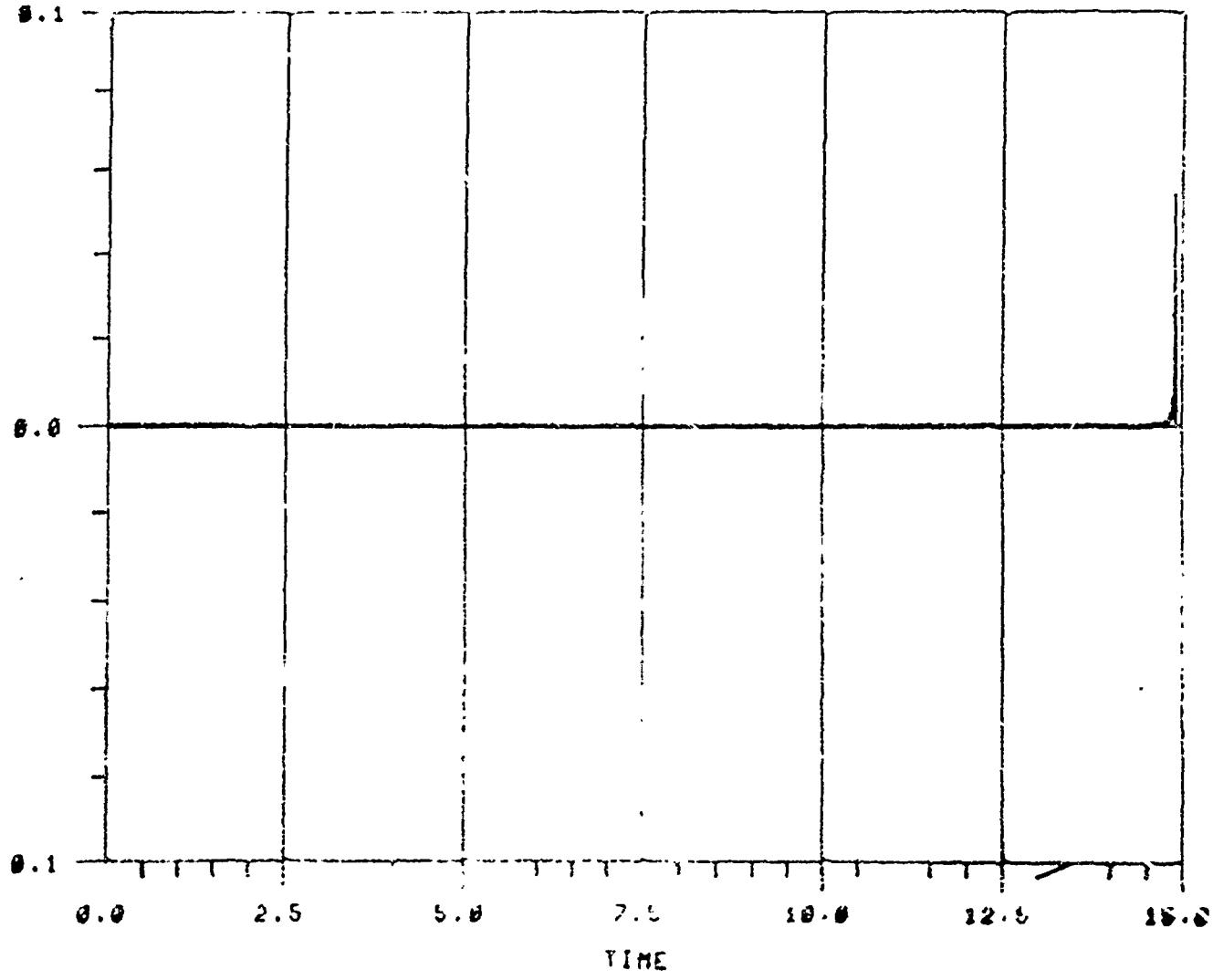

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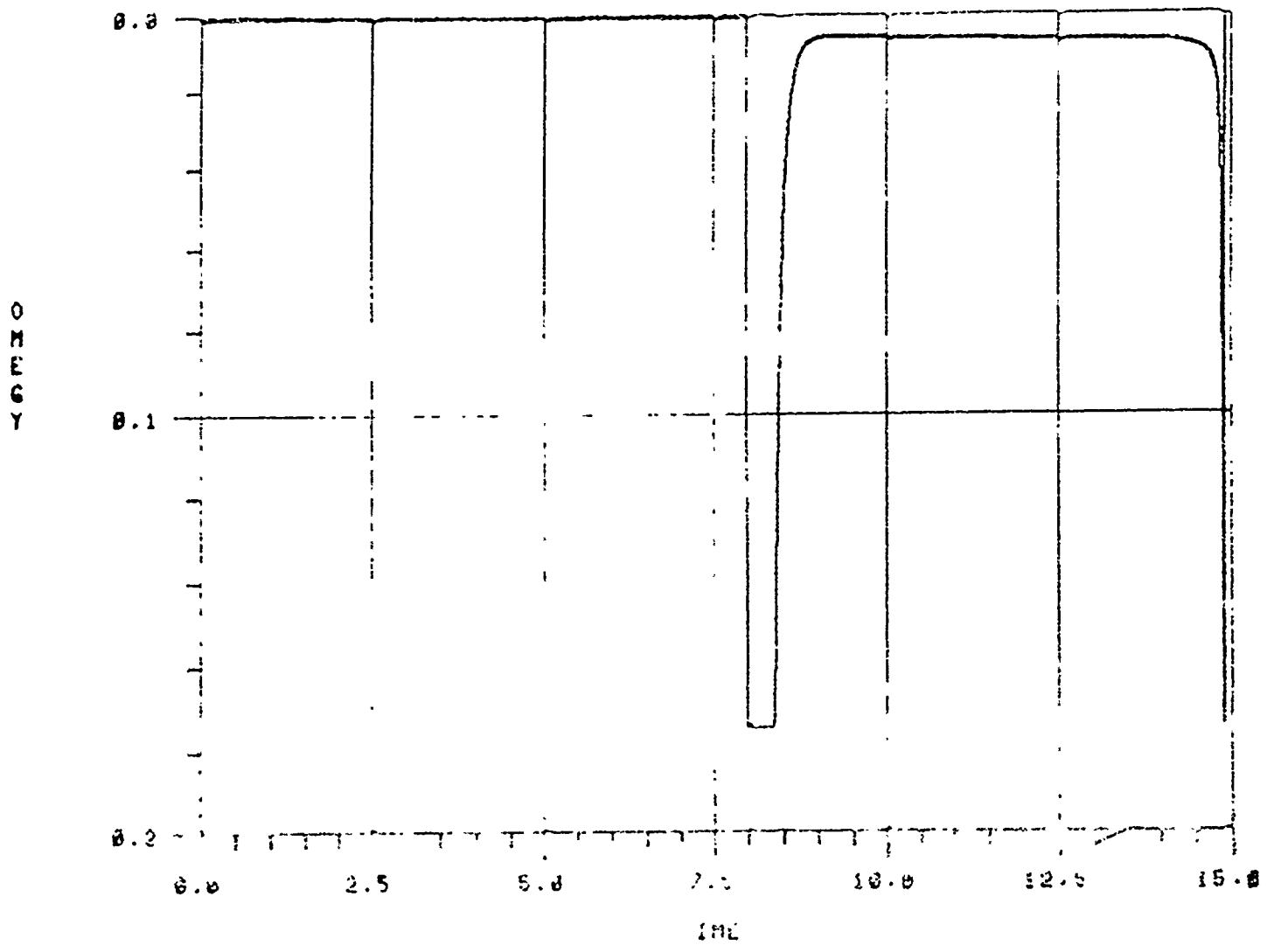

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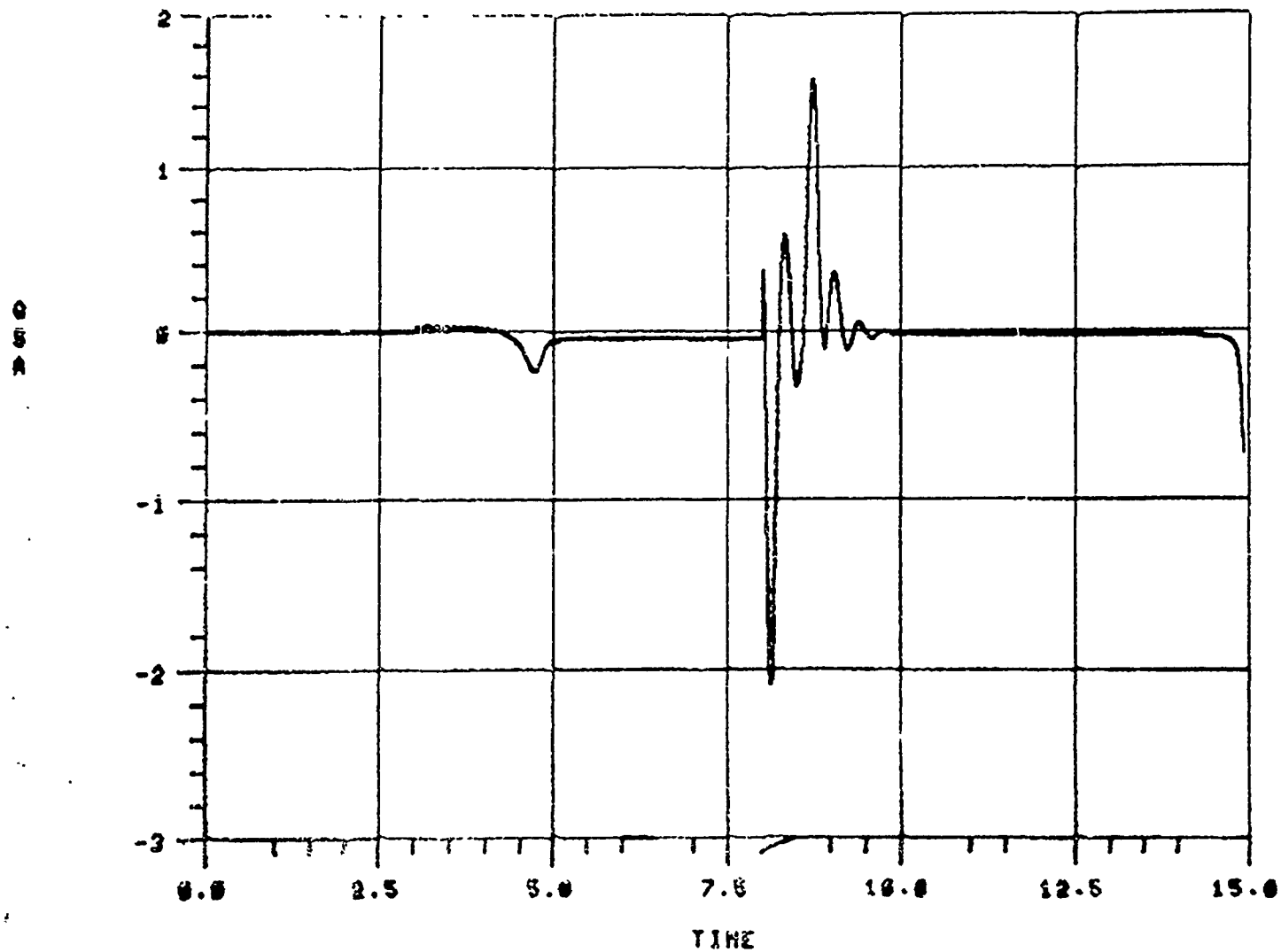

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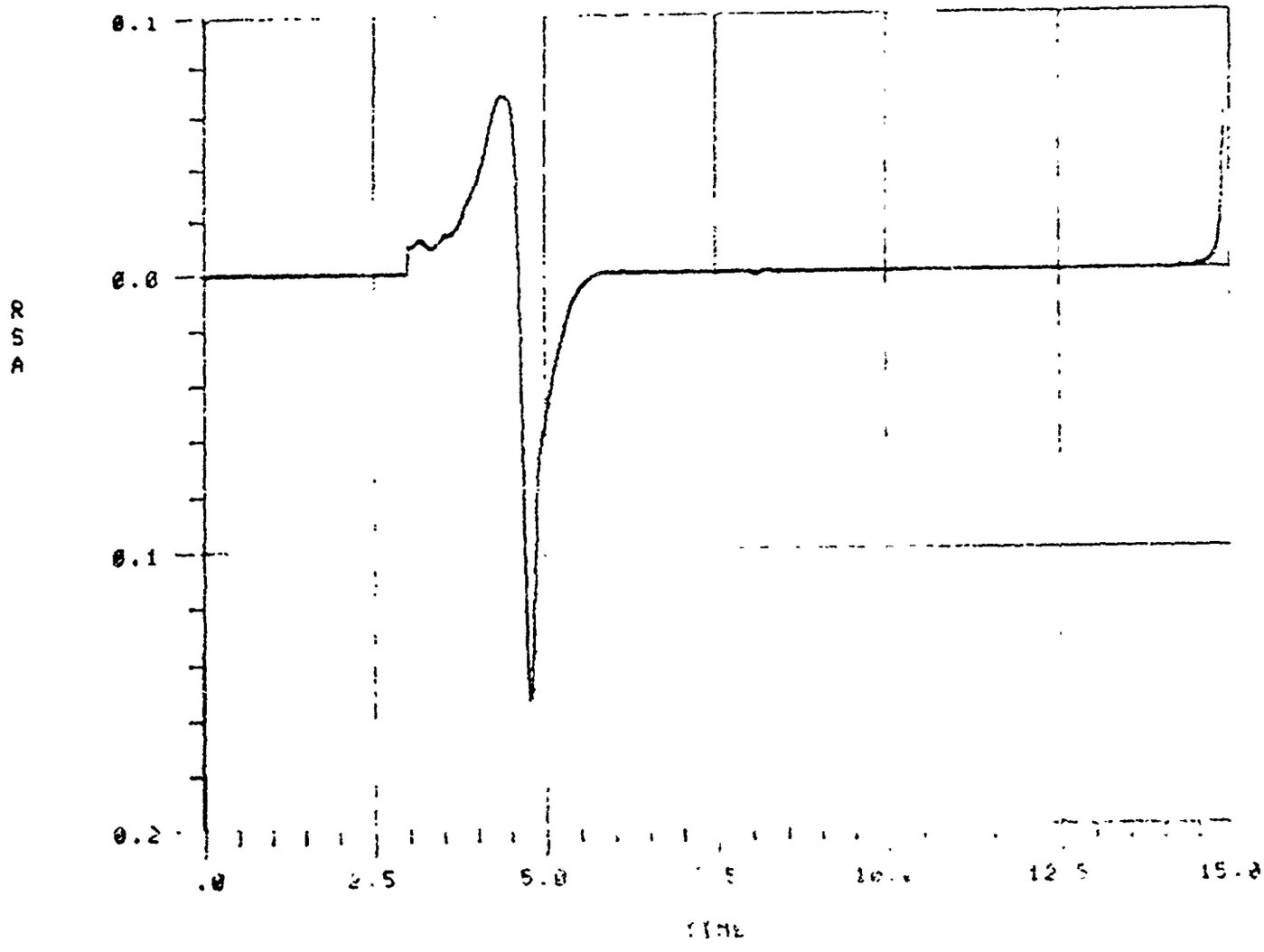

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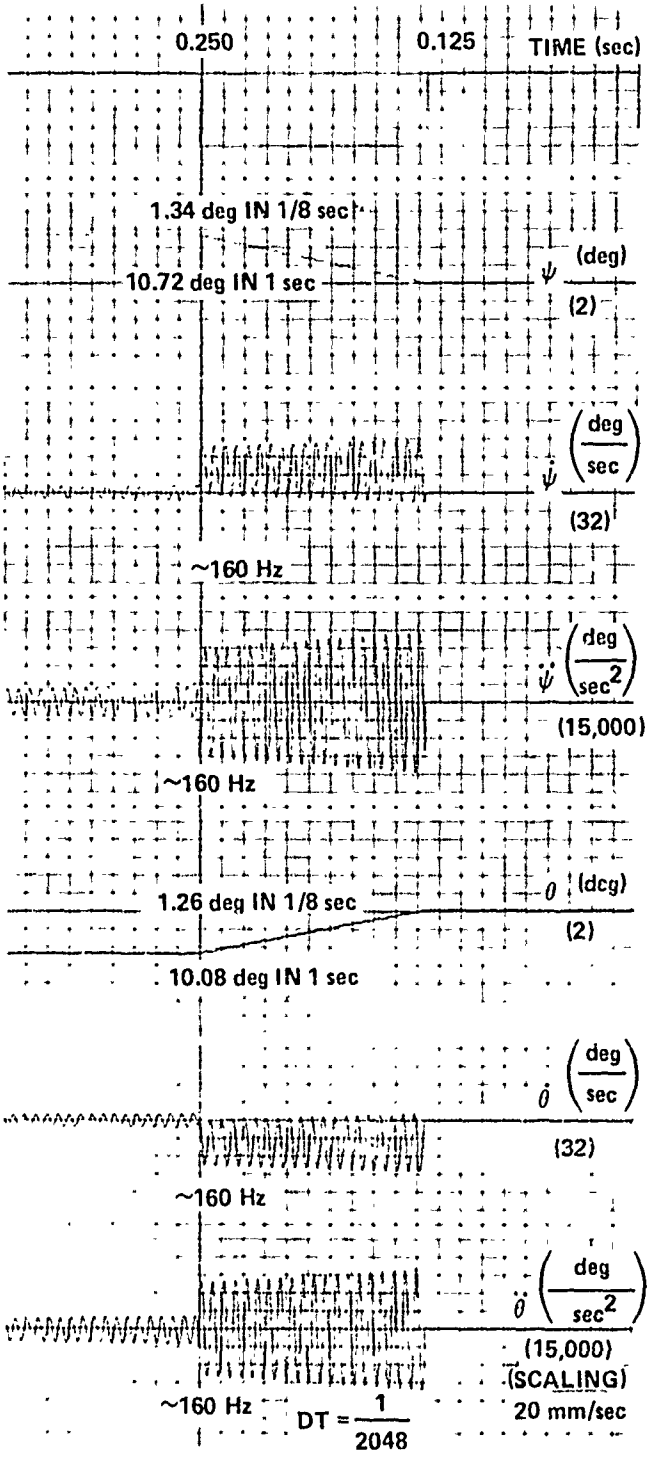

0.250
0.125
TIME (sec)
1.34 deg IN 1/8 sec
10.72 deg IN 1 sec
ψ (deg)
(2)
ψ̇ (deg/sec)
(32)
~160 Hz
ψ̈ (deg/sec²)
(15,000)
~160 Hz
θ (deg)
1.26 deg IN 1/8 sec
(2)
10.08 deg IN 1 sec
θ̇ (deg/sec)
(32)
~160 Hz
θ̈ (deg/sec²)
(15,000)
(SCALING)
~160 Hz
DT = 1/2048
20 mm/sec

Figure 56.

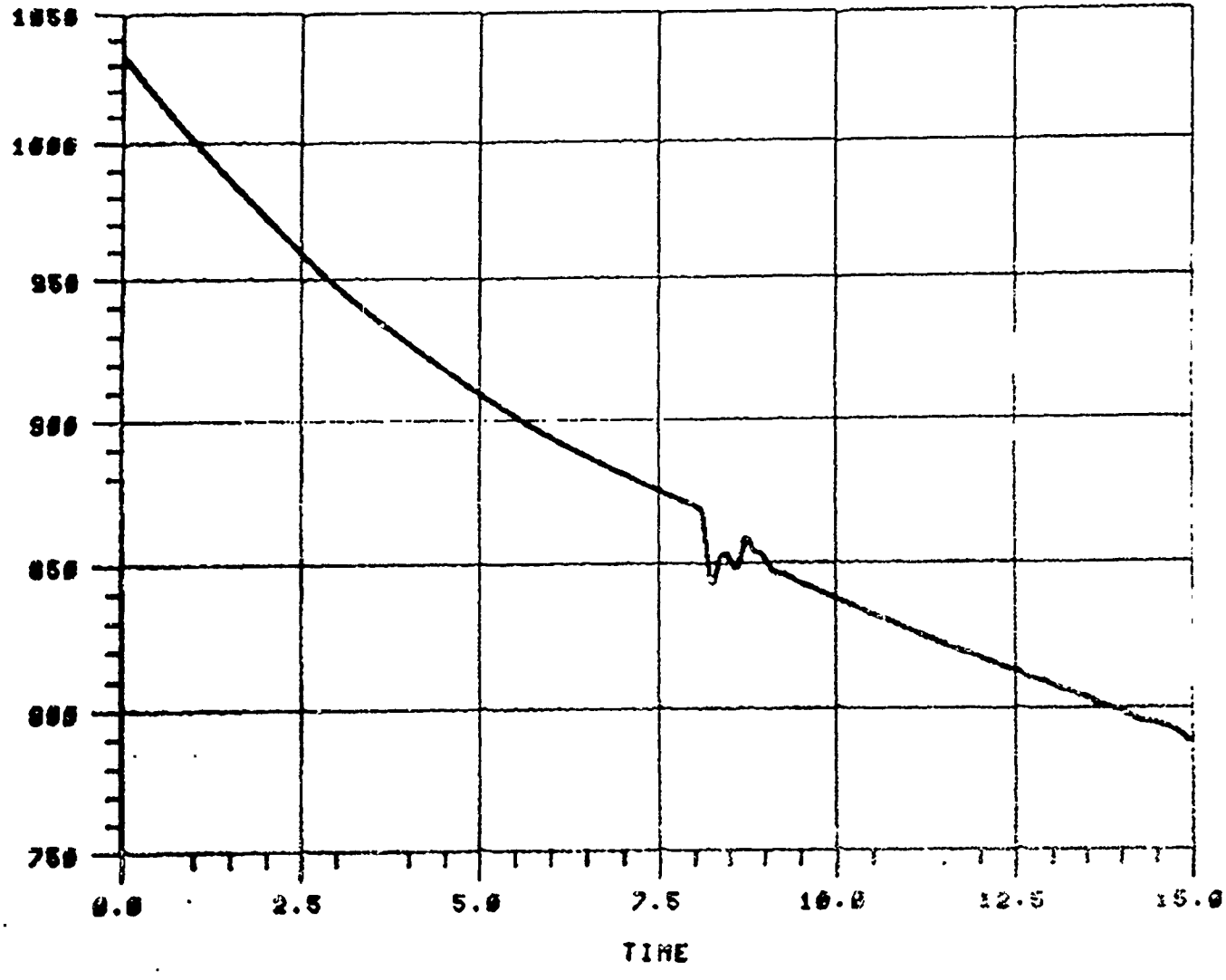
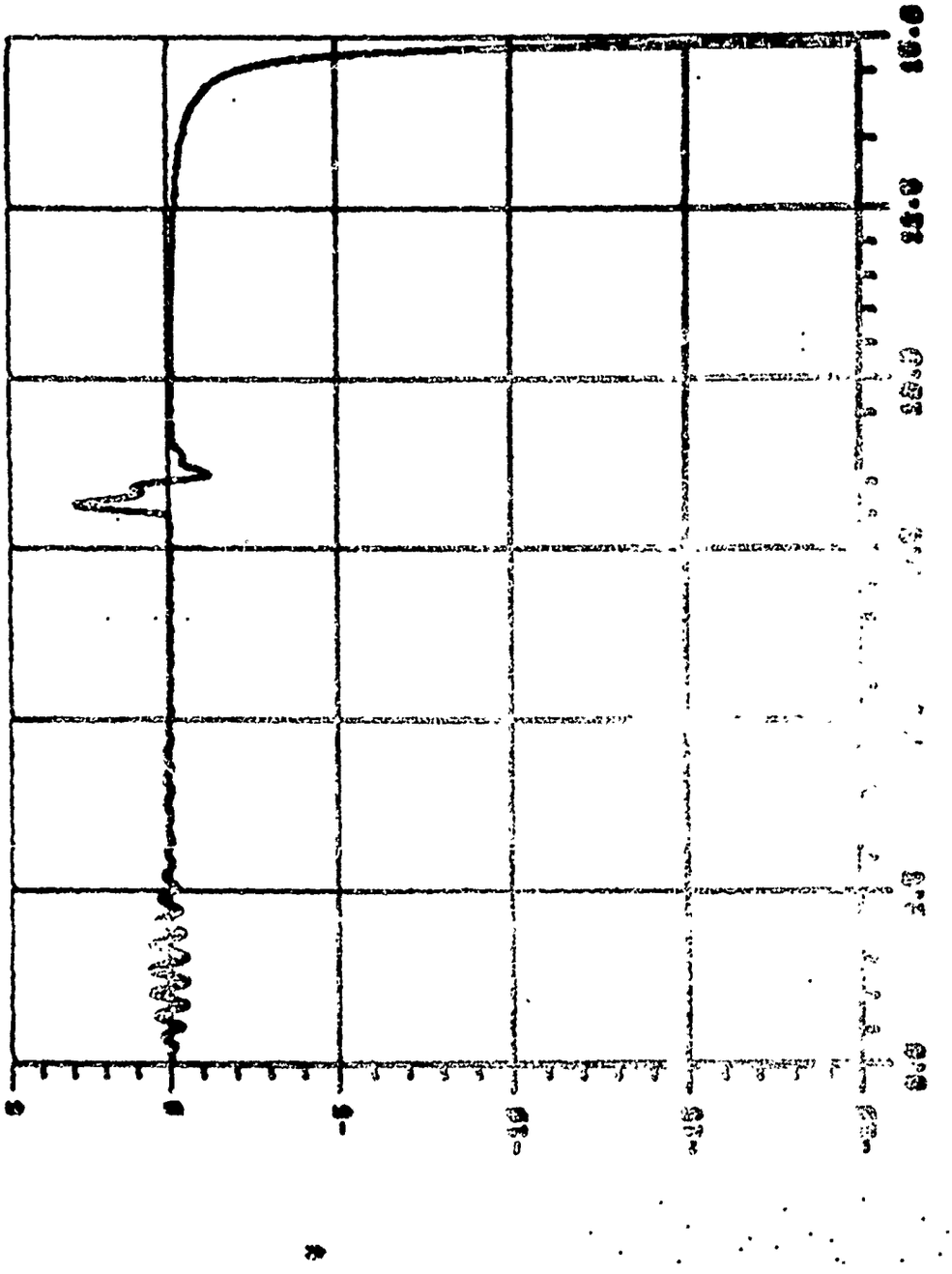


Figure 57.



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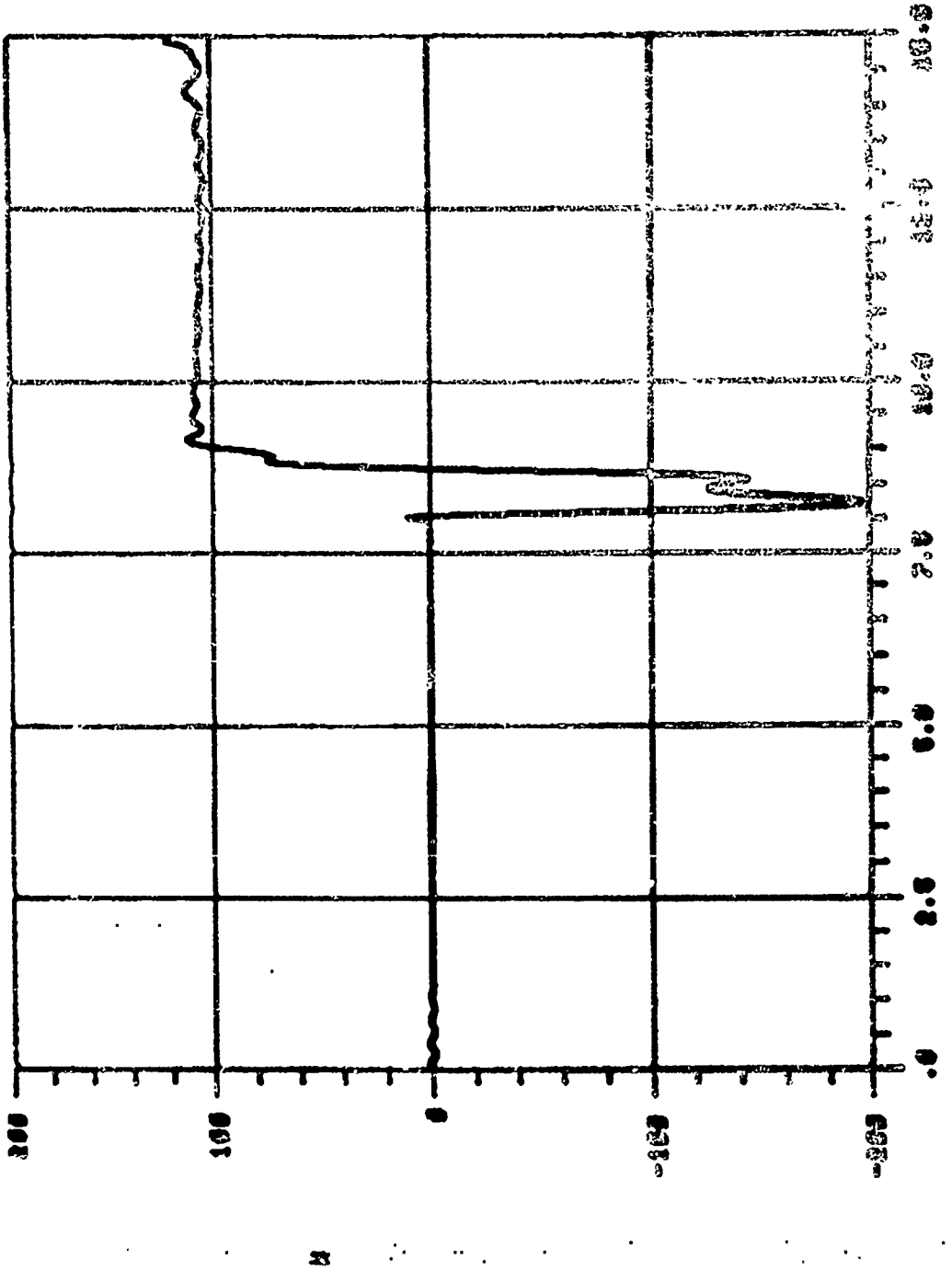

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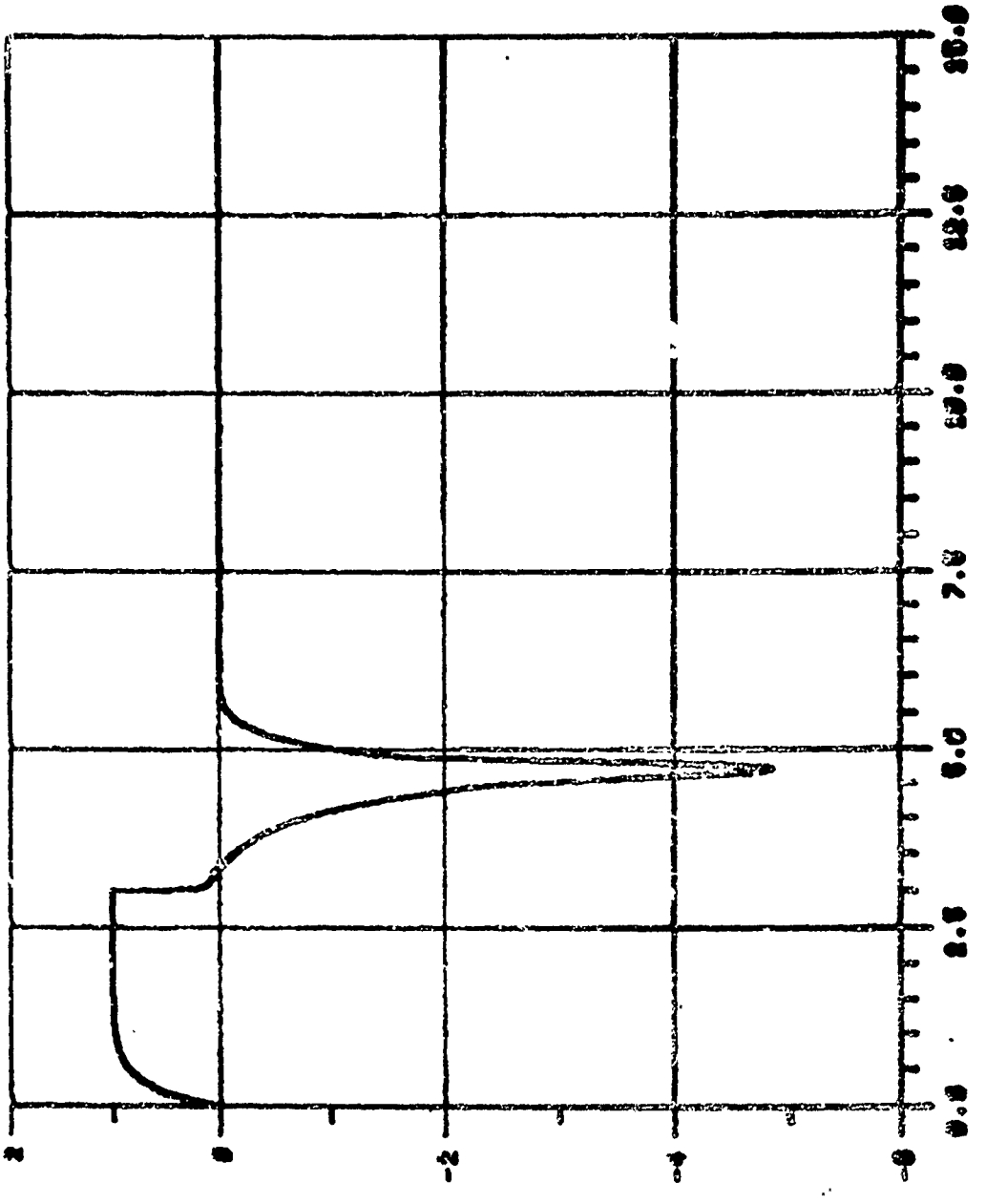

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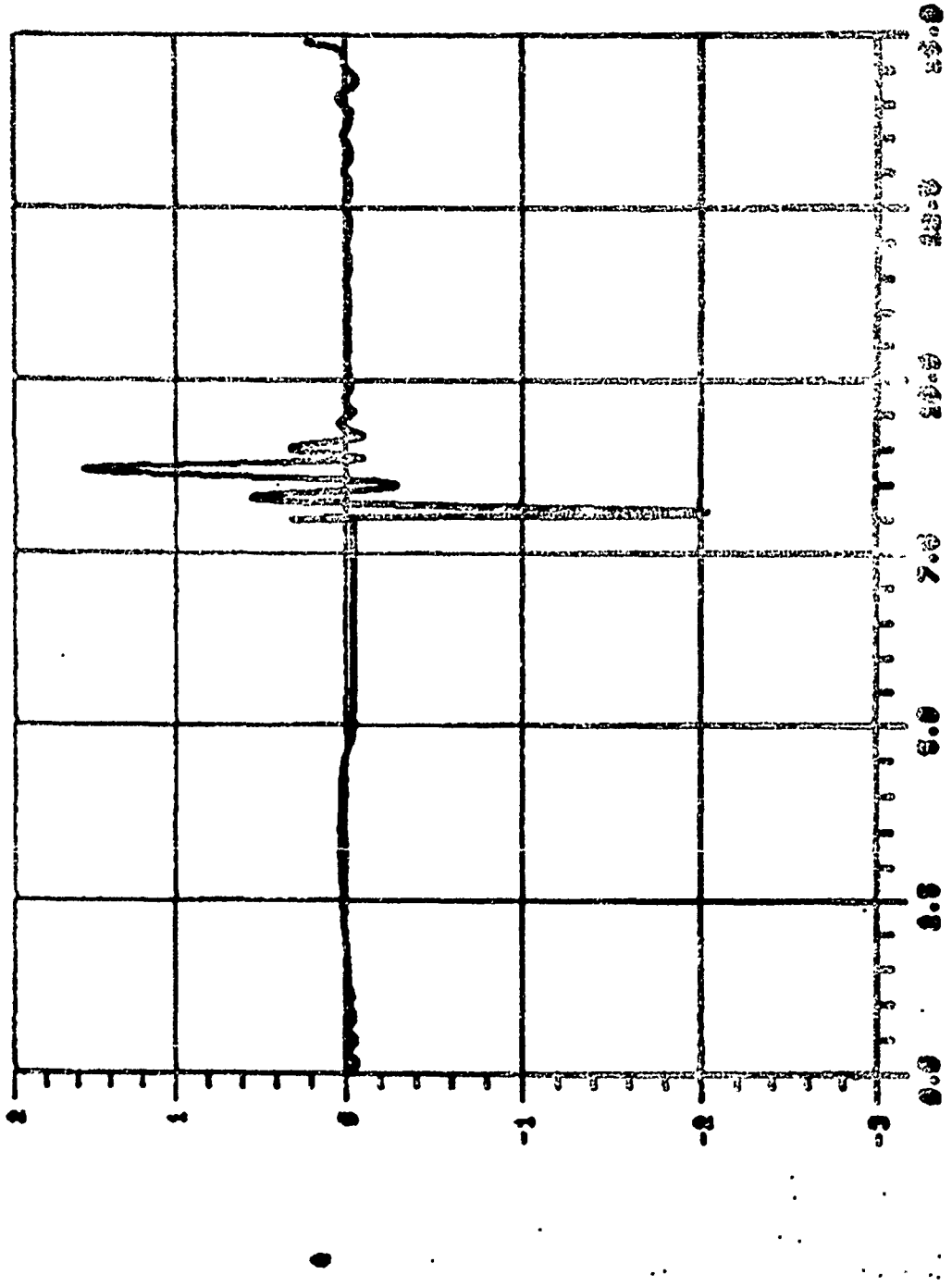

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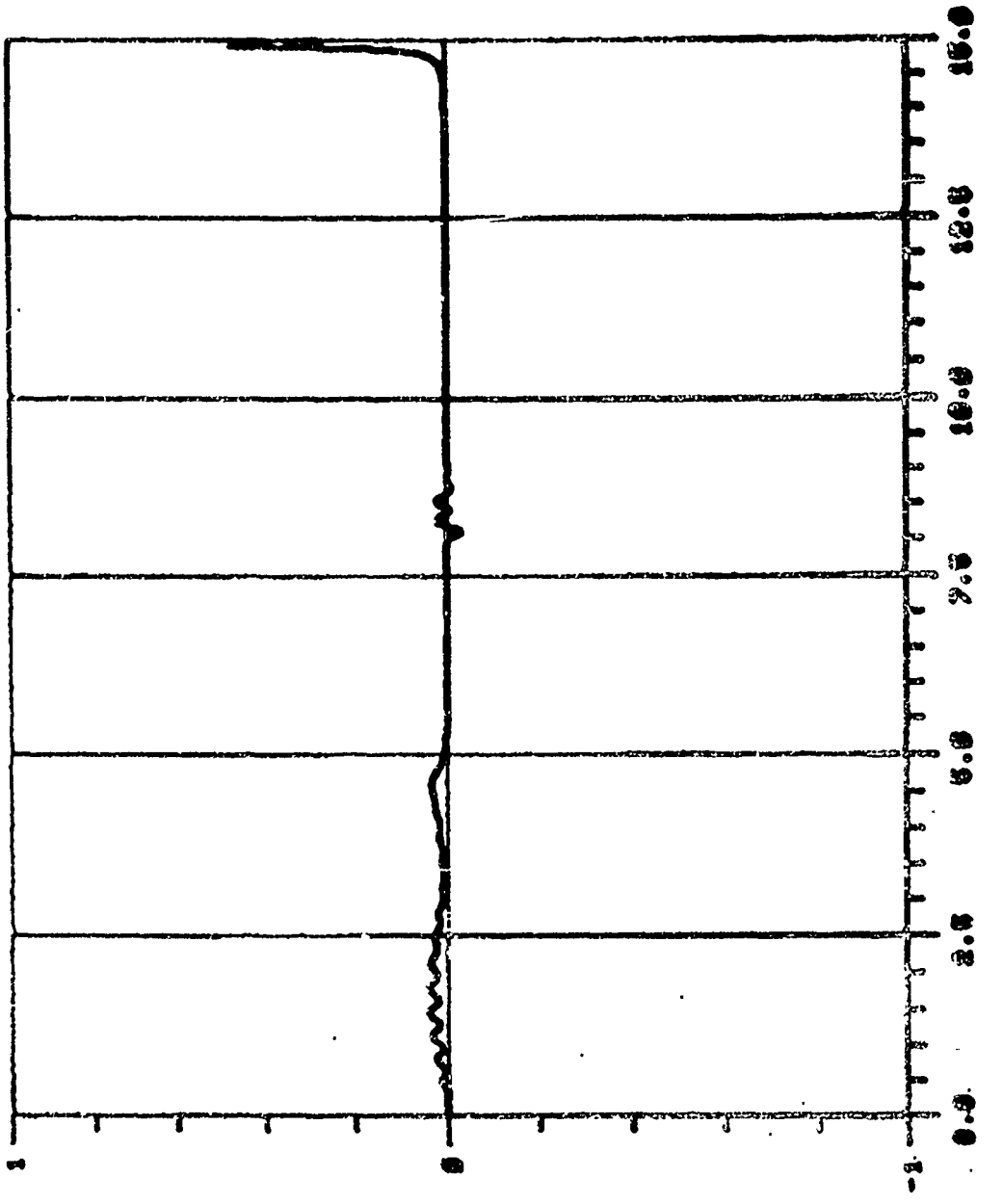


Figure 62.

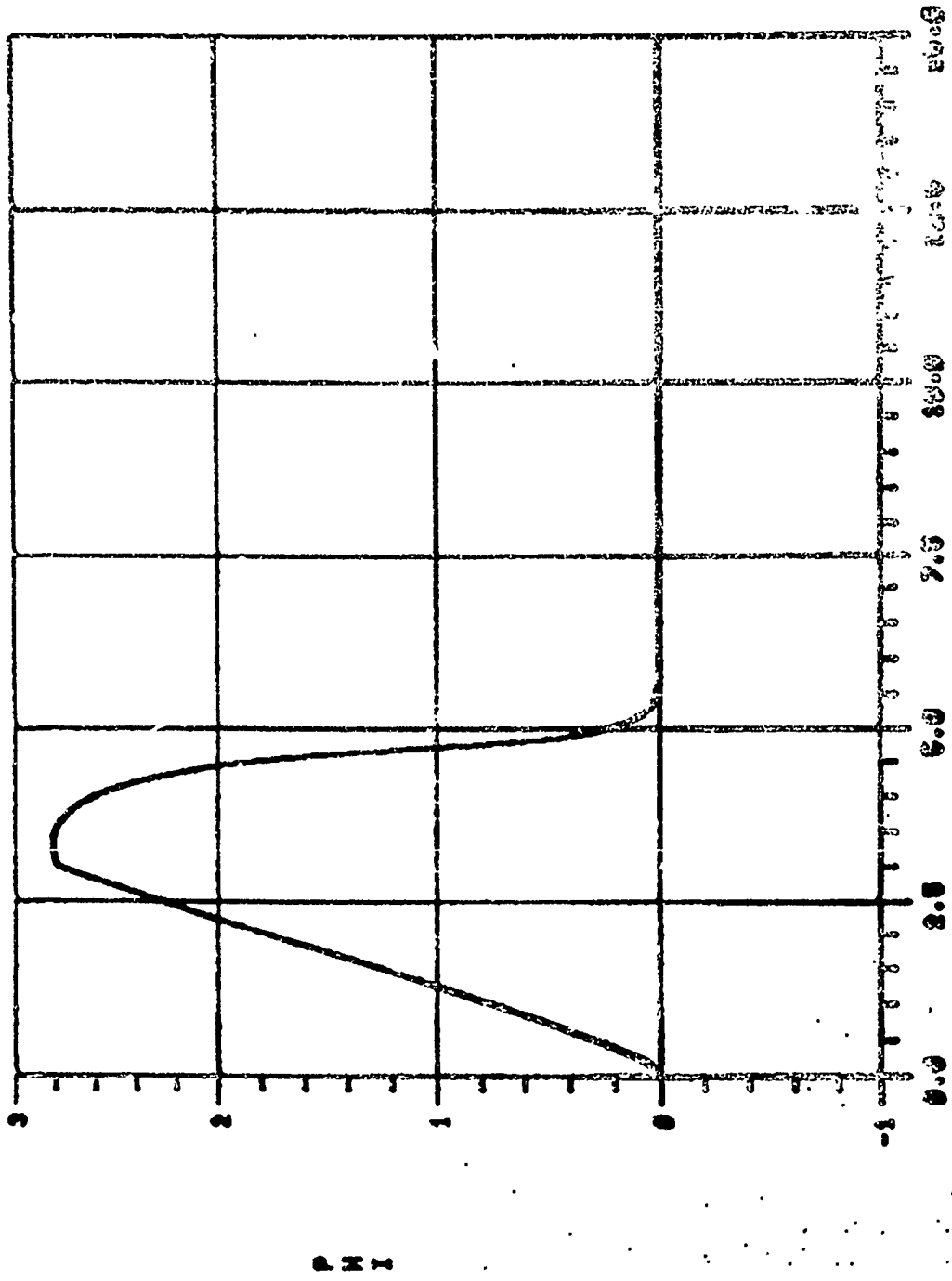
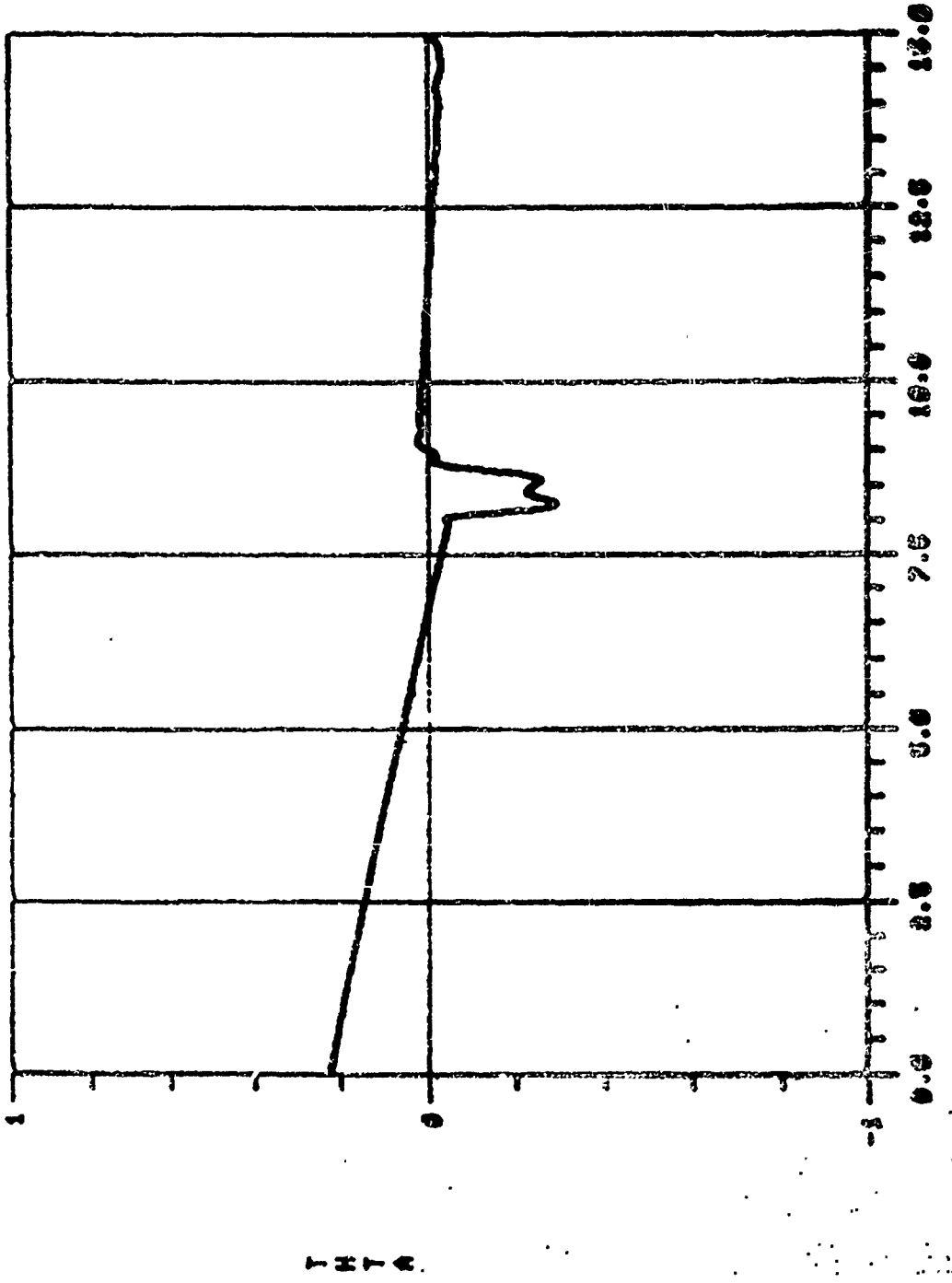


Figure 63.



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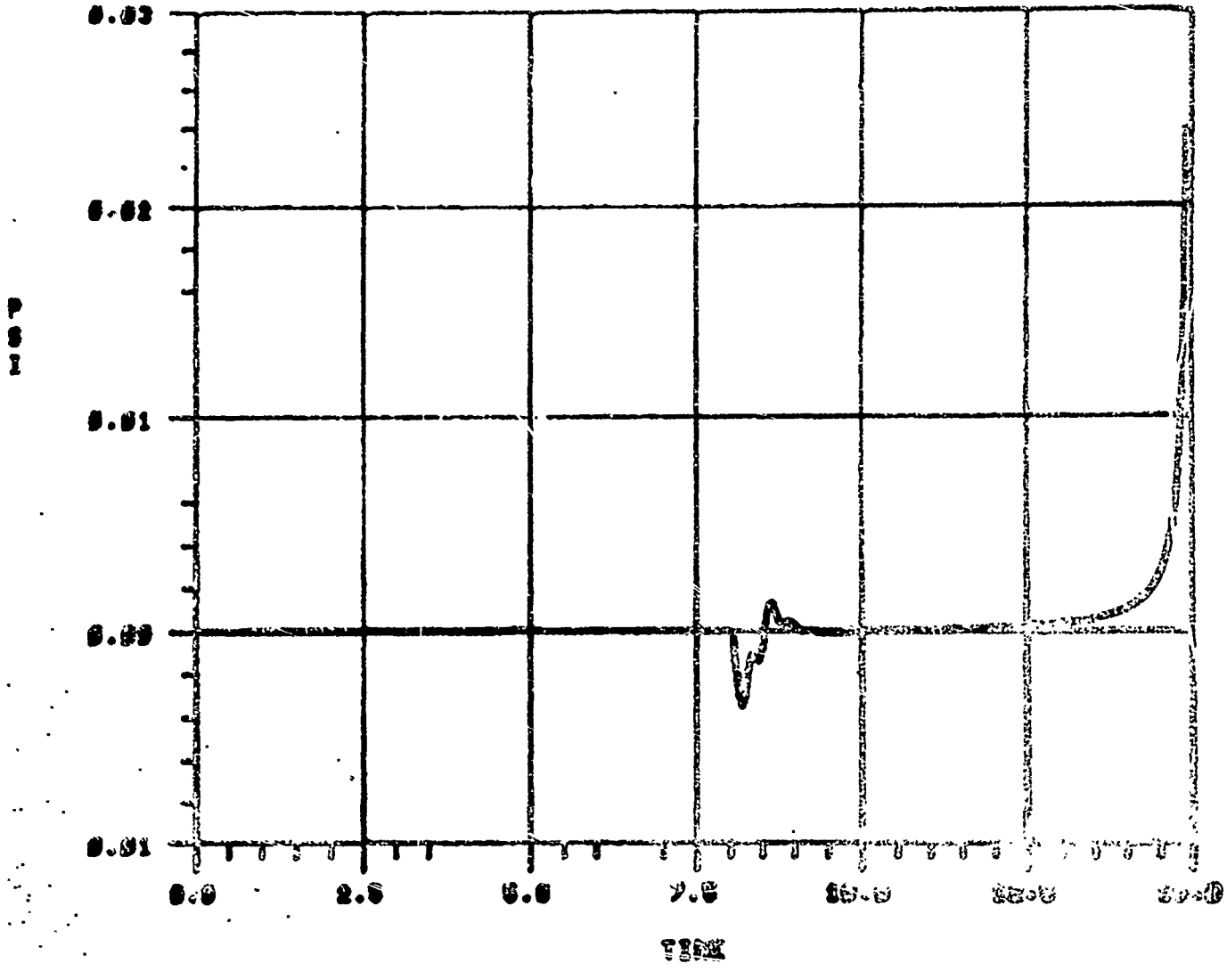

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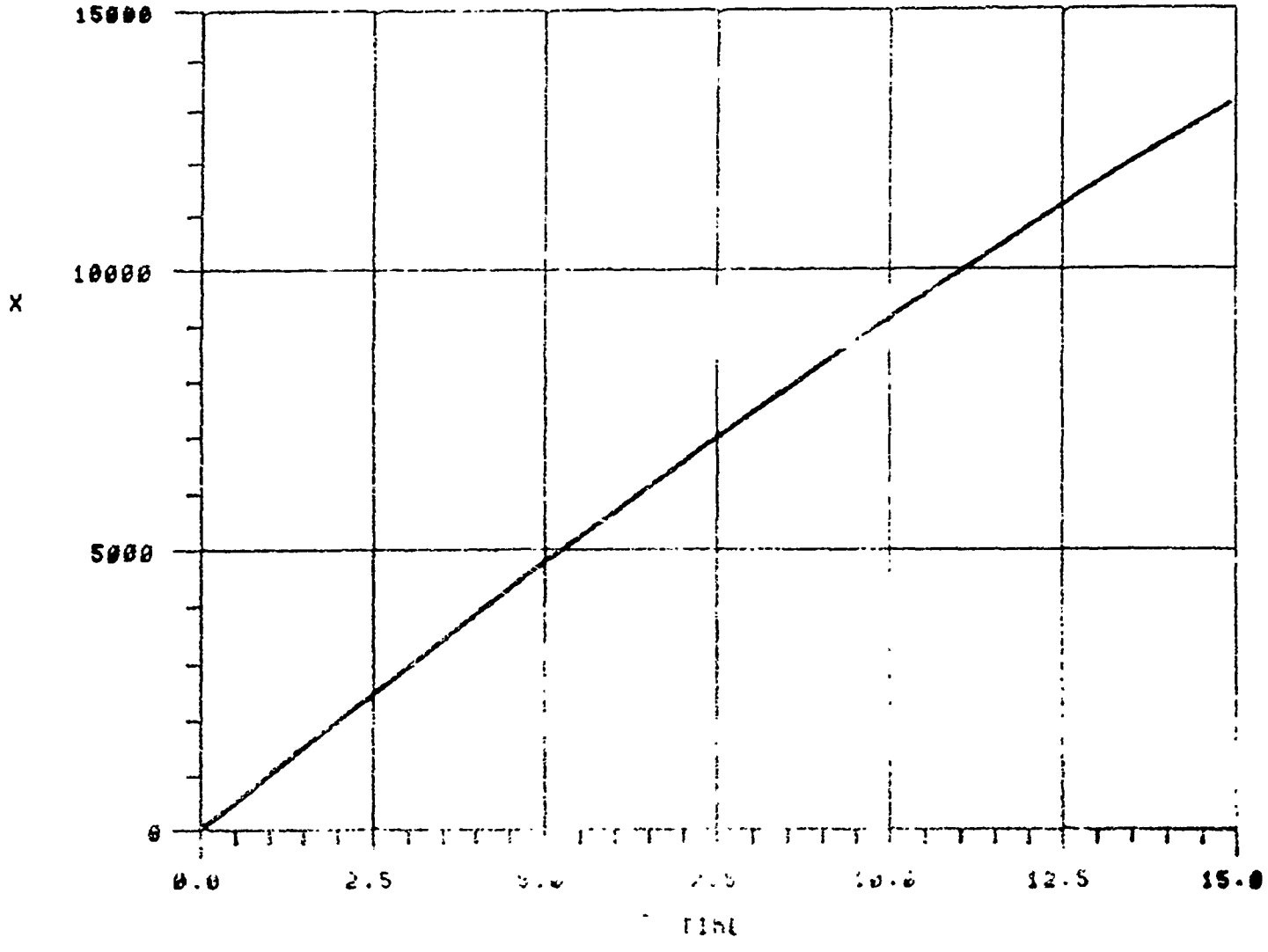

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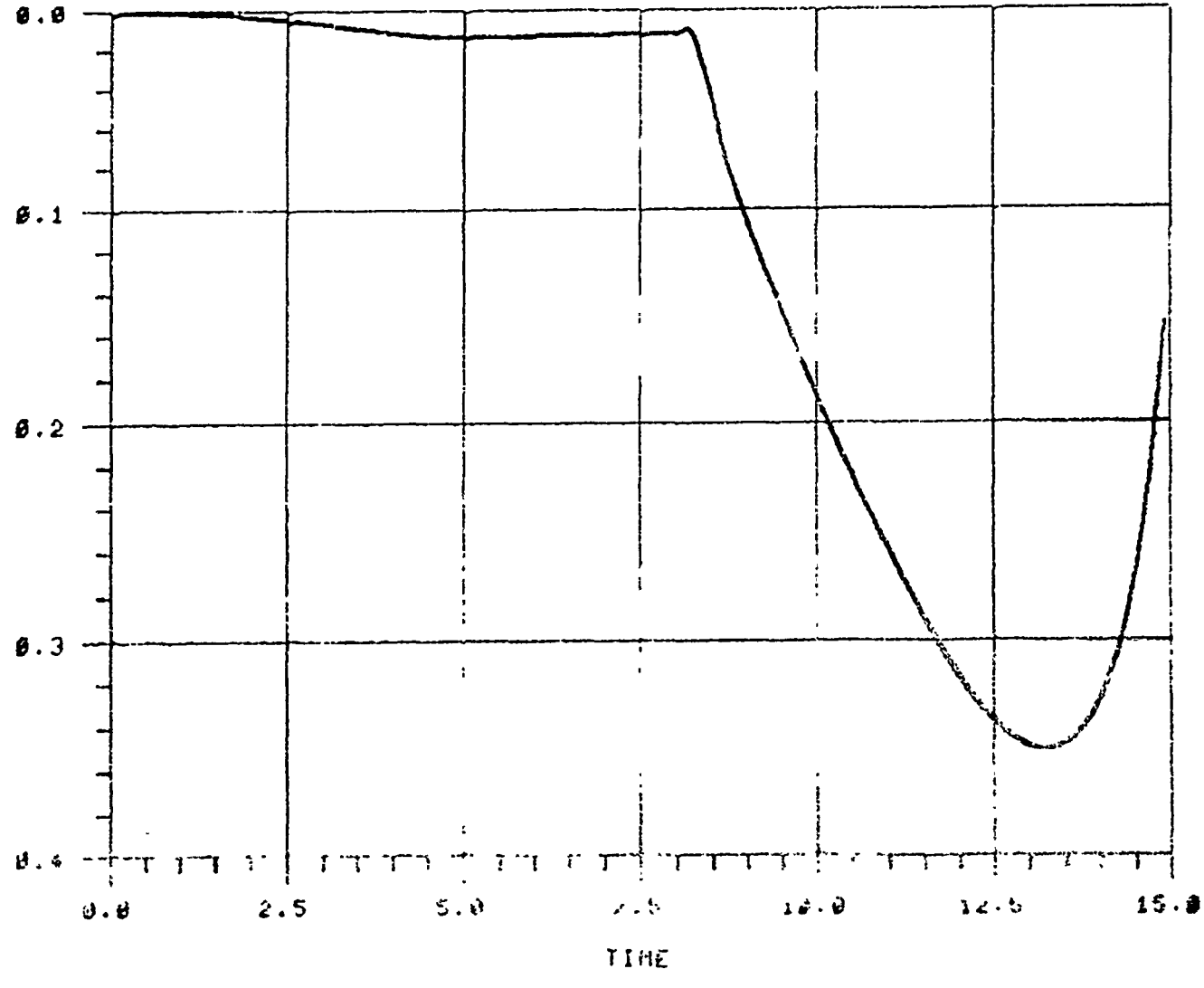

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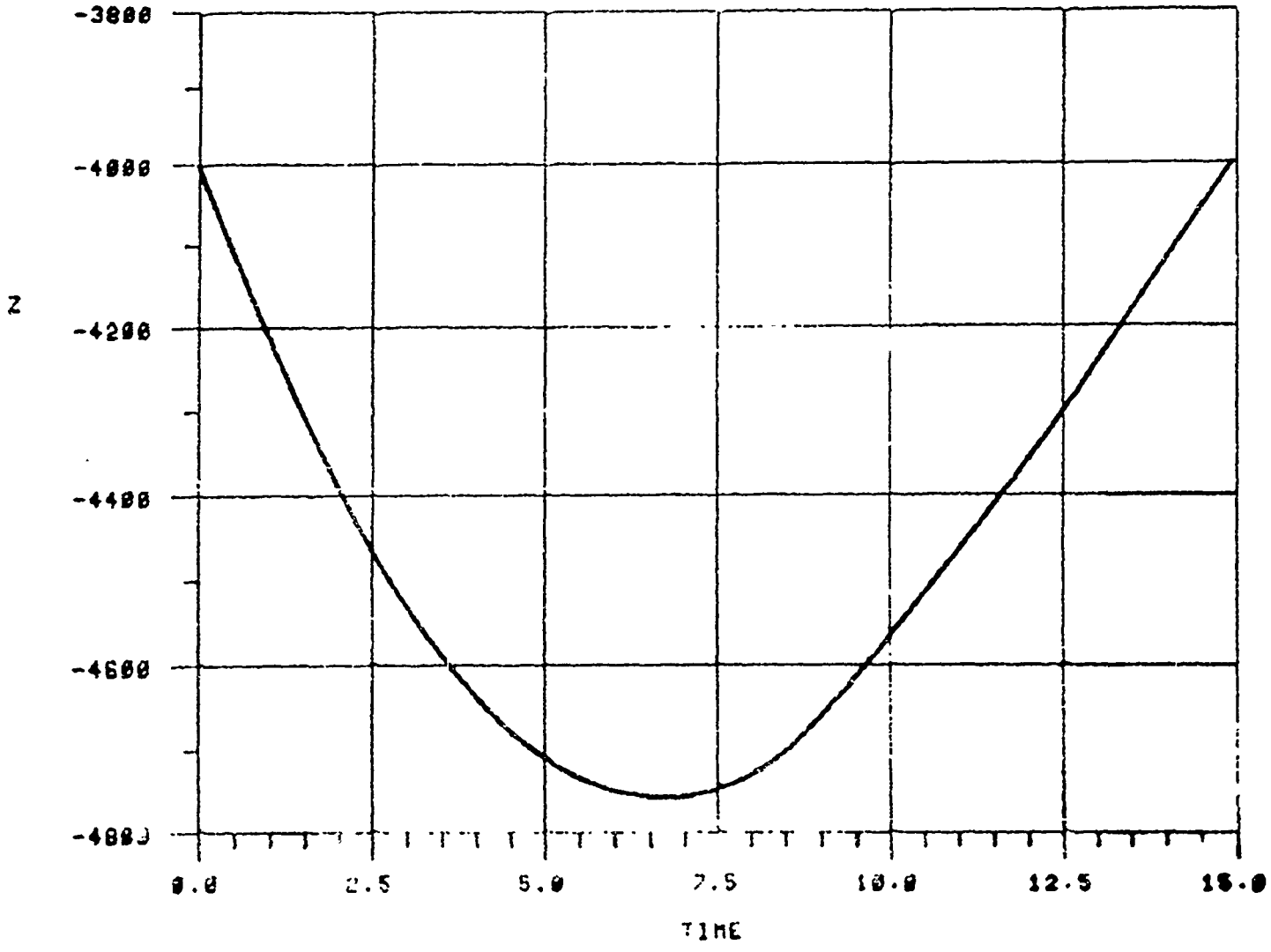

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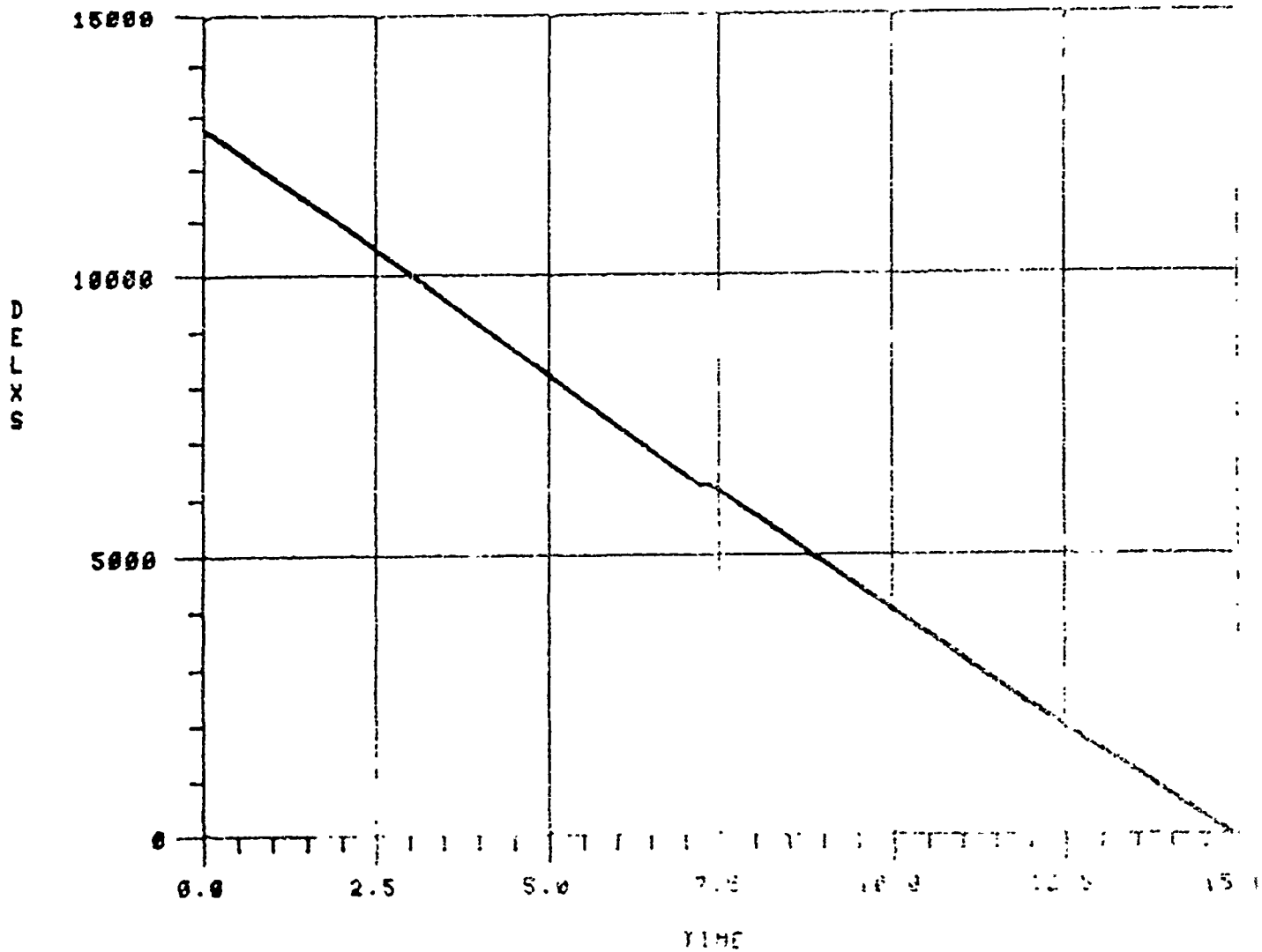
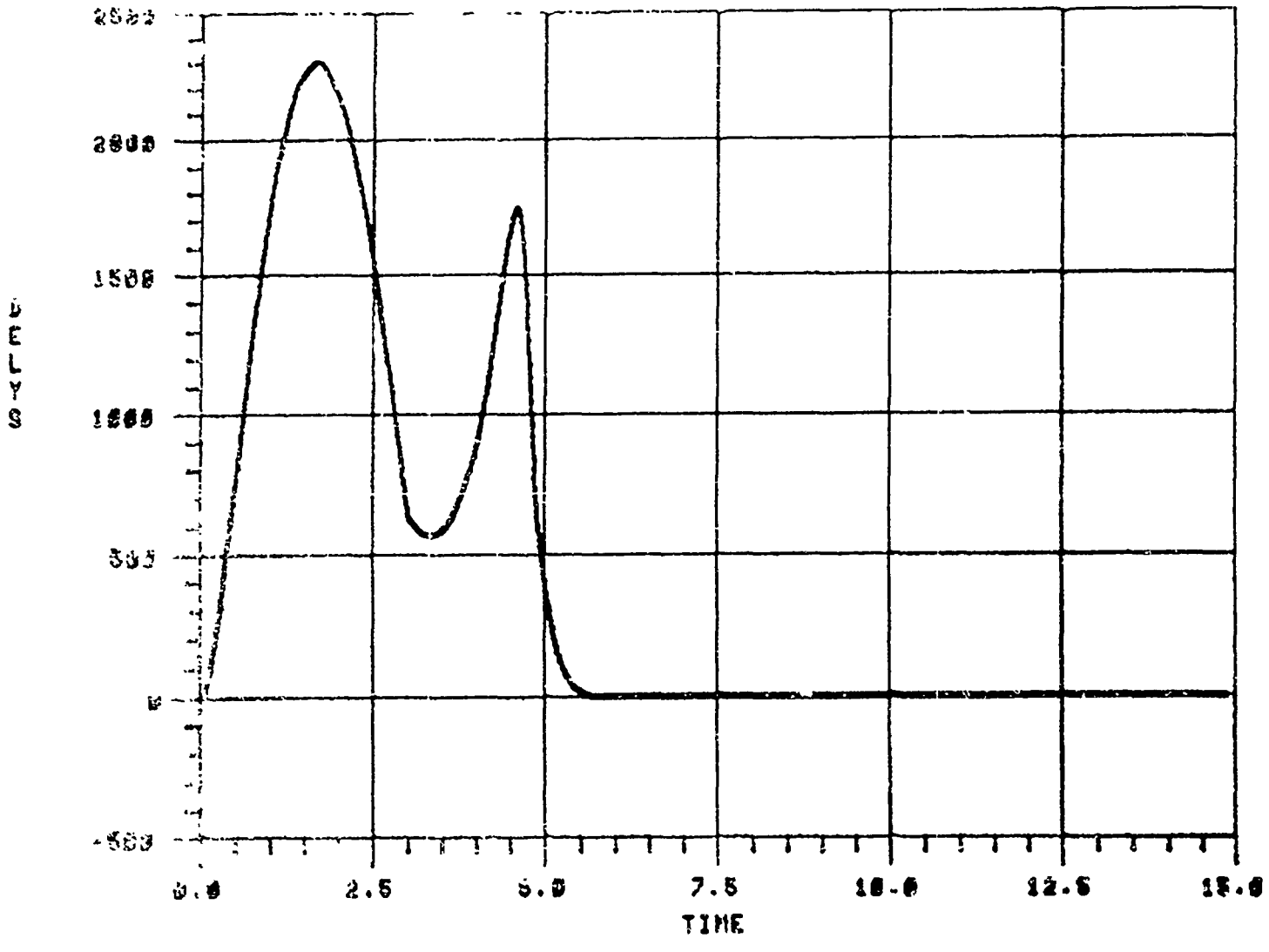


Figure 69.



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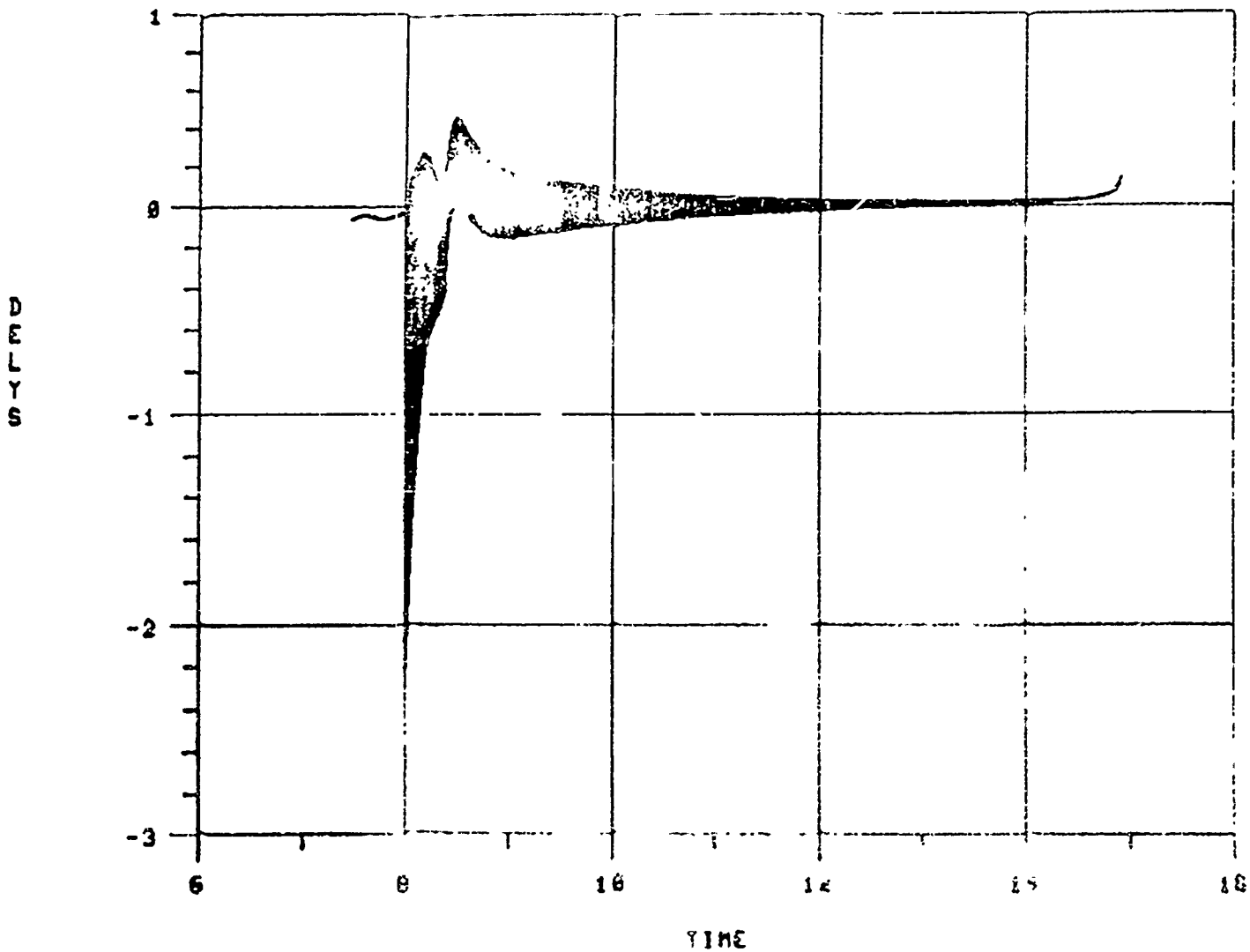

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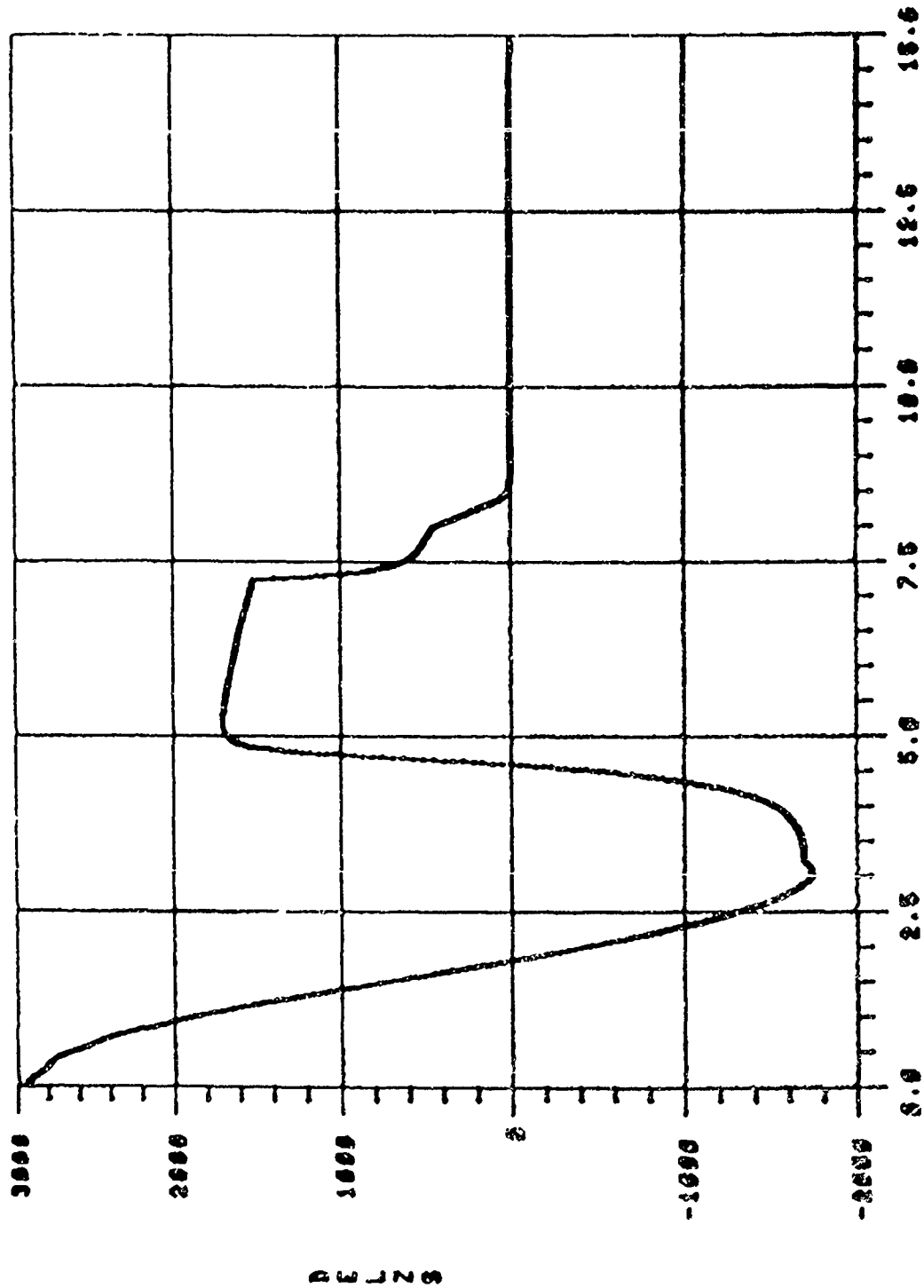

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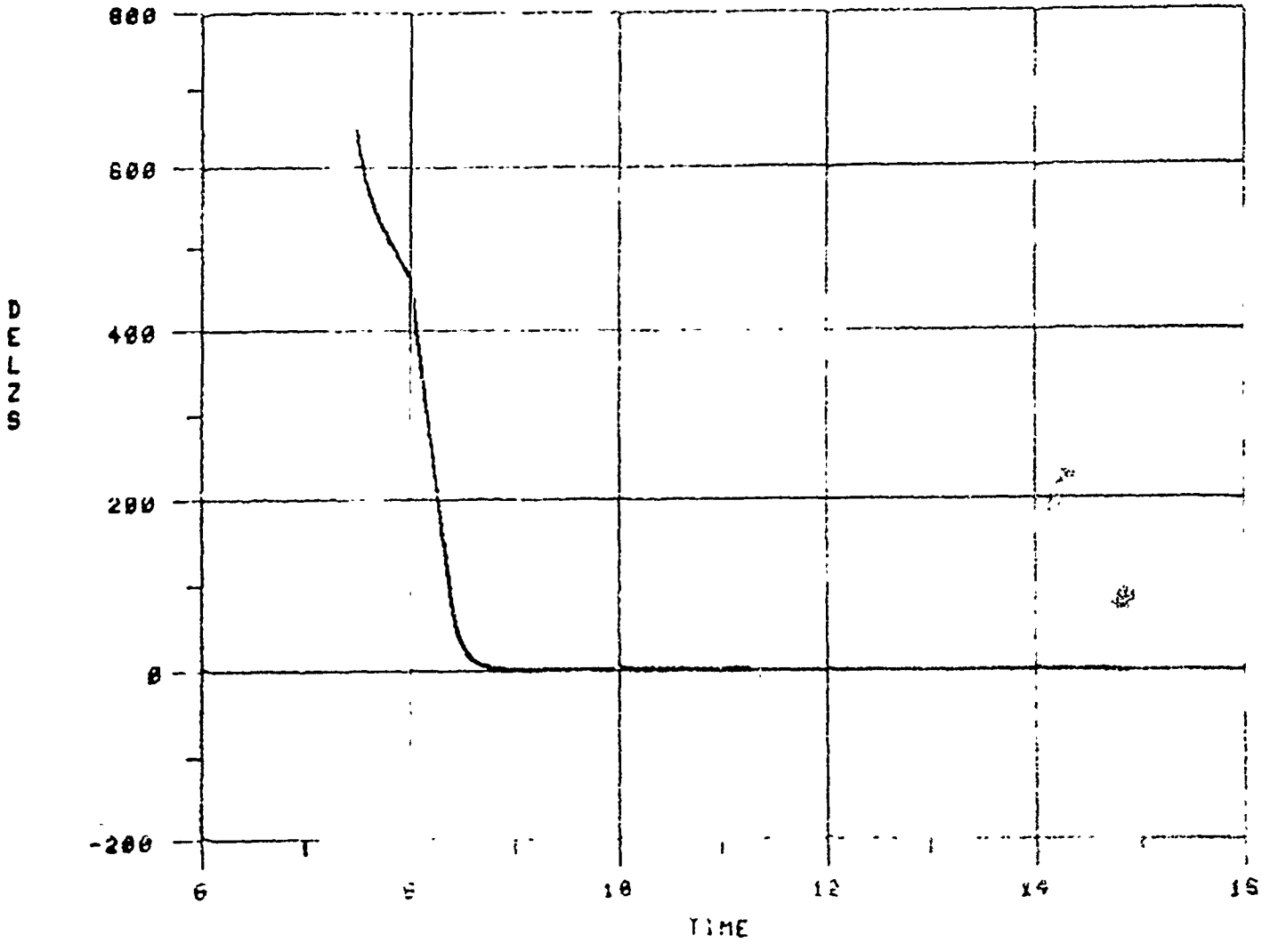

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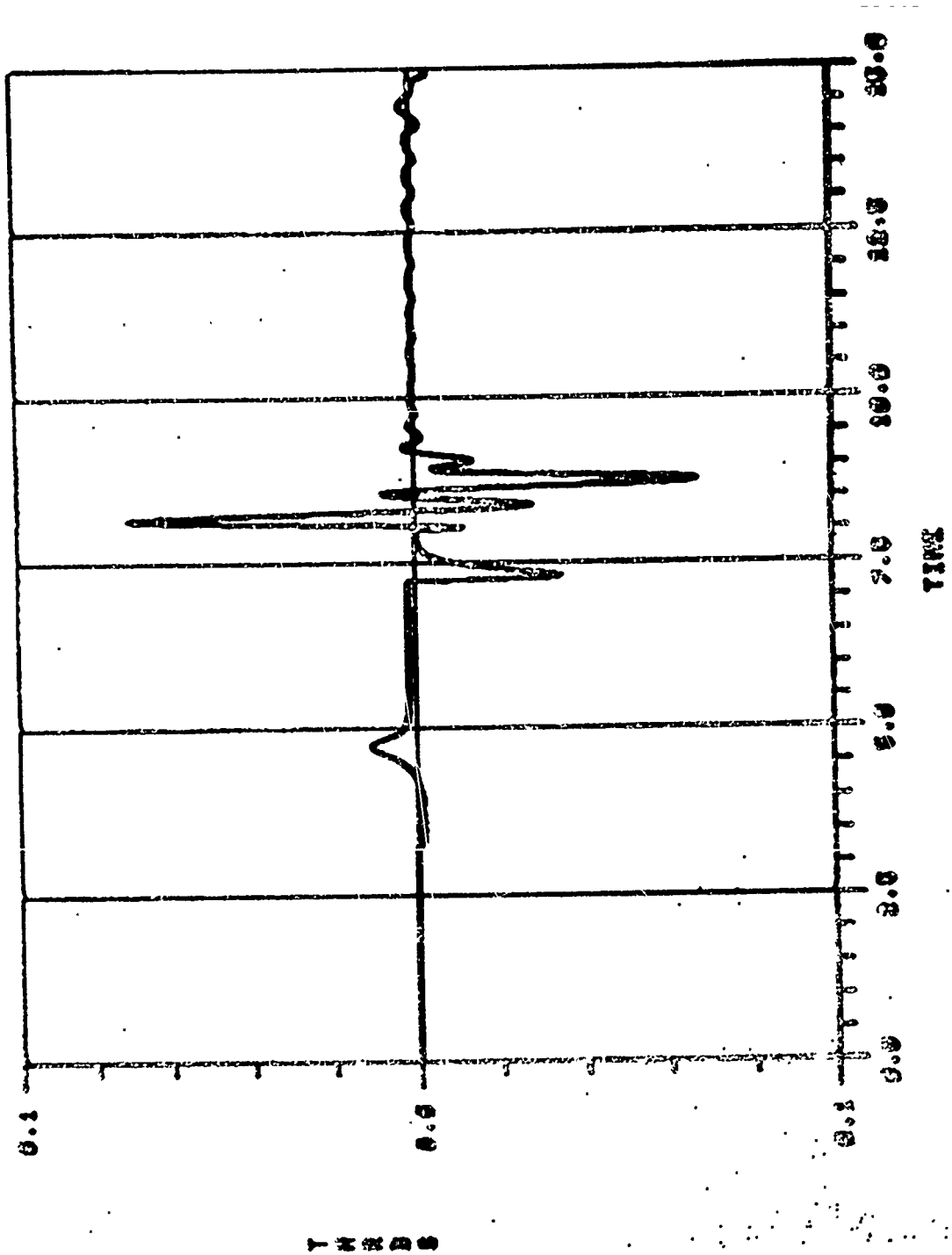

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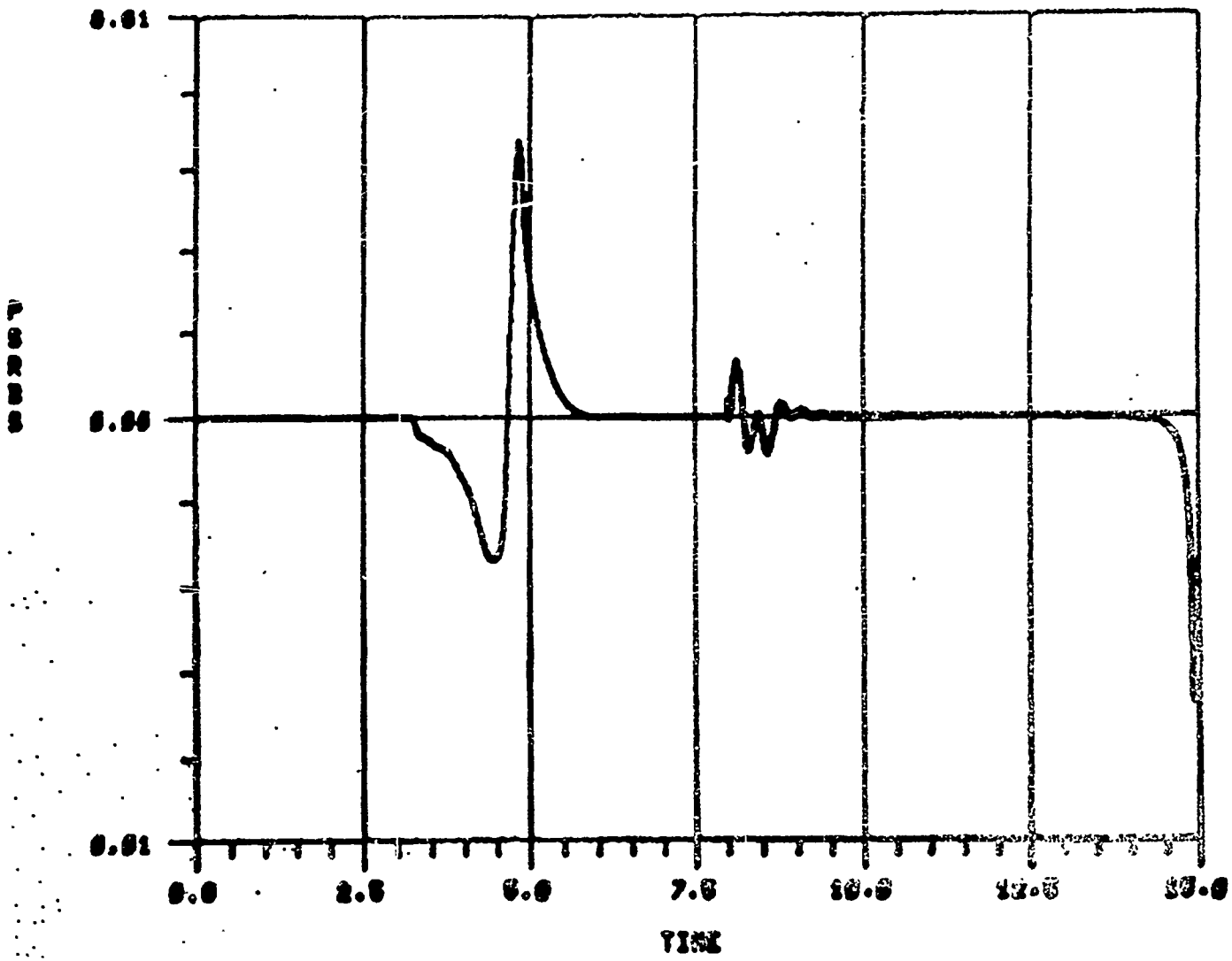

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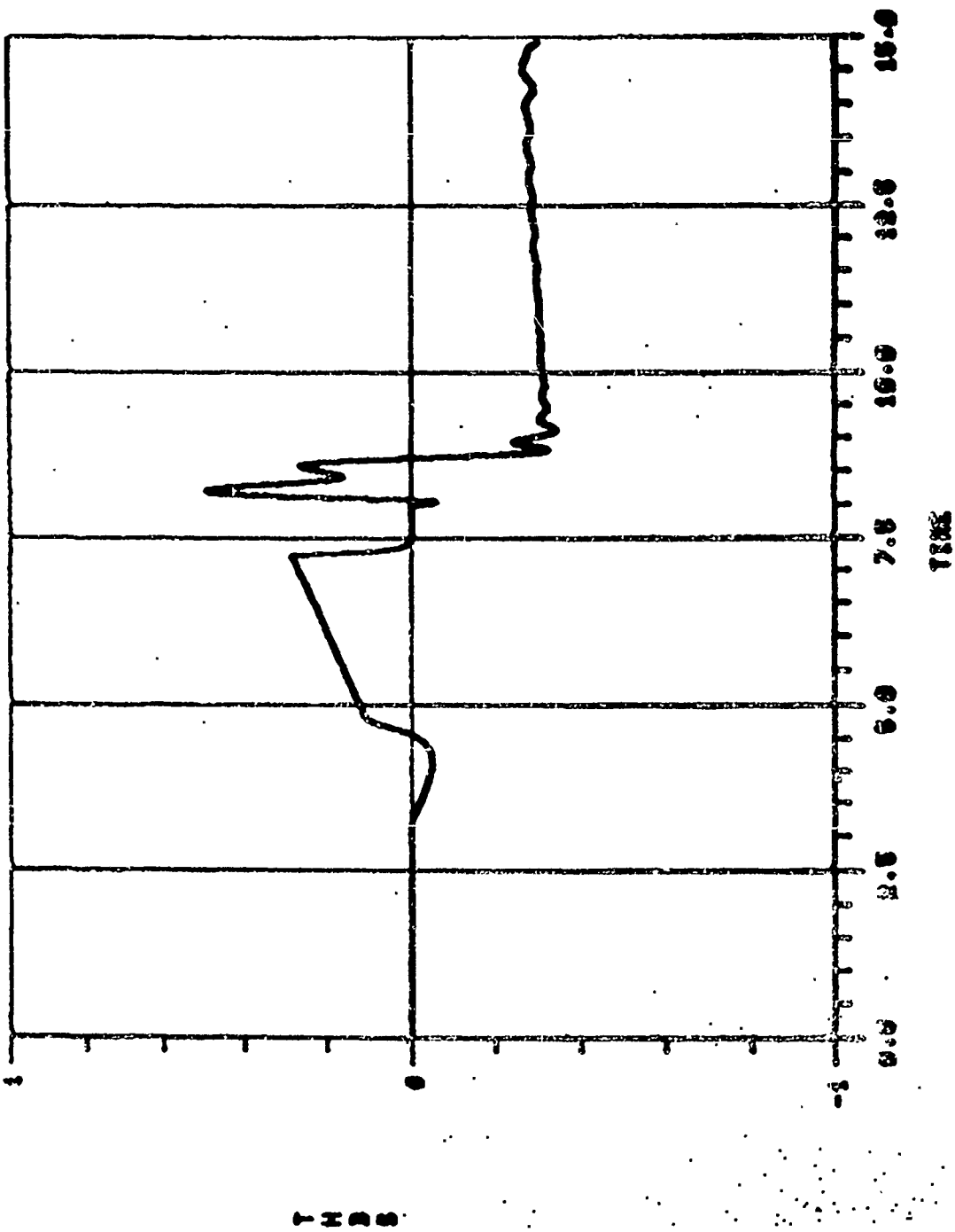

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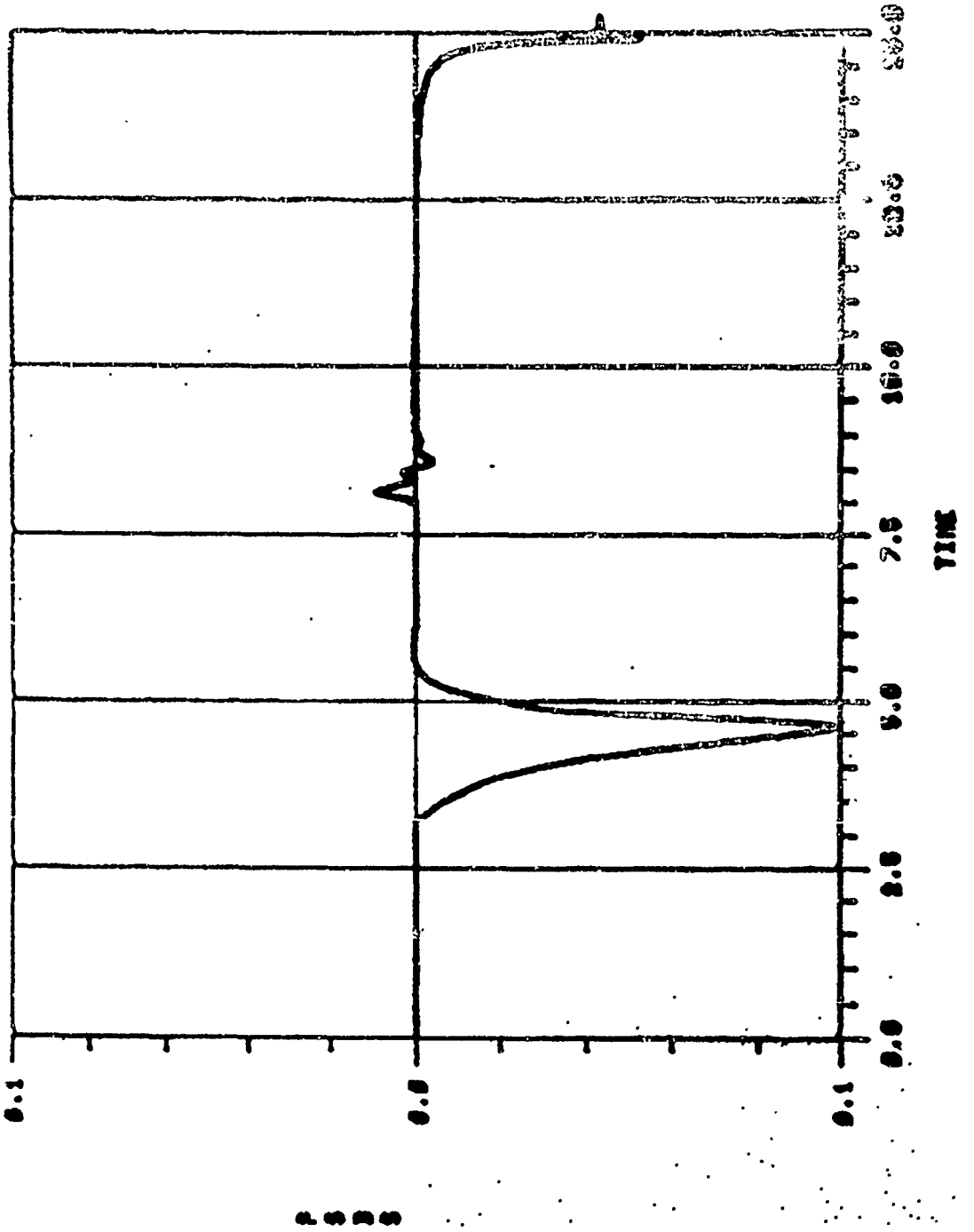

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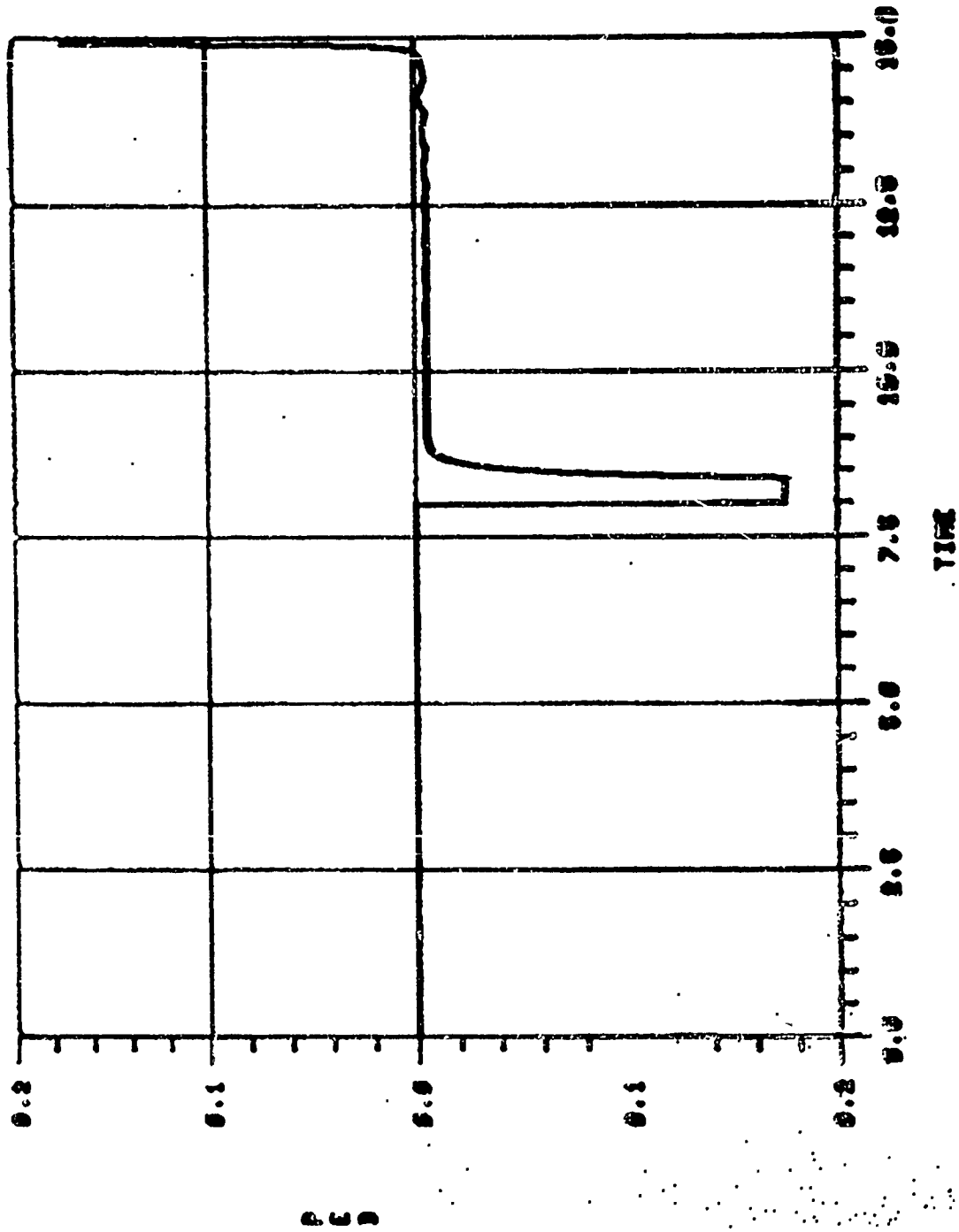

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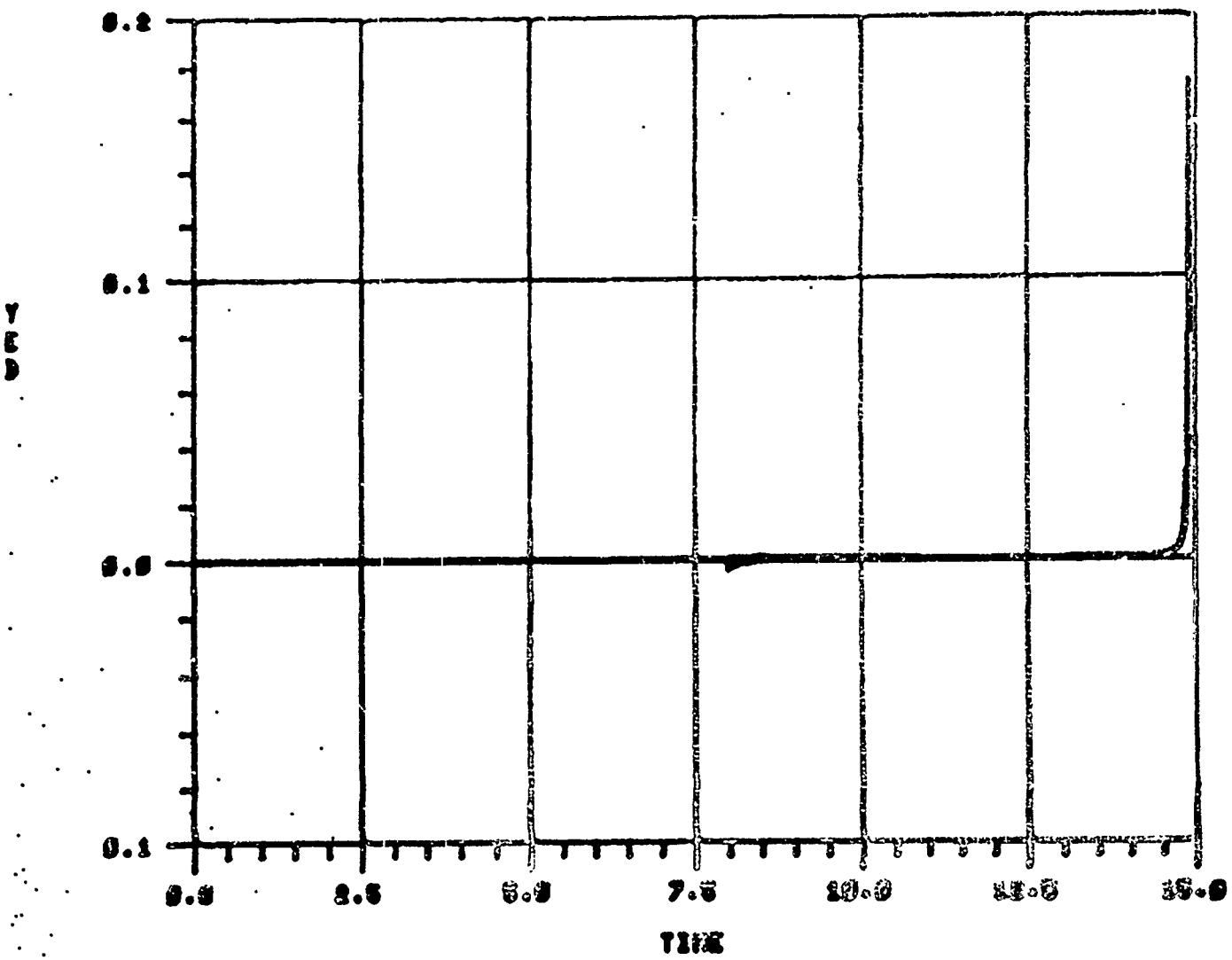

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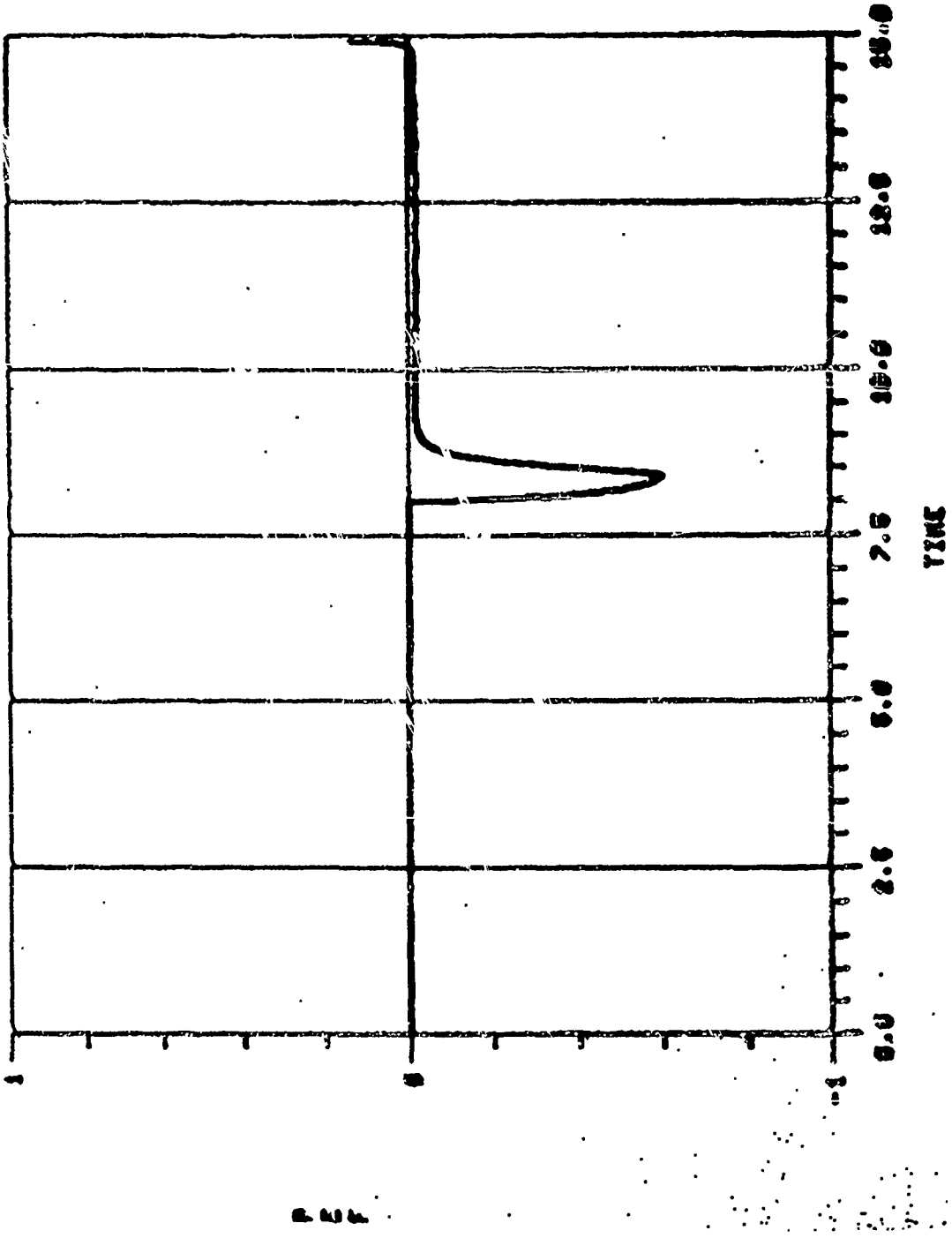

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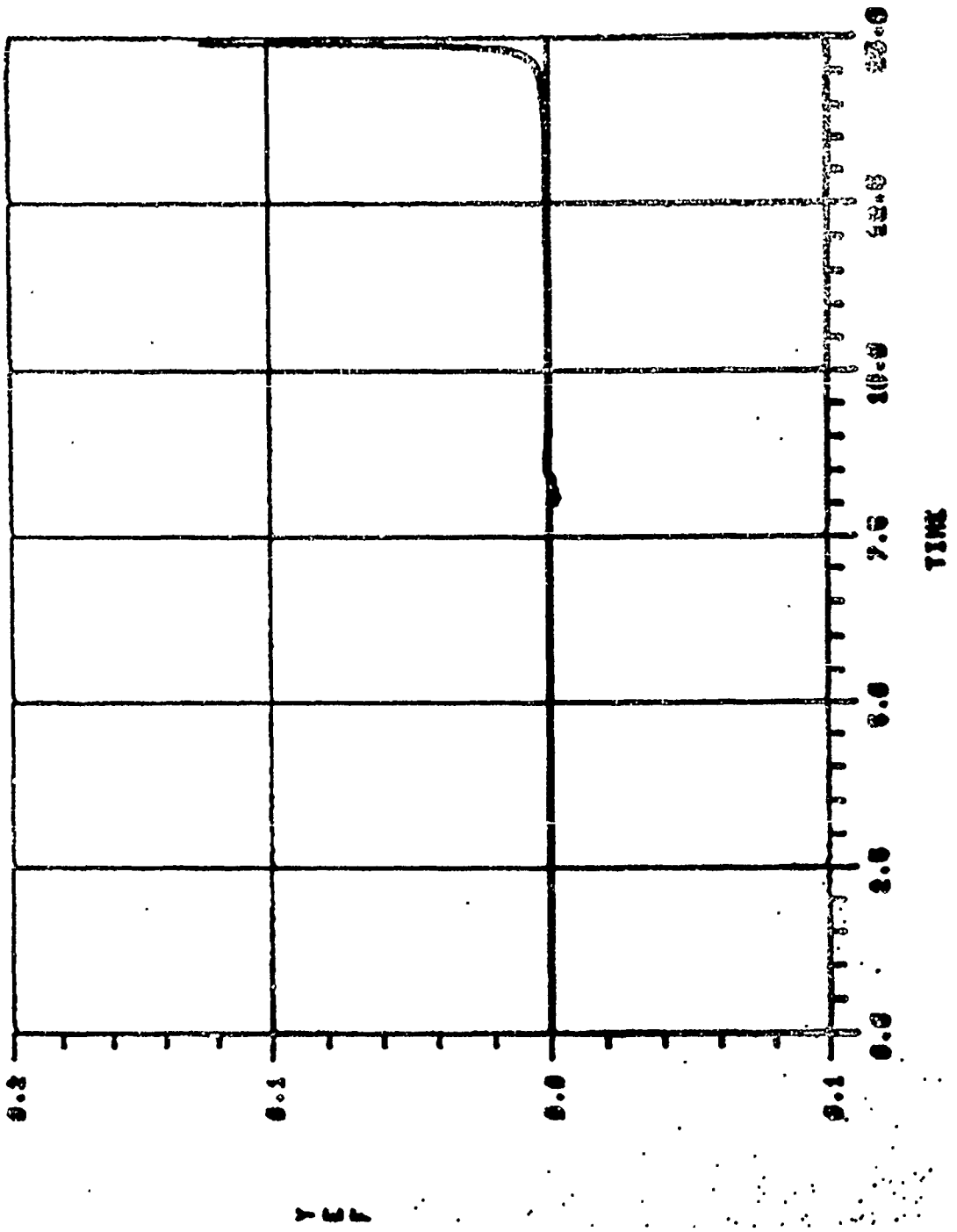

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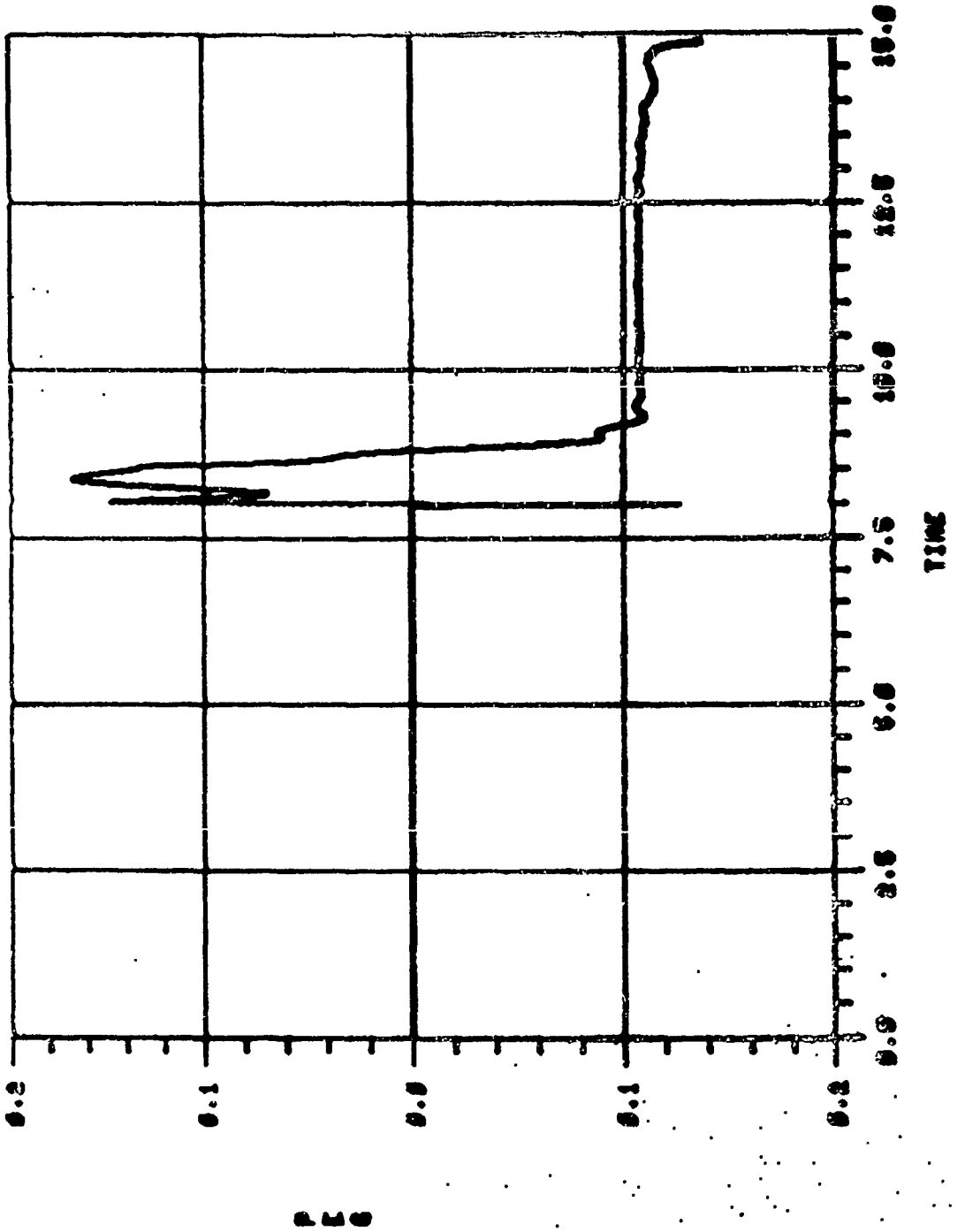

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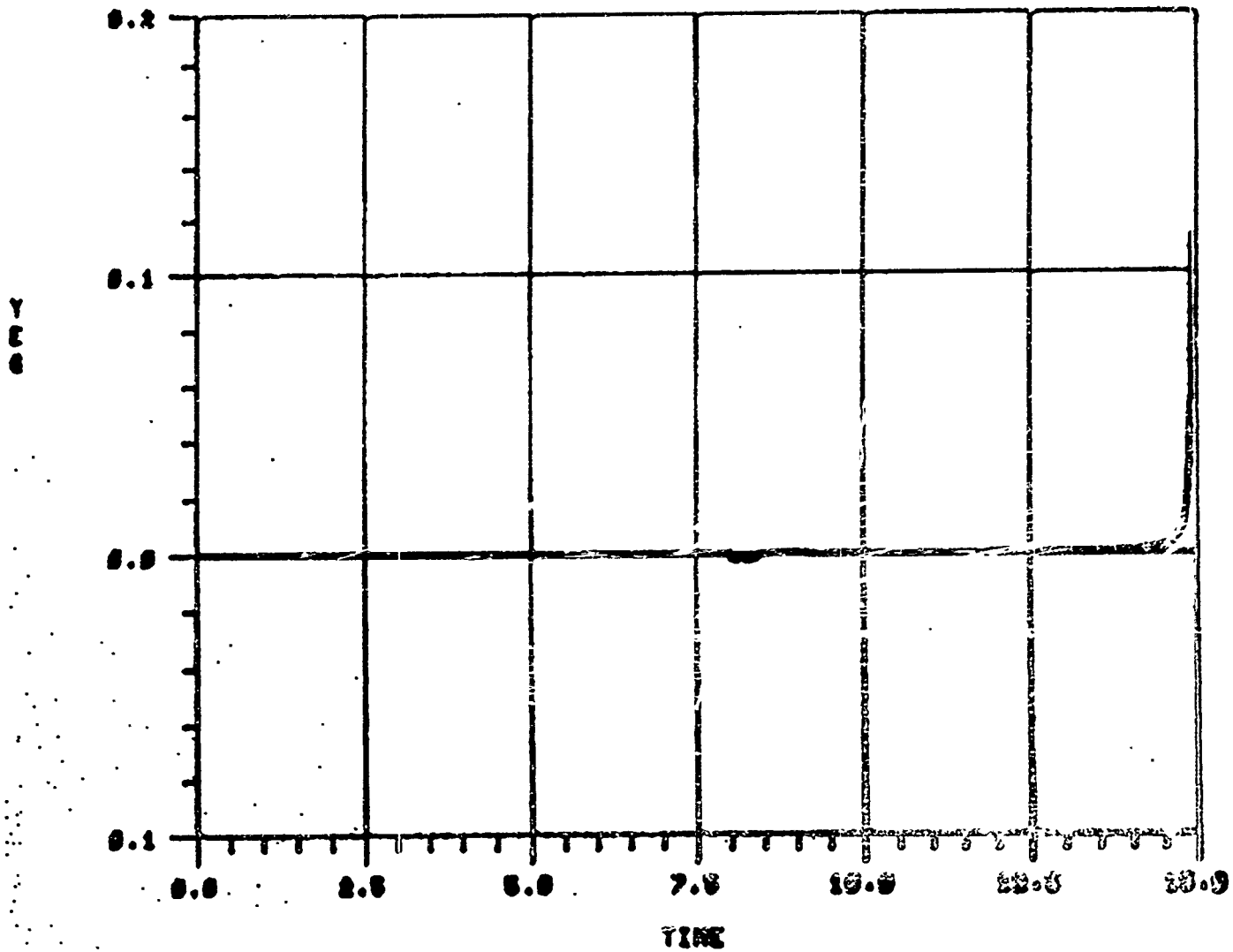

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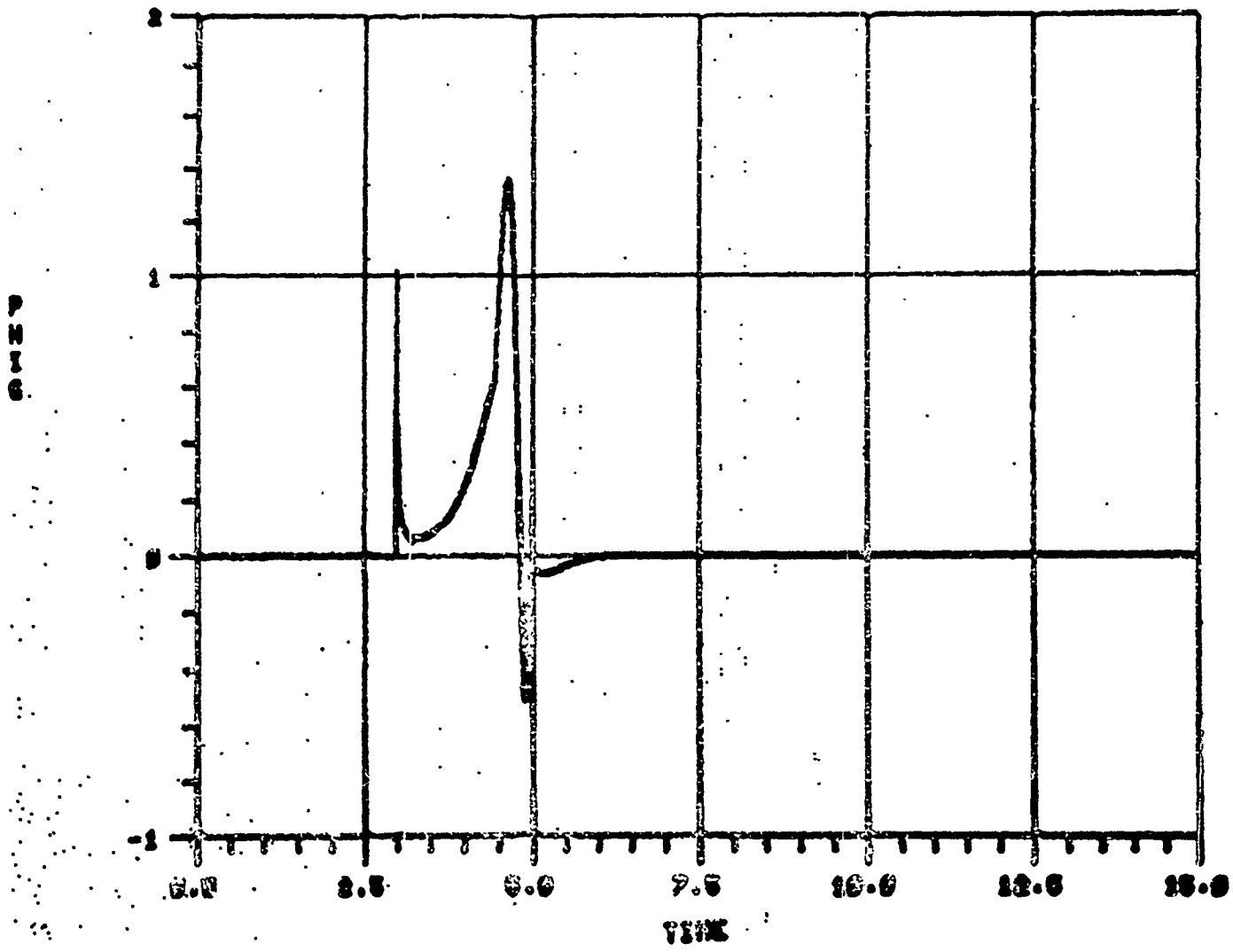

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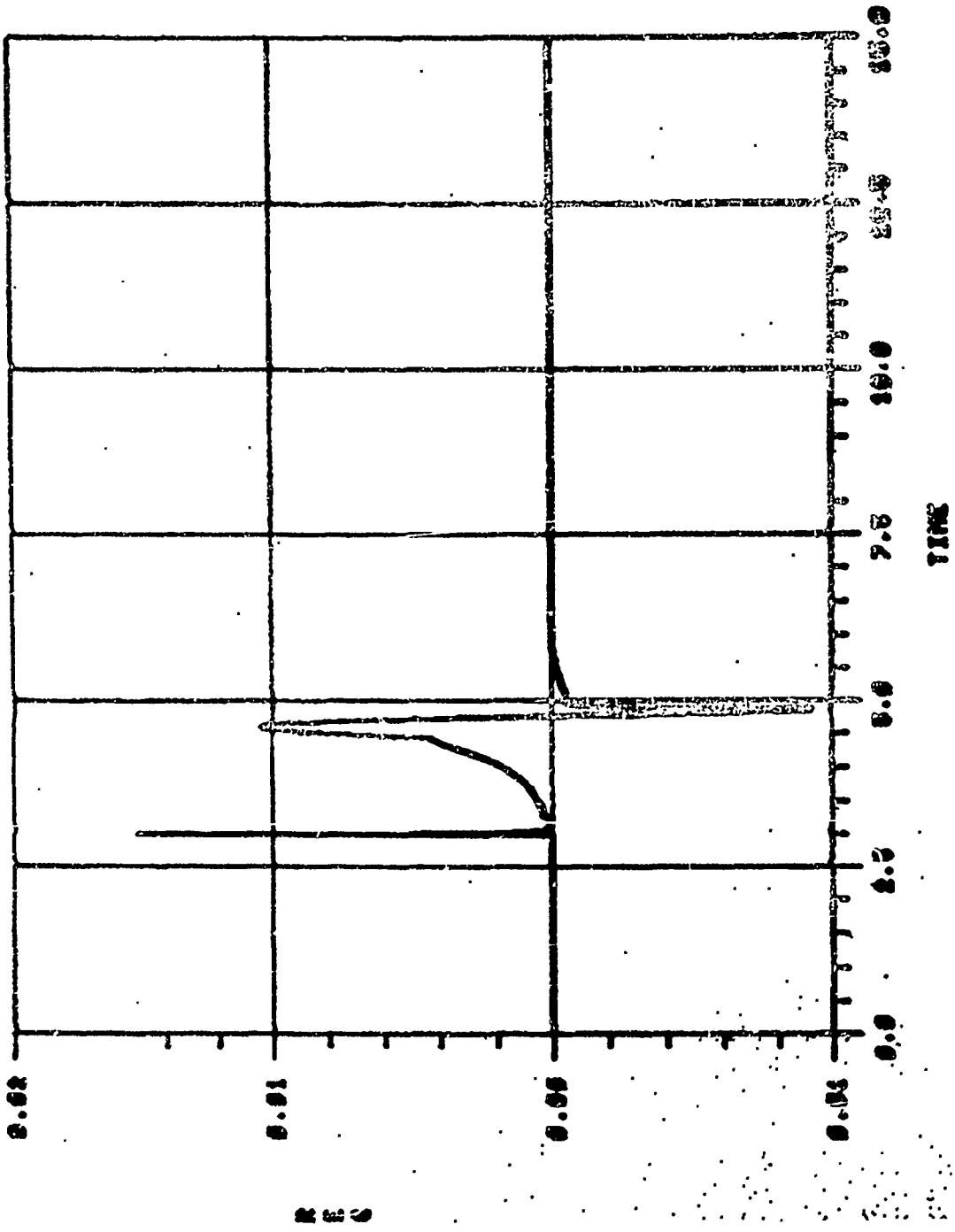

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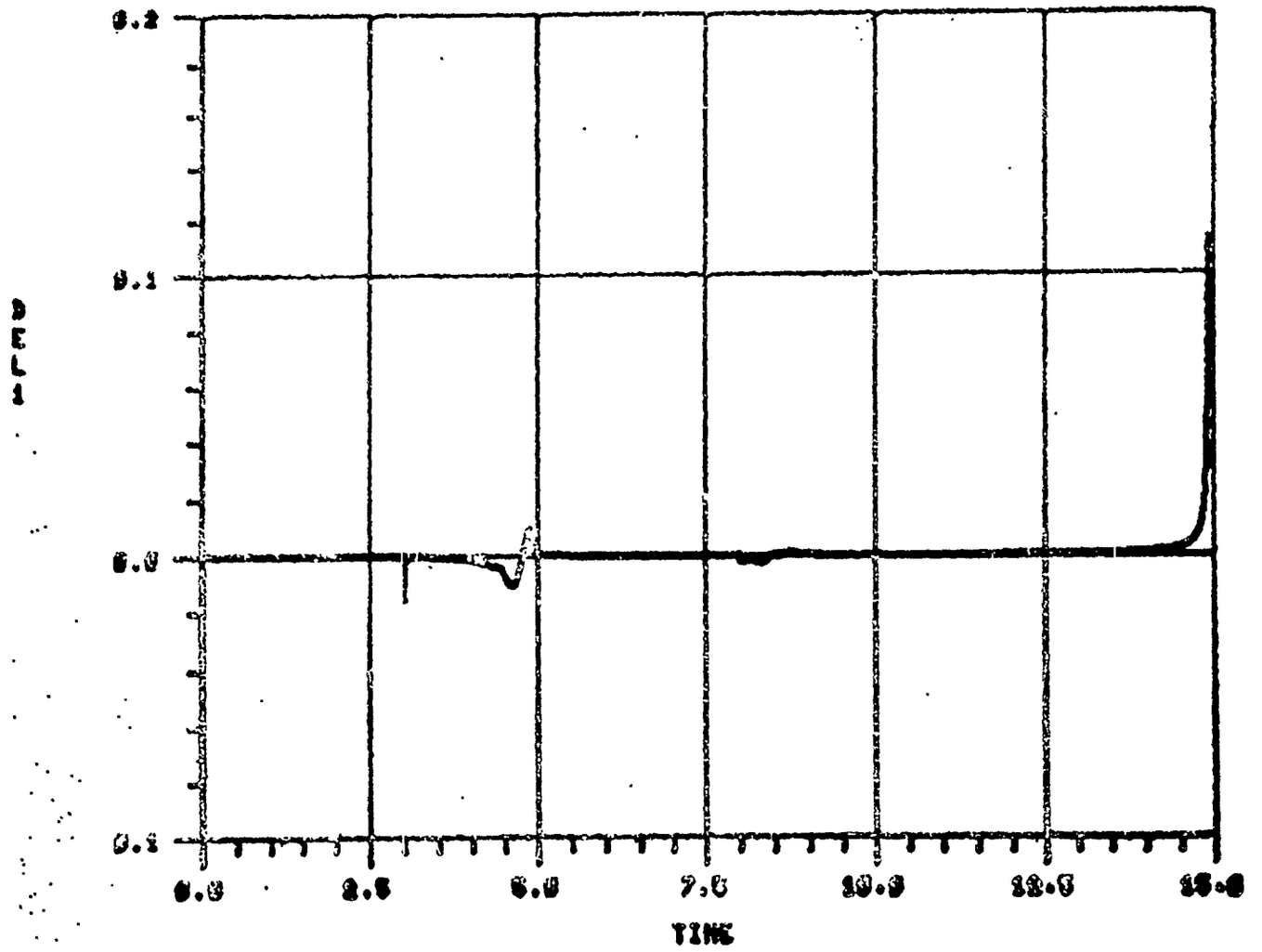

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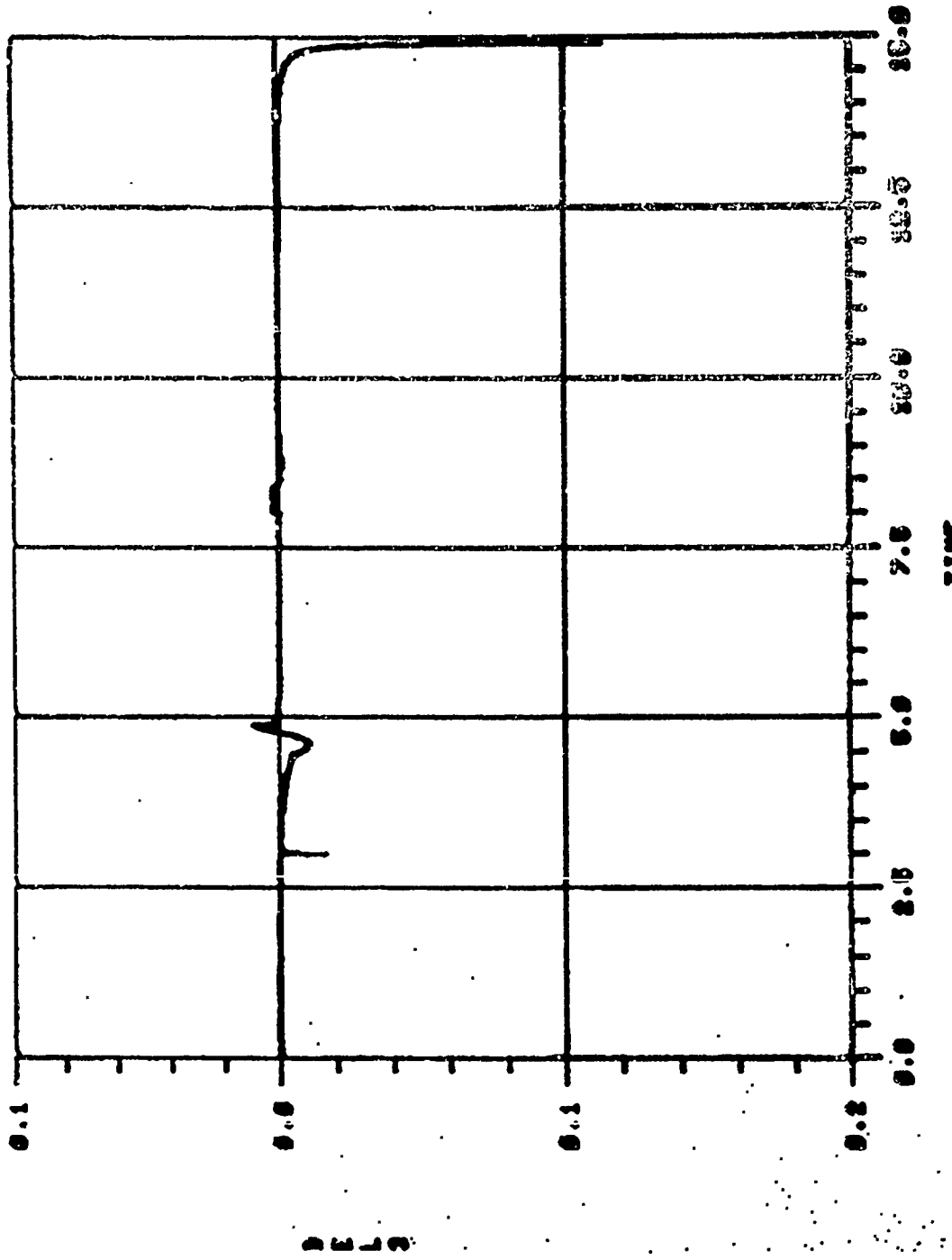

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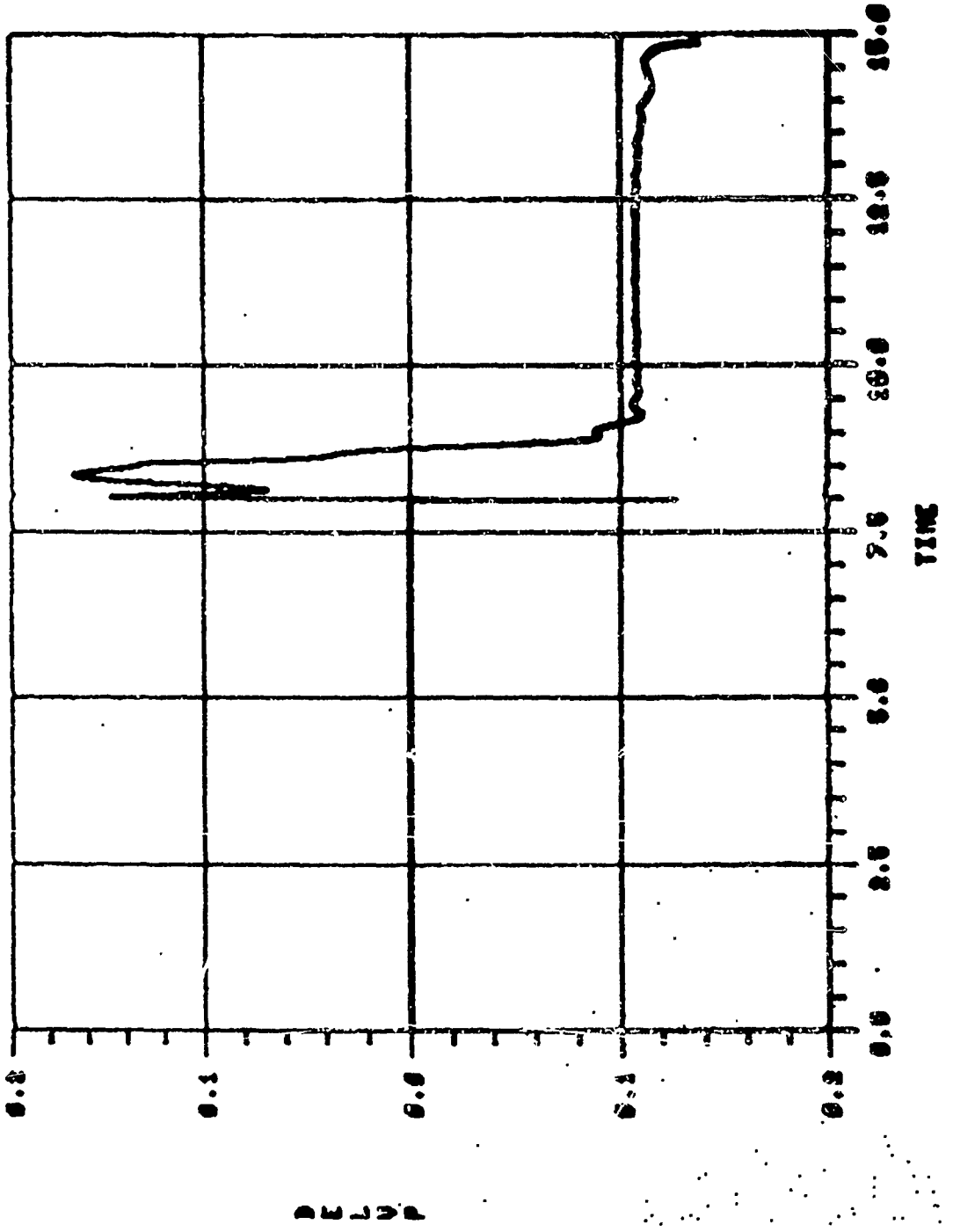

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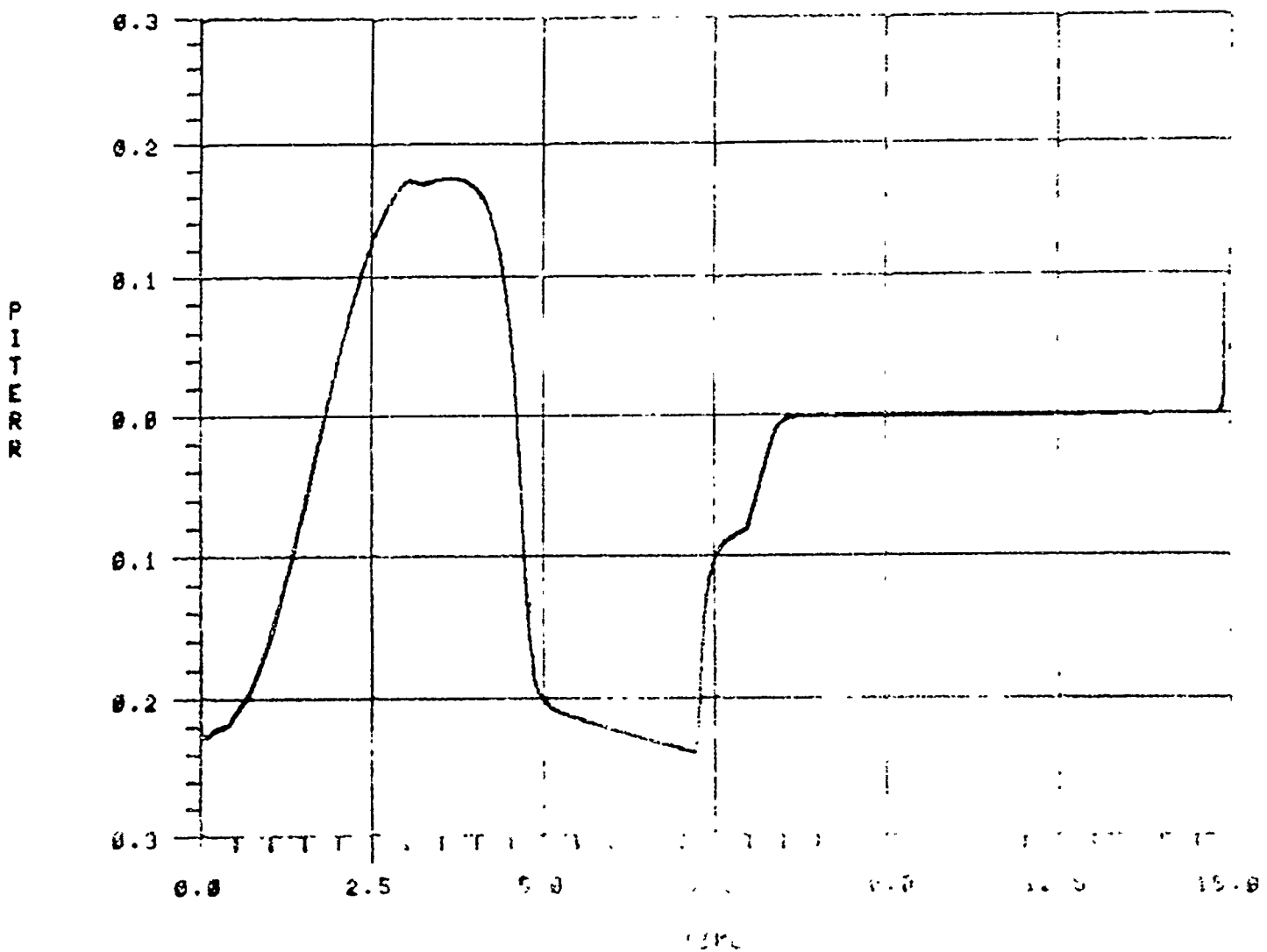

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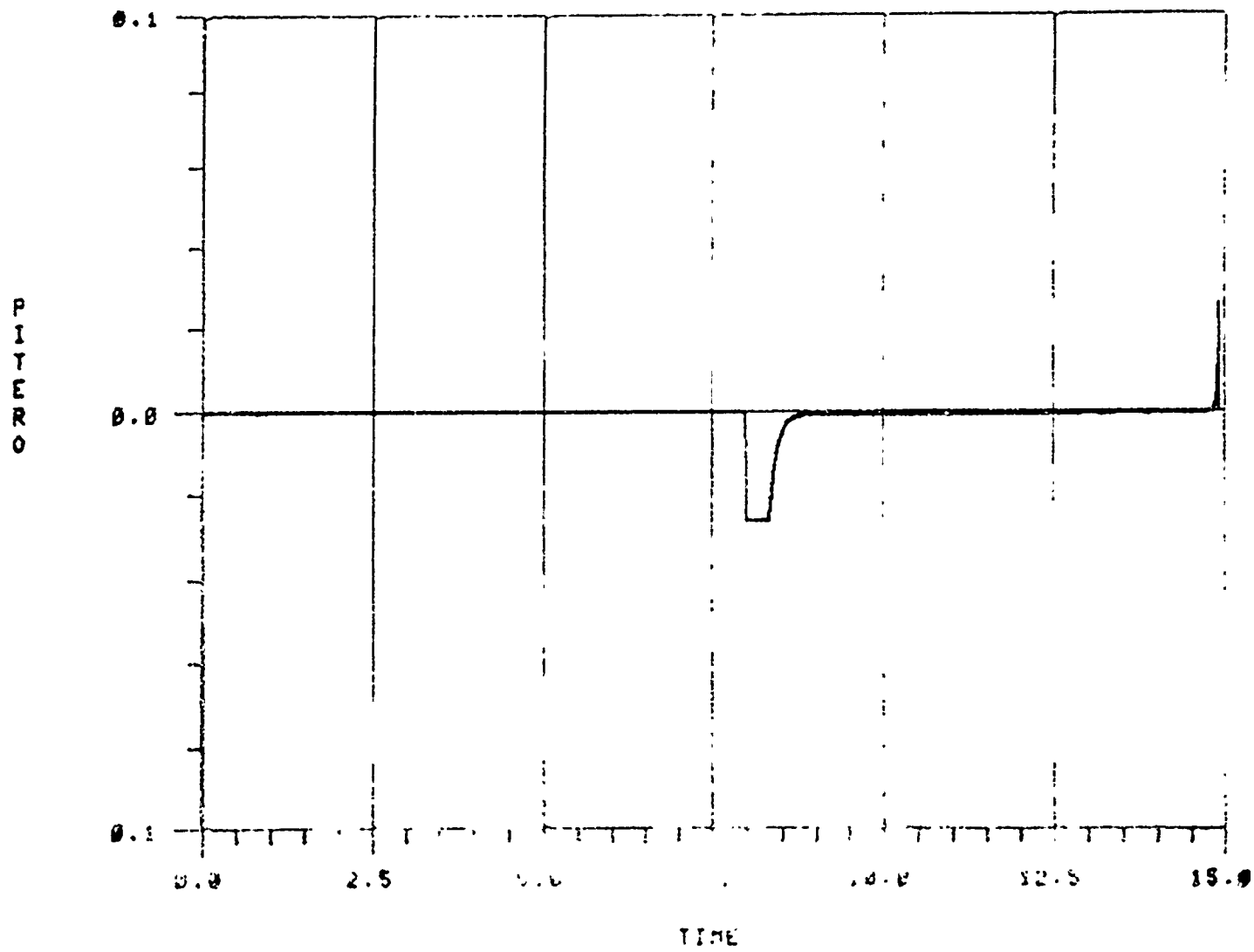

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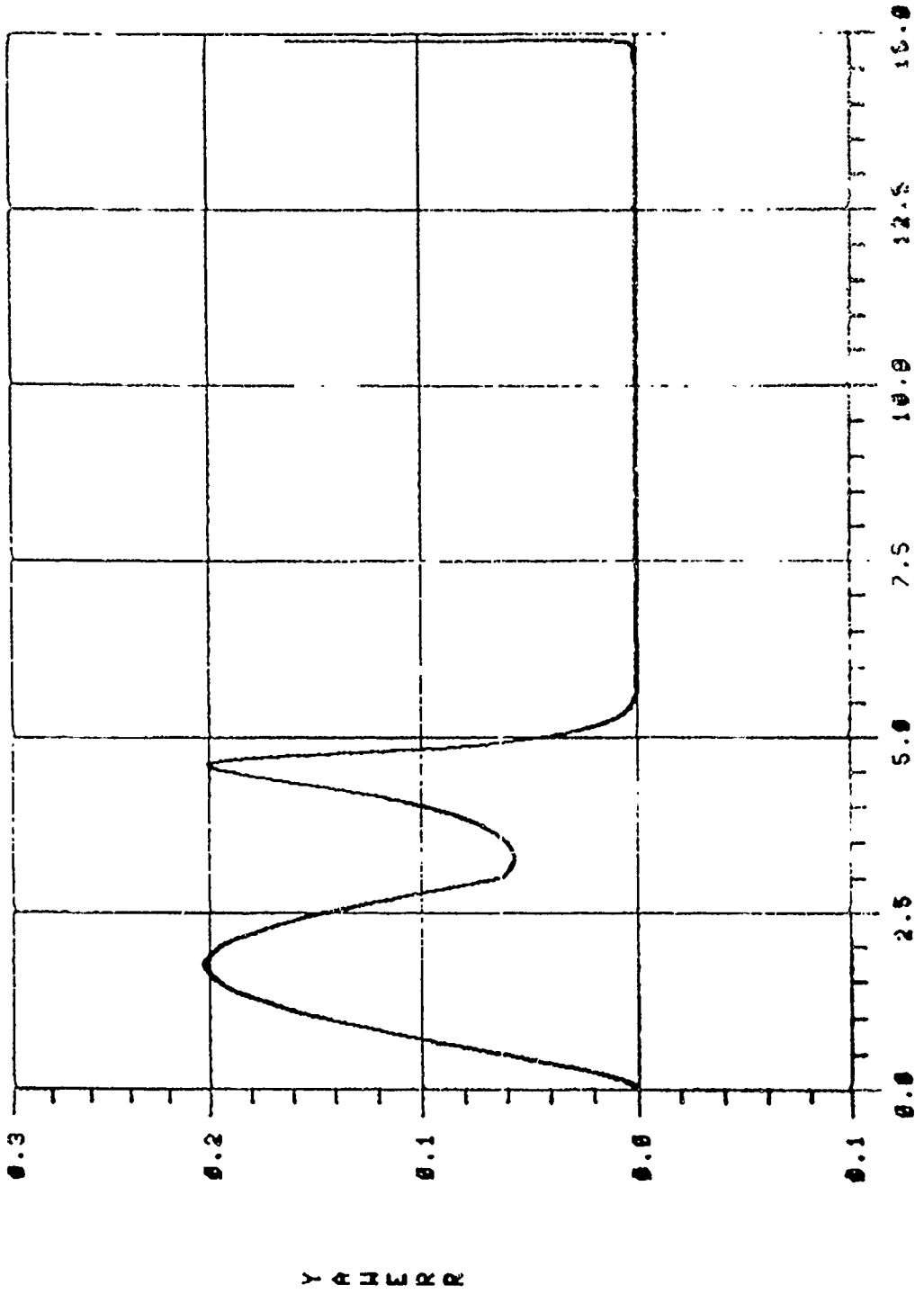

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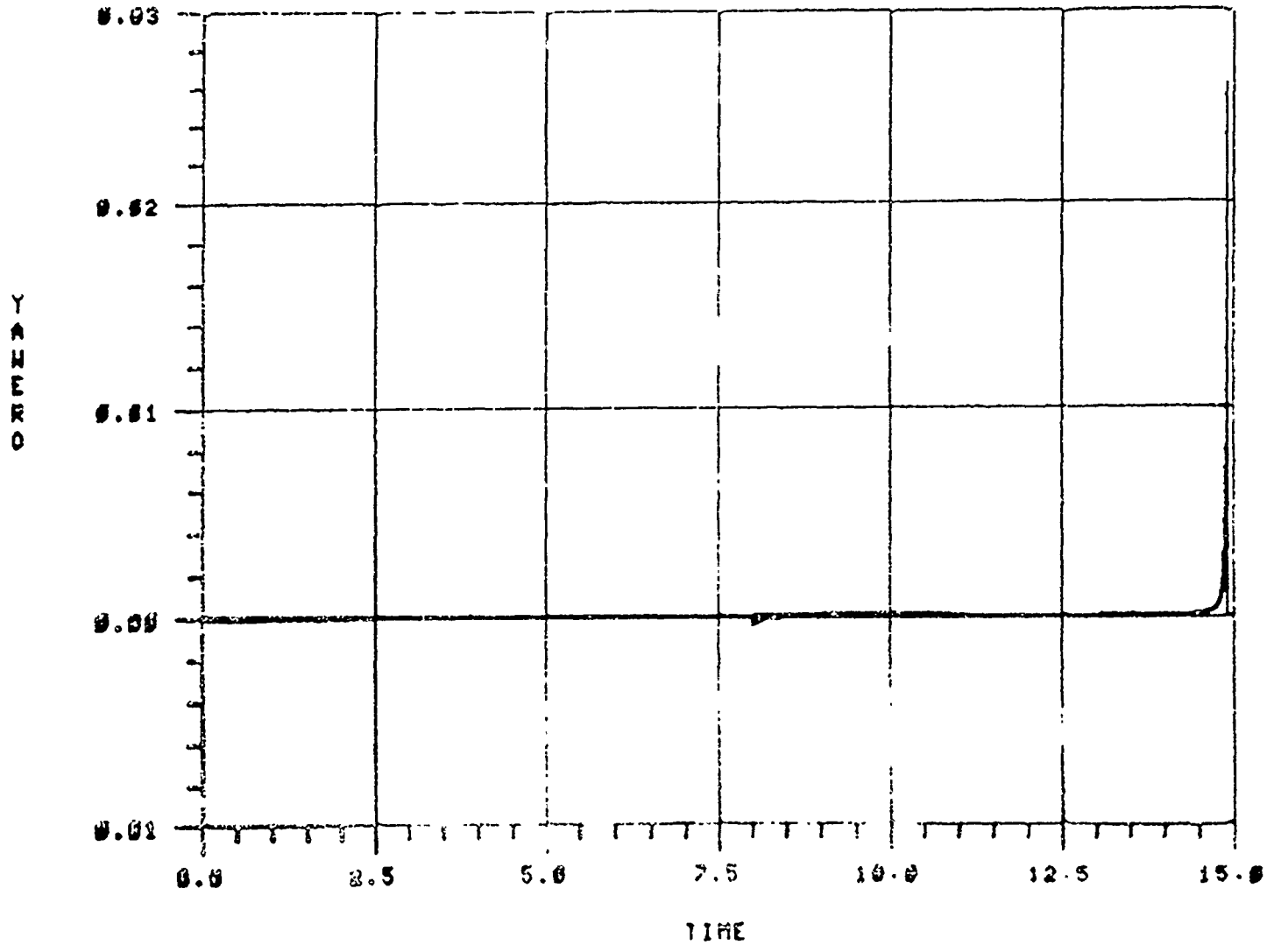

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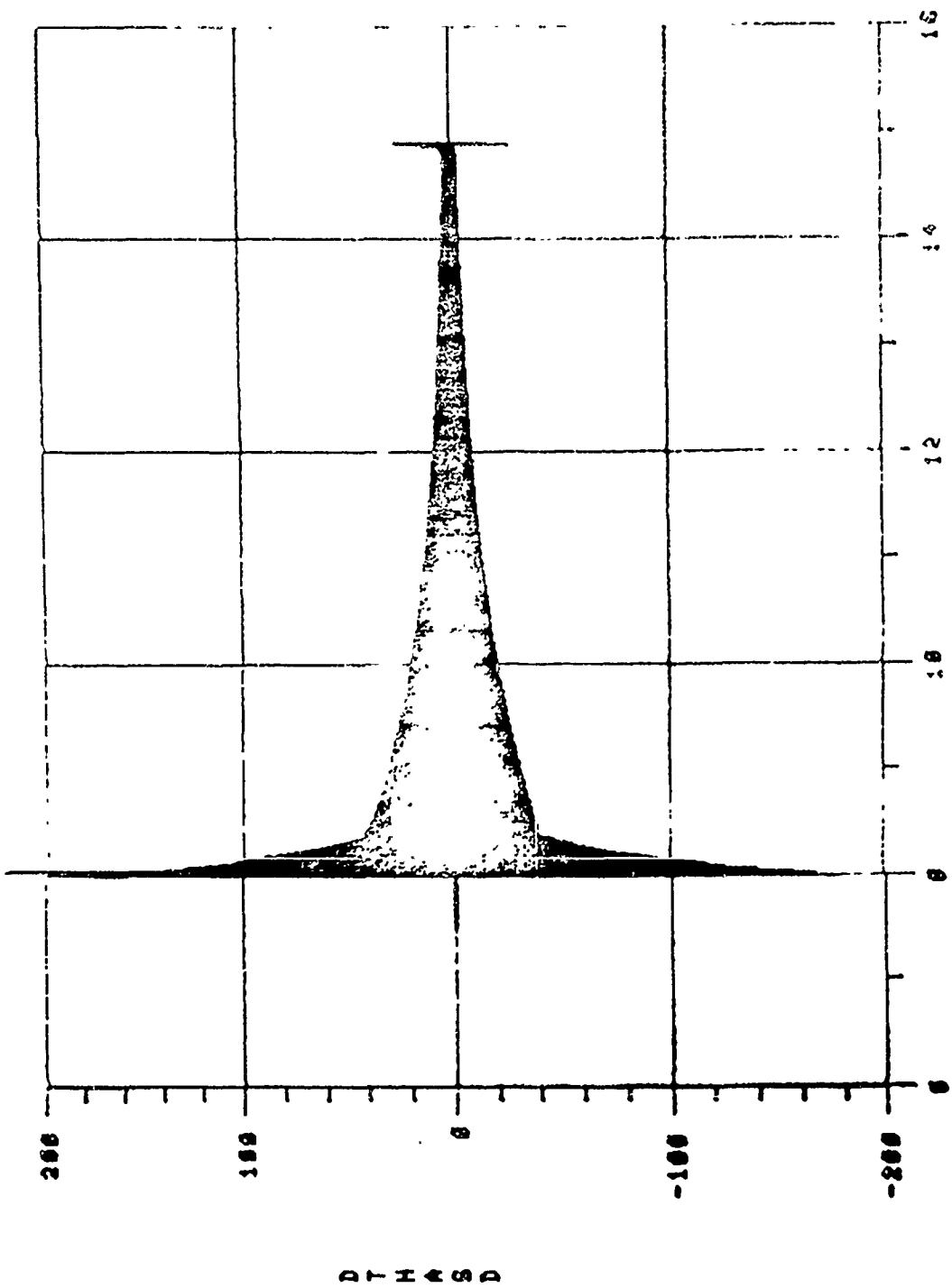

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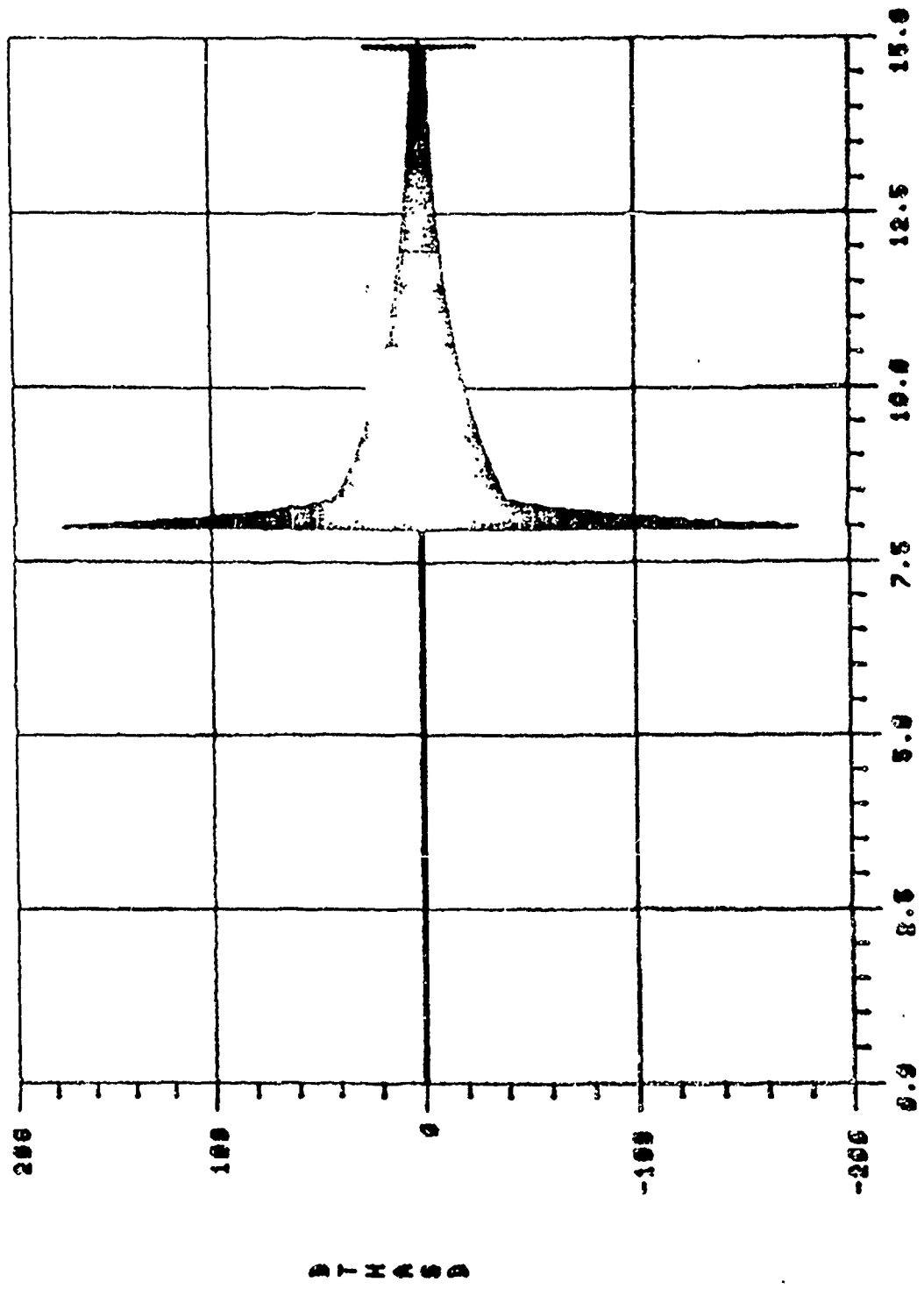

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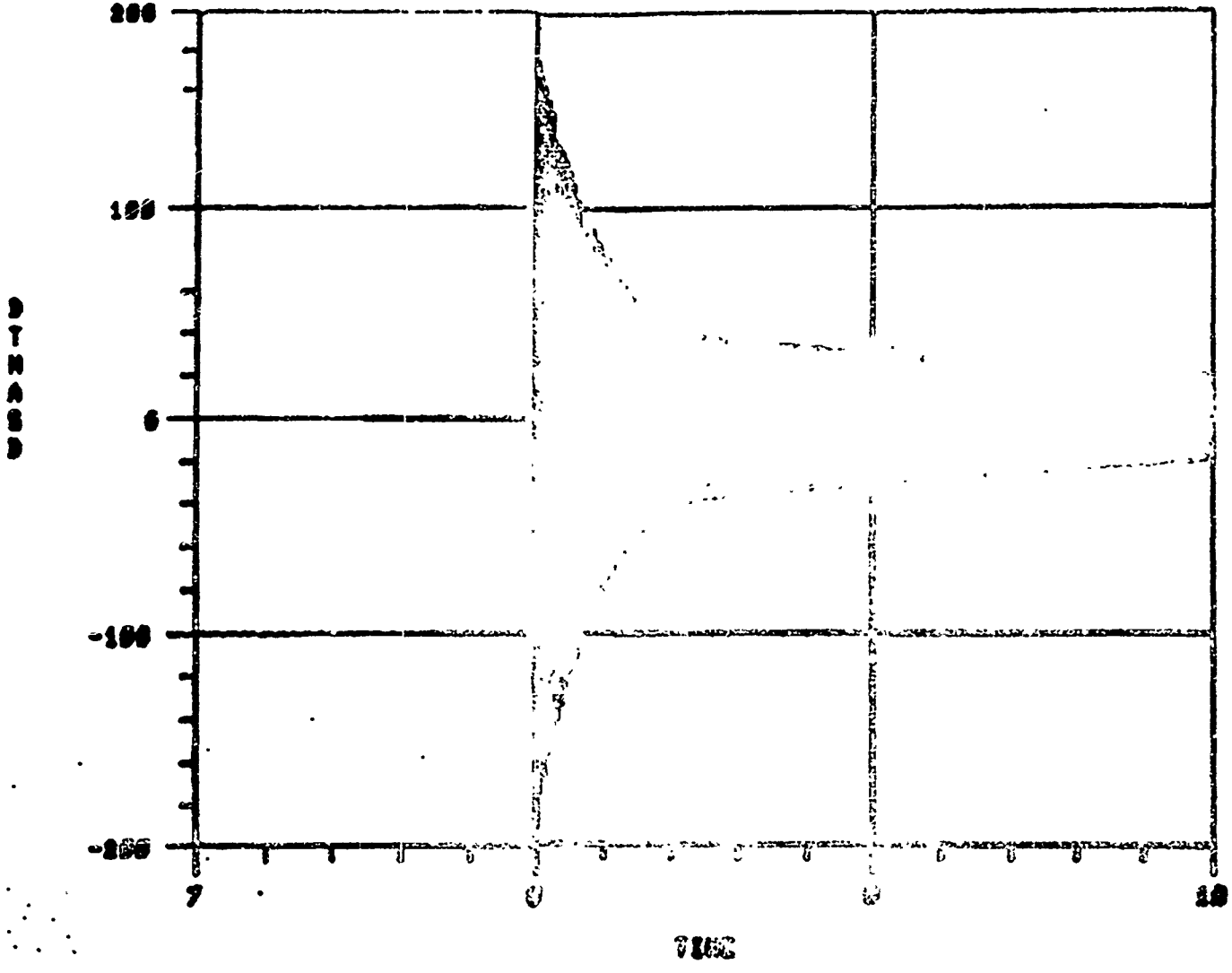

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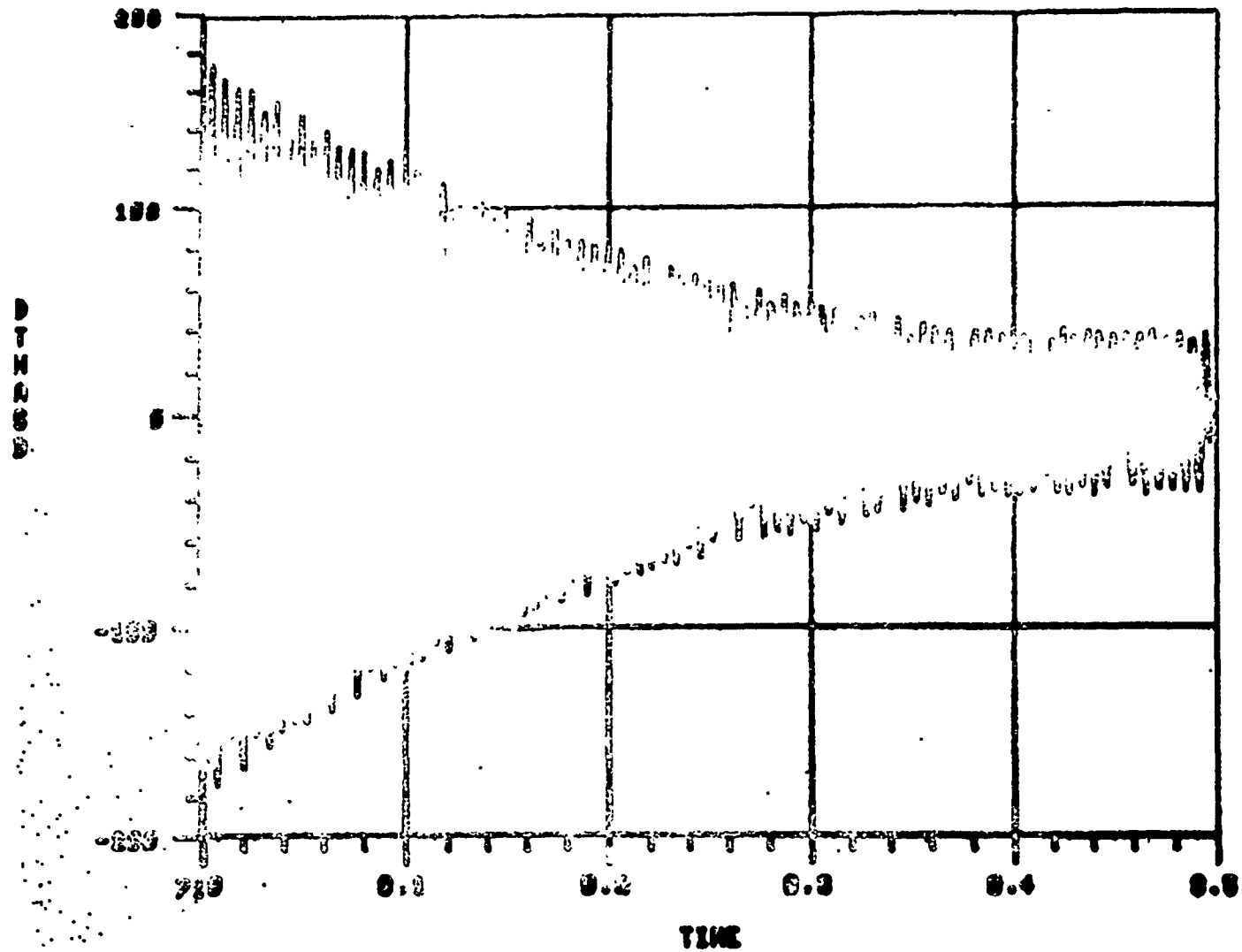

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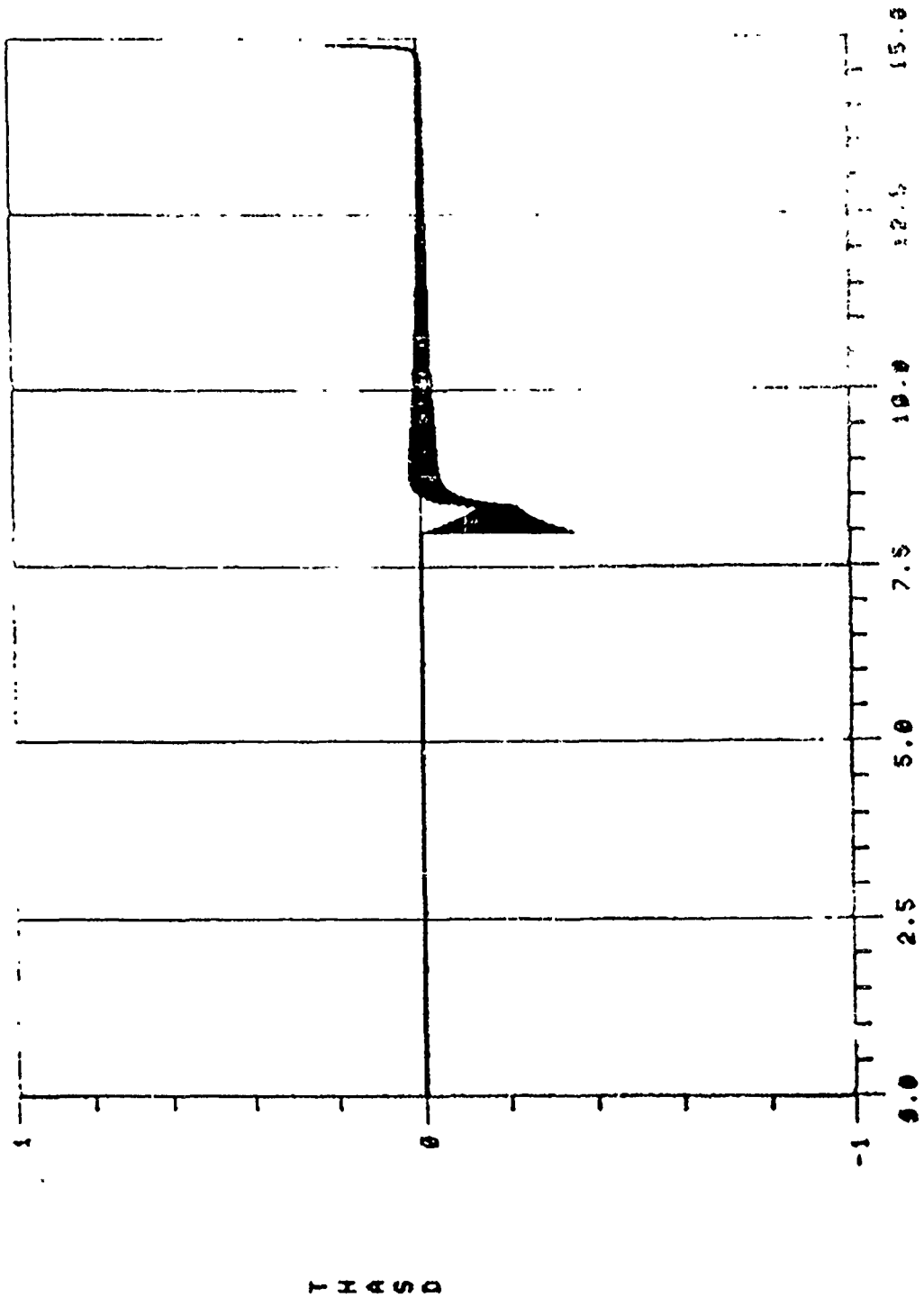

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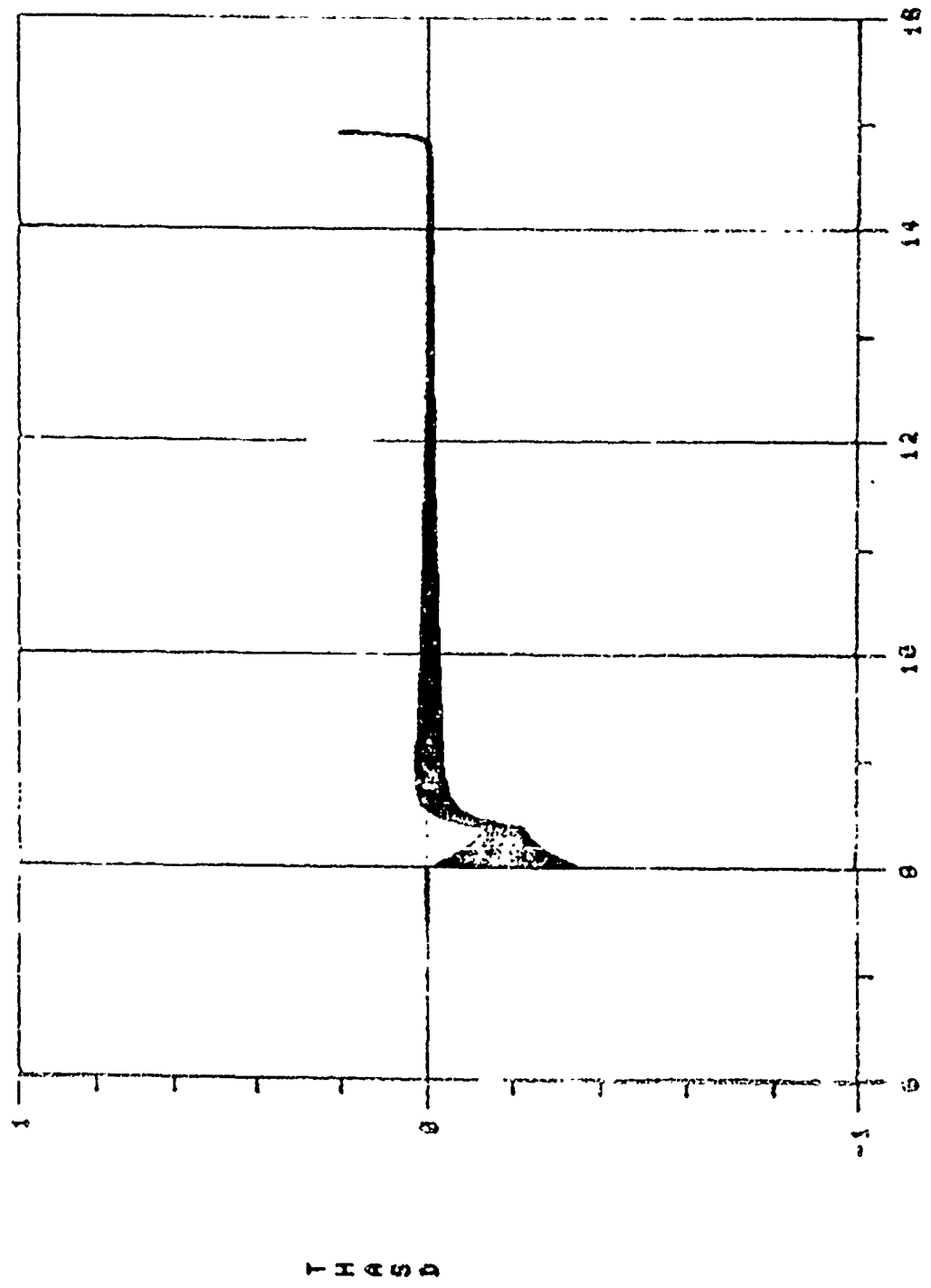


Figure 98.

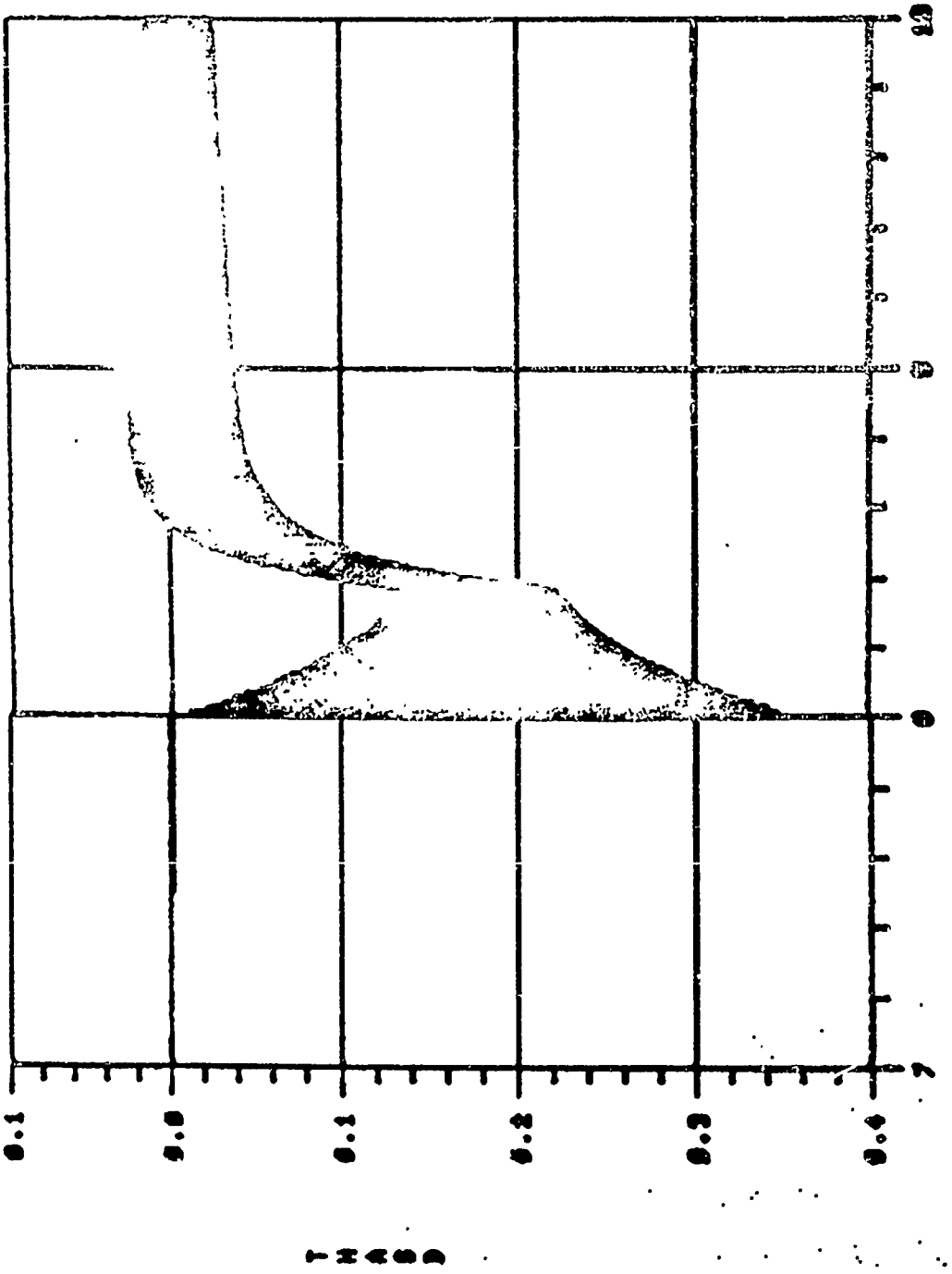


Figure 99.

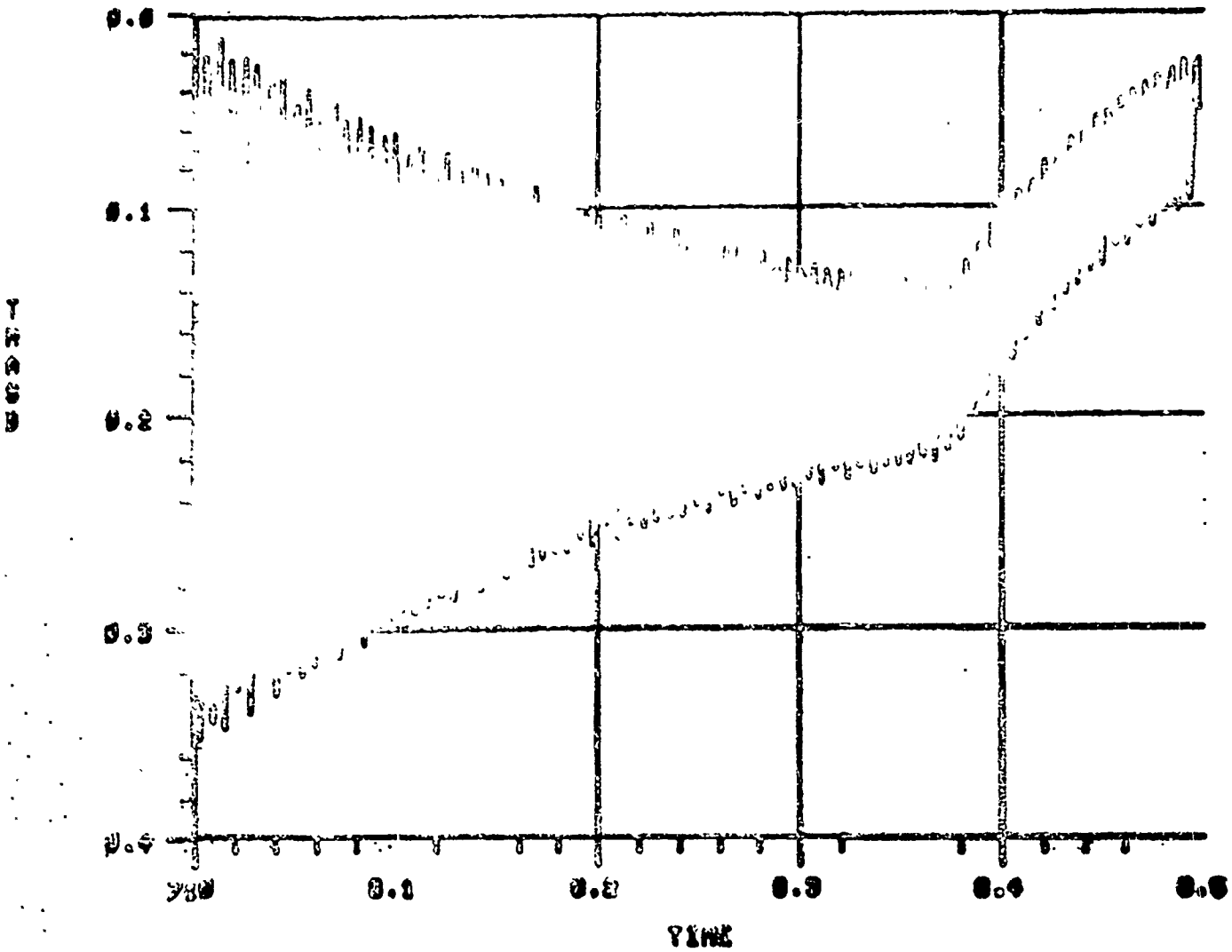


Figure 100.

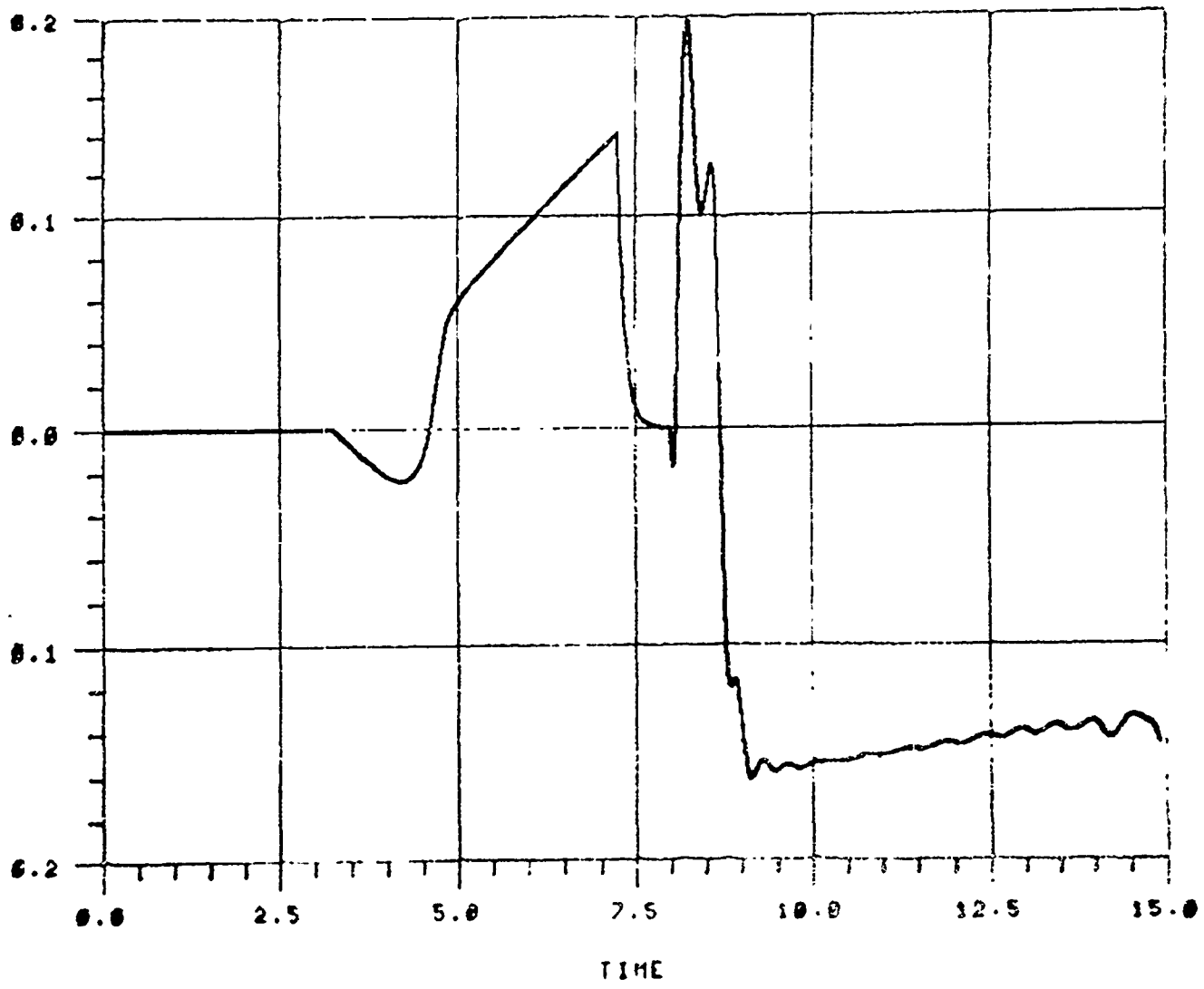


Figure 101.

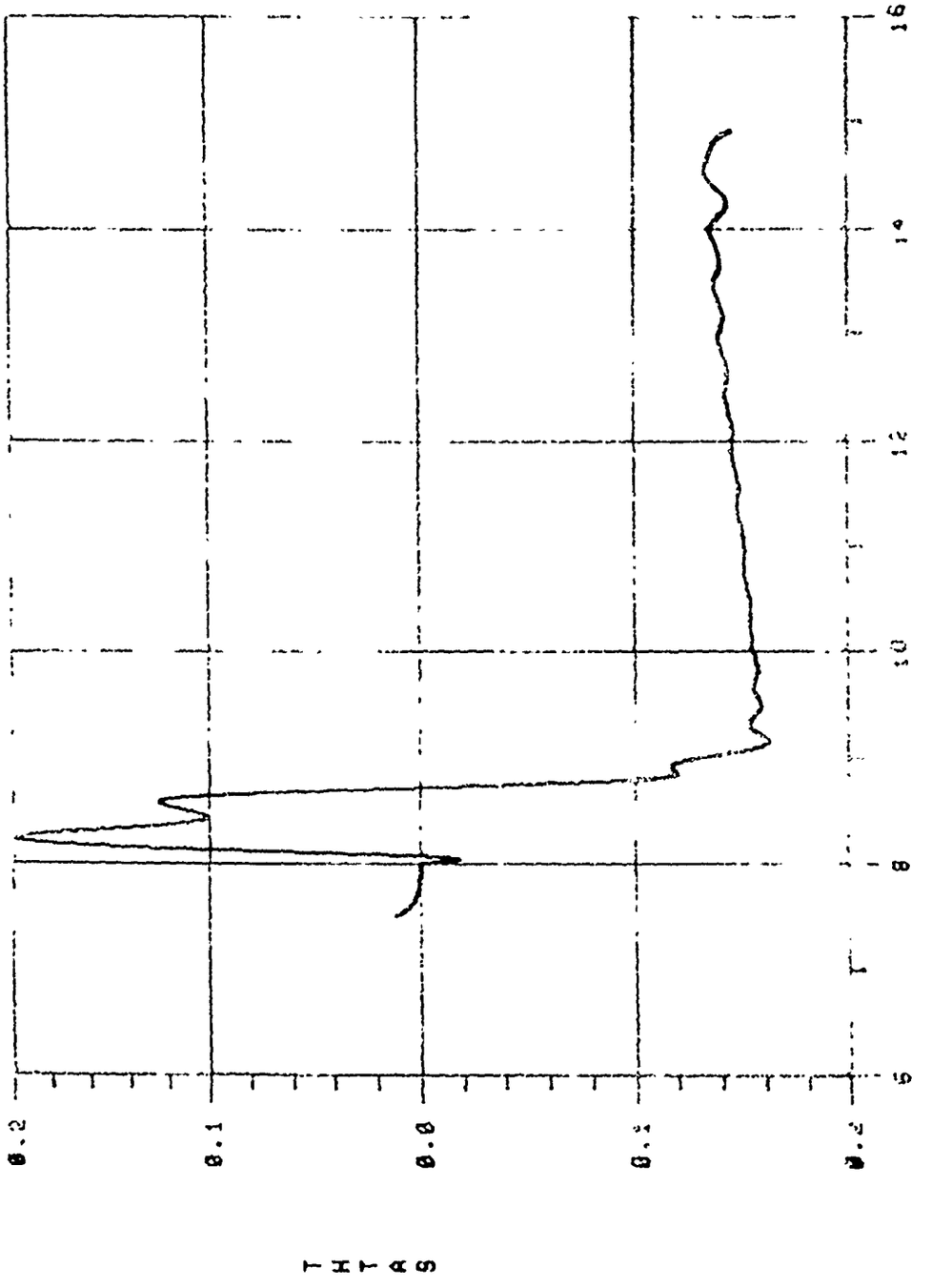


Figure 102.

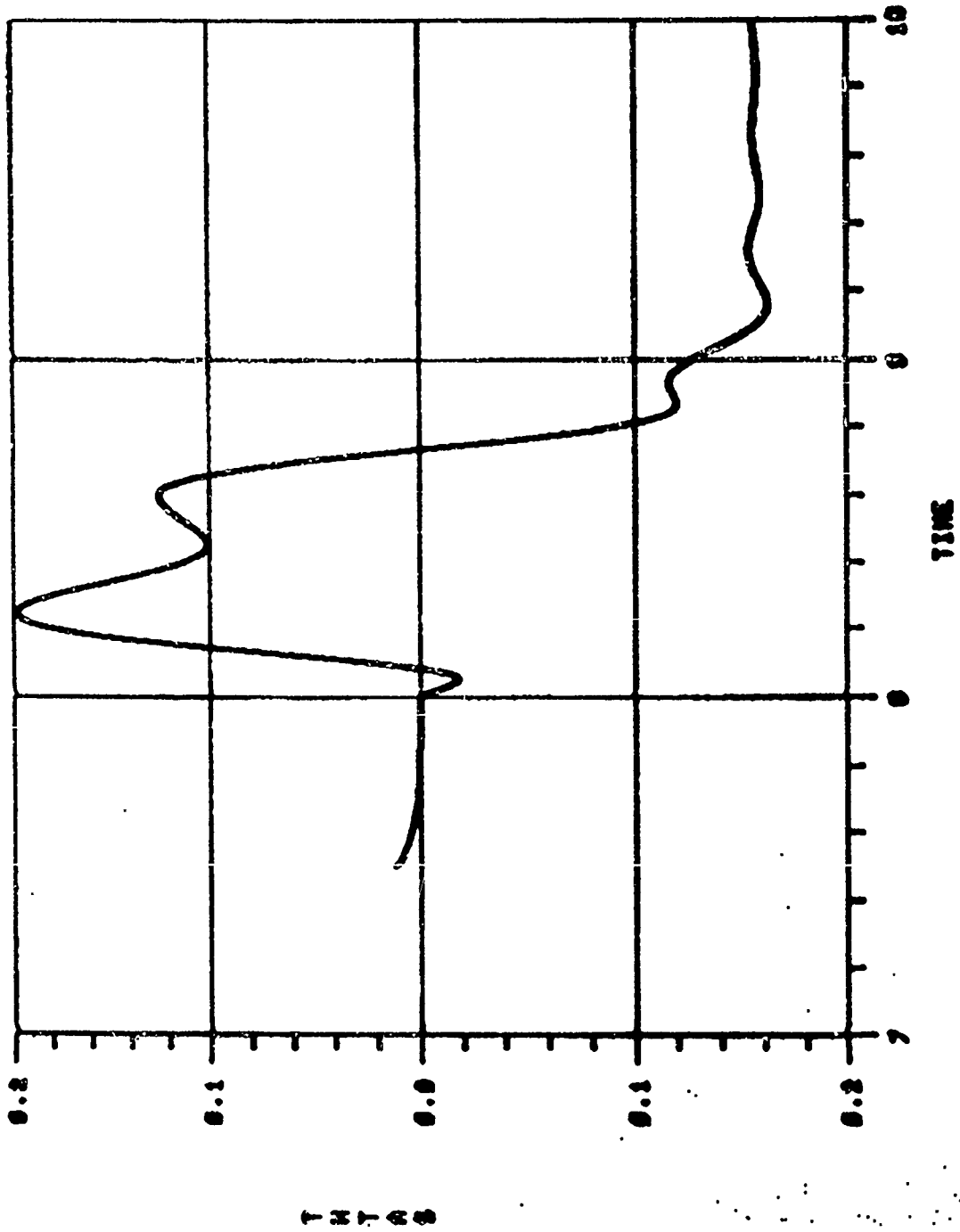


Figure 103.

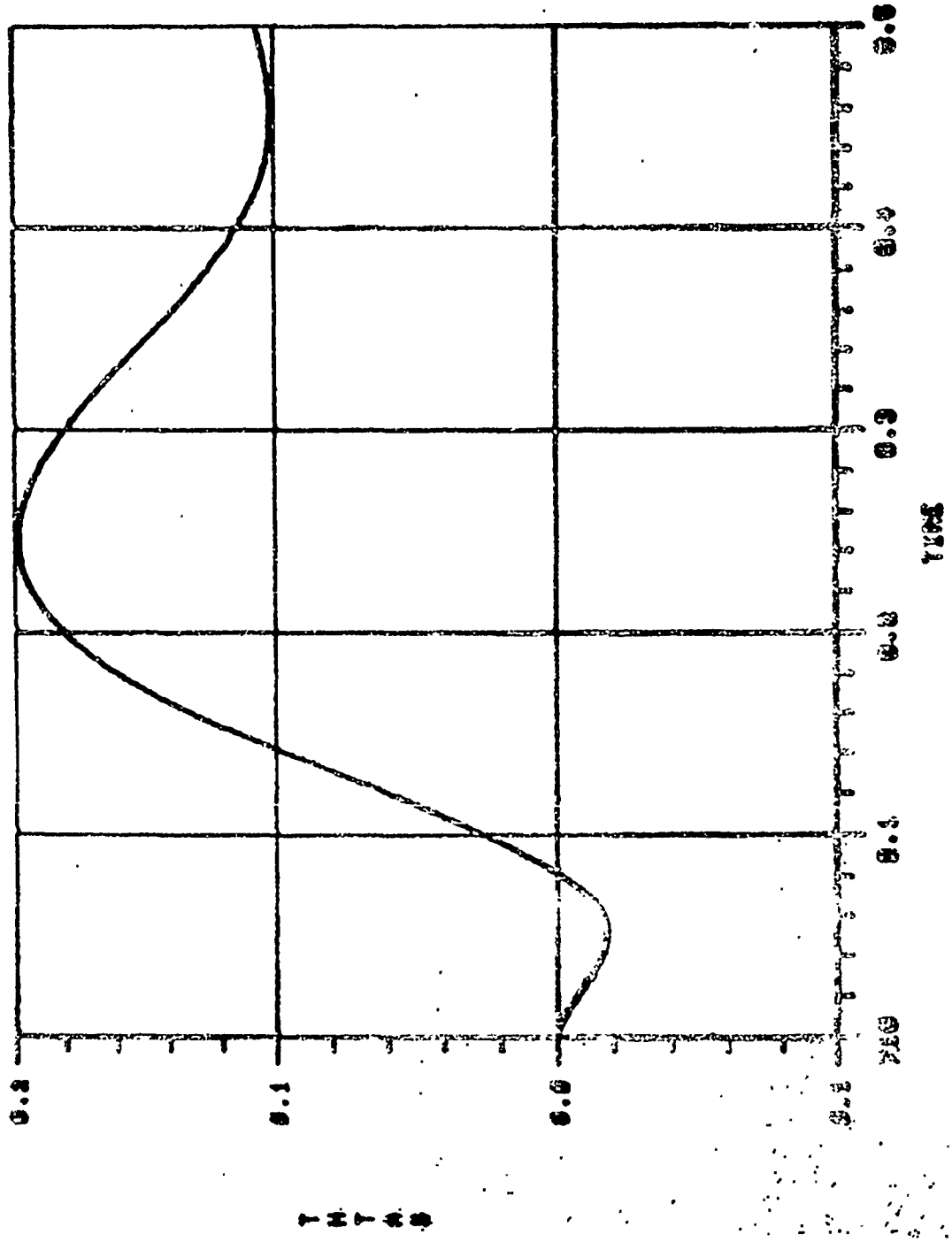


Figure 104.

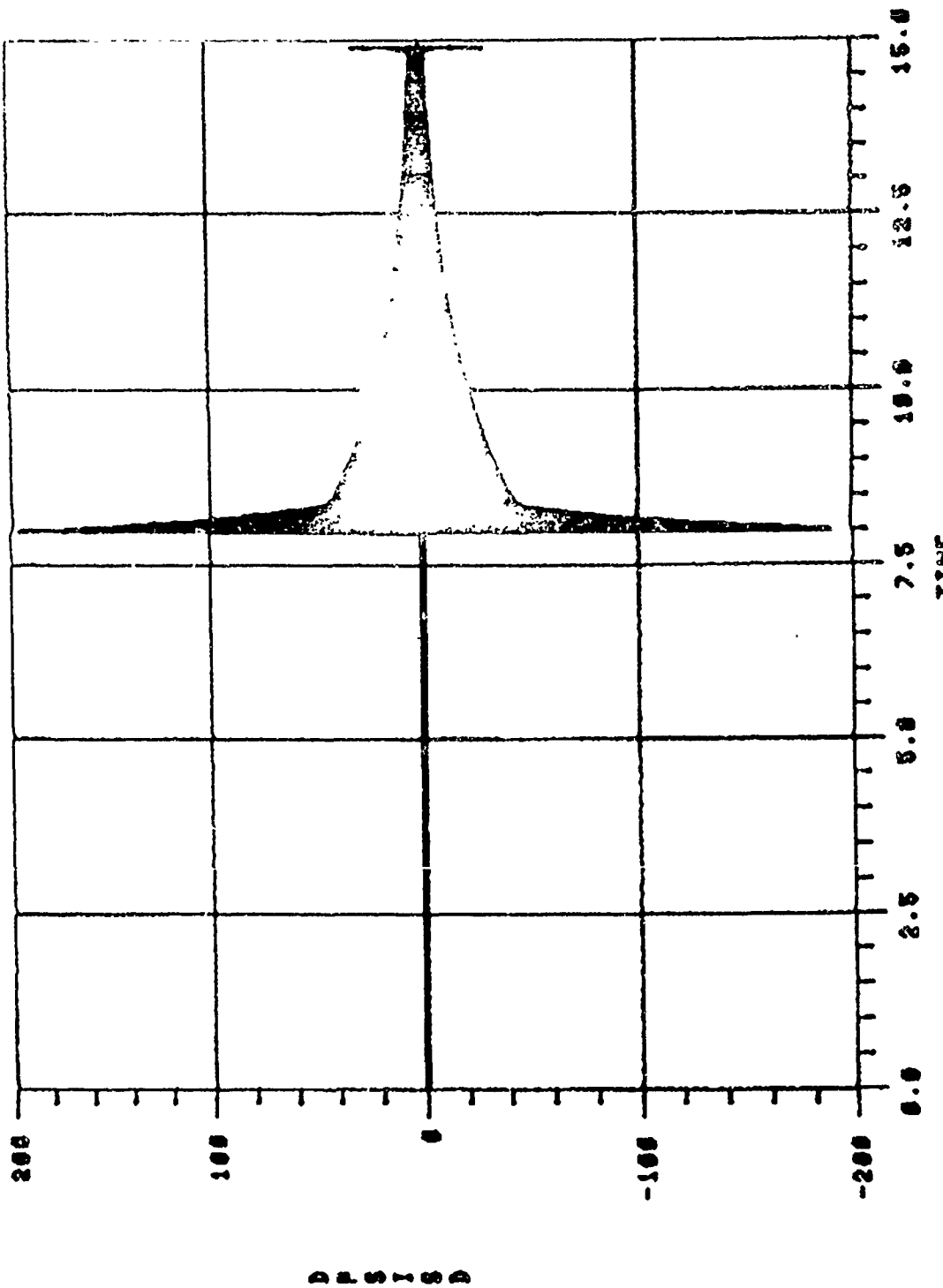
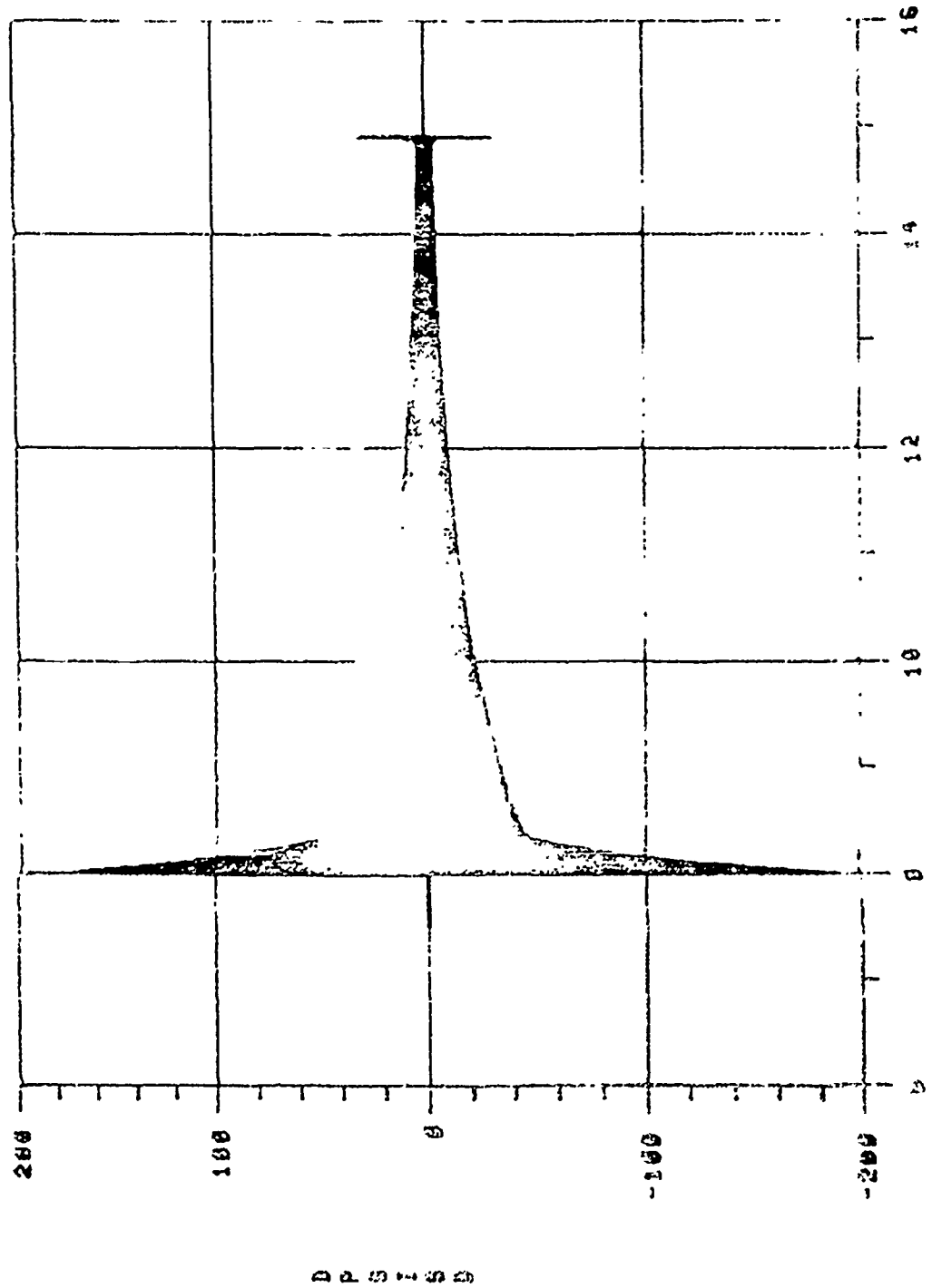


Figure 105.



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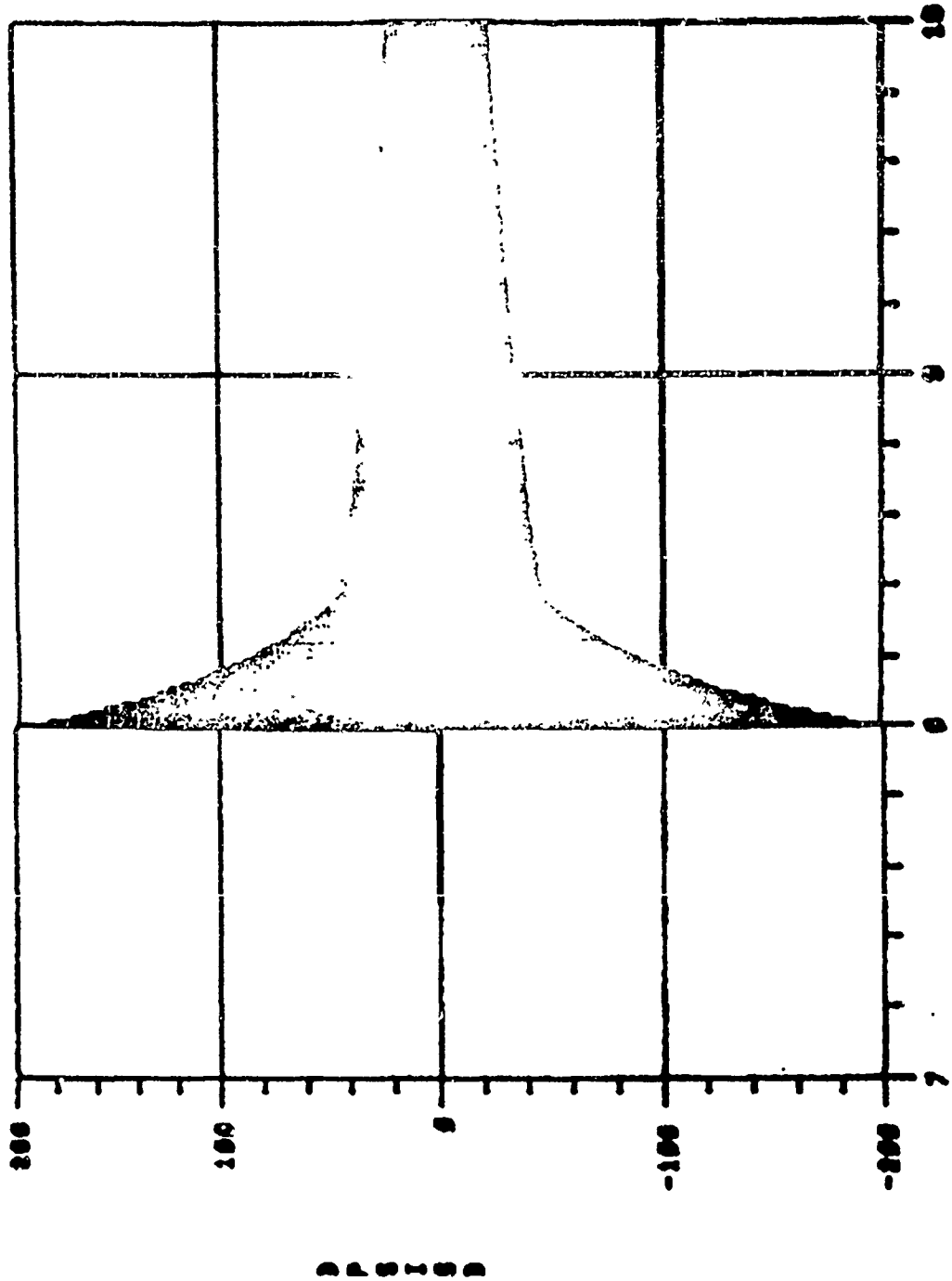

Figure 107.

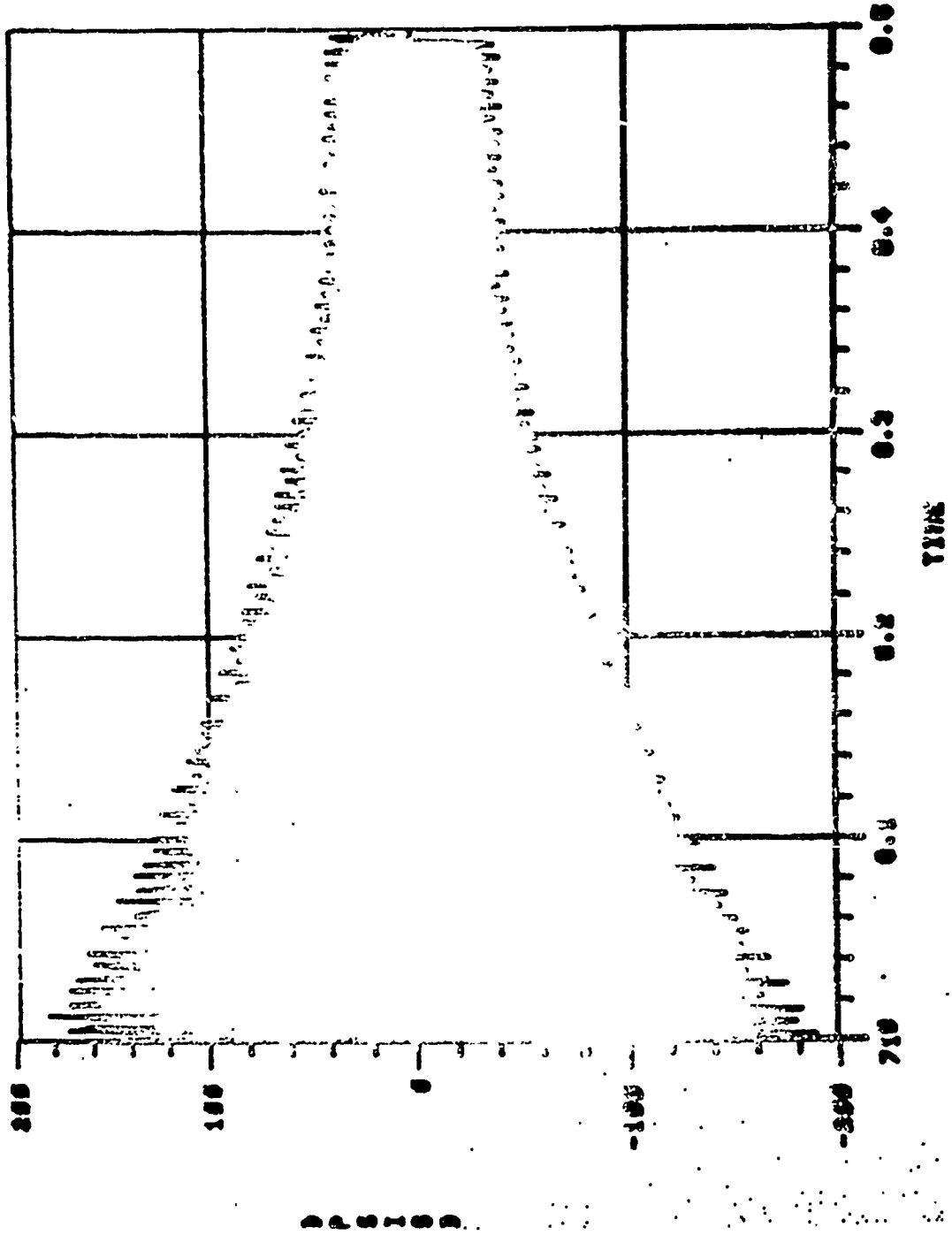

Figure 108.

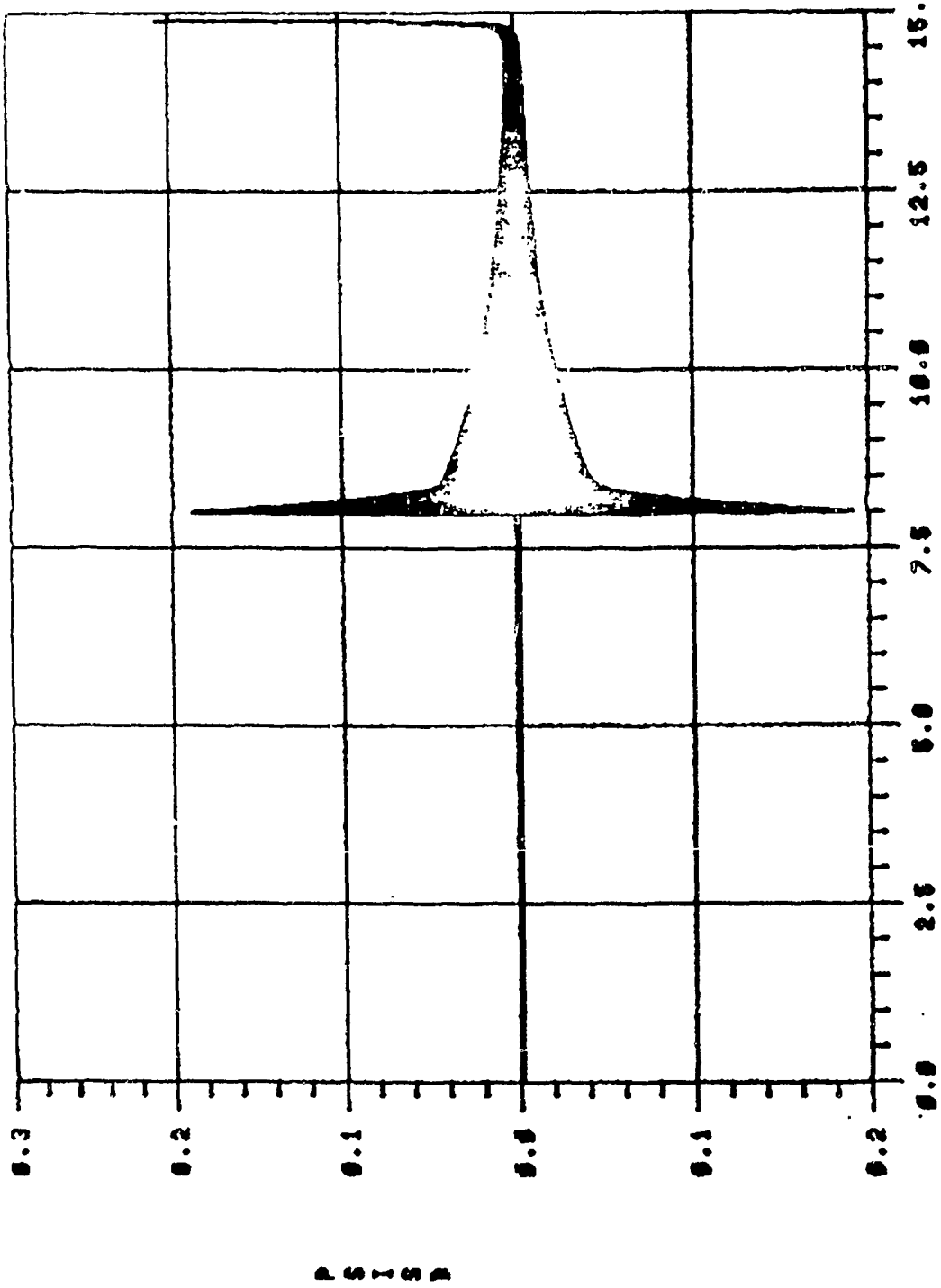

Figure 109.

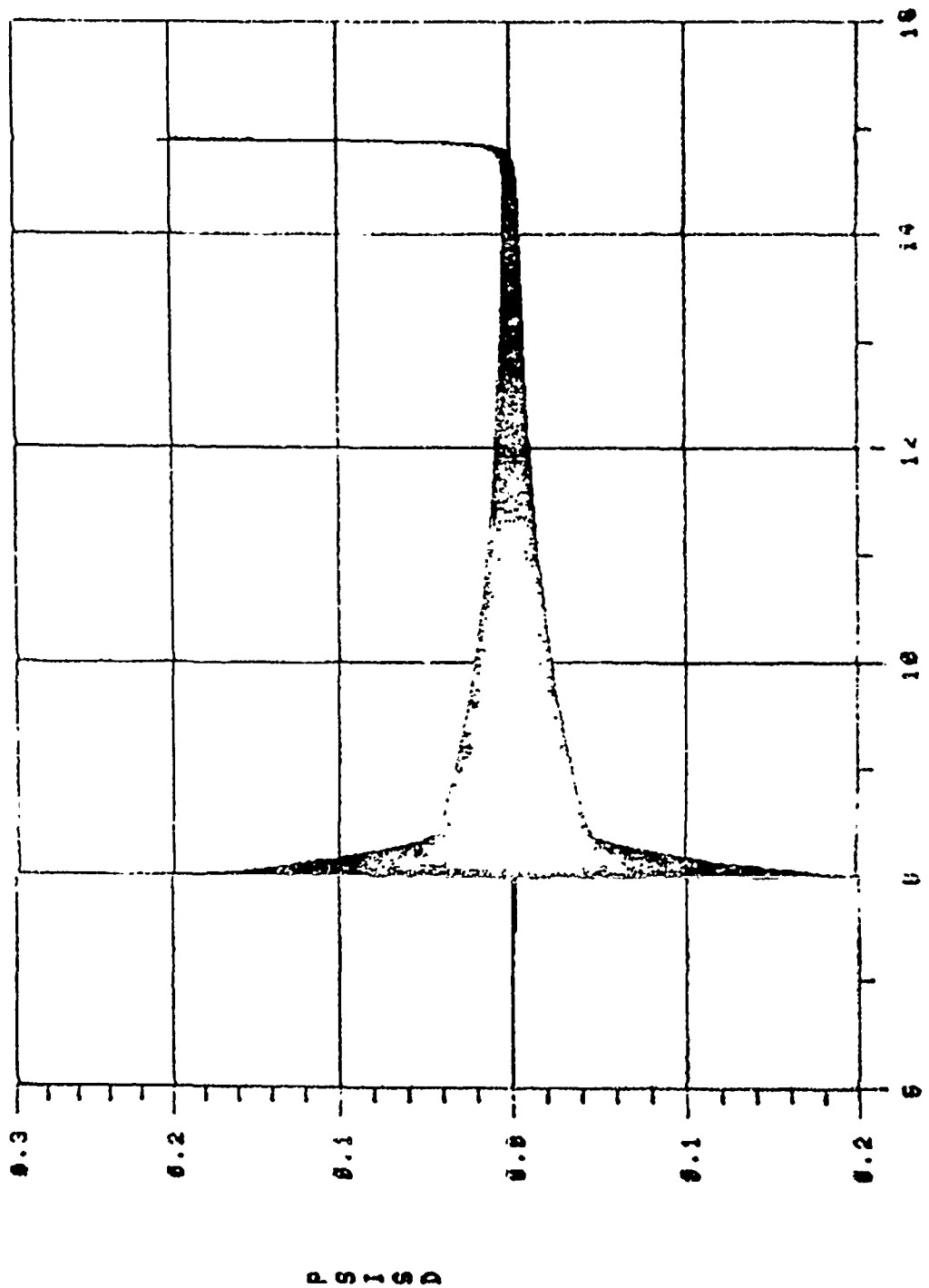

Figure 110.

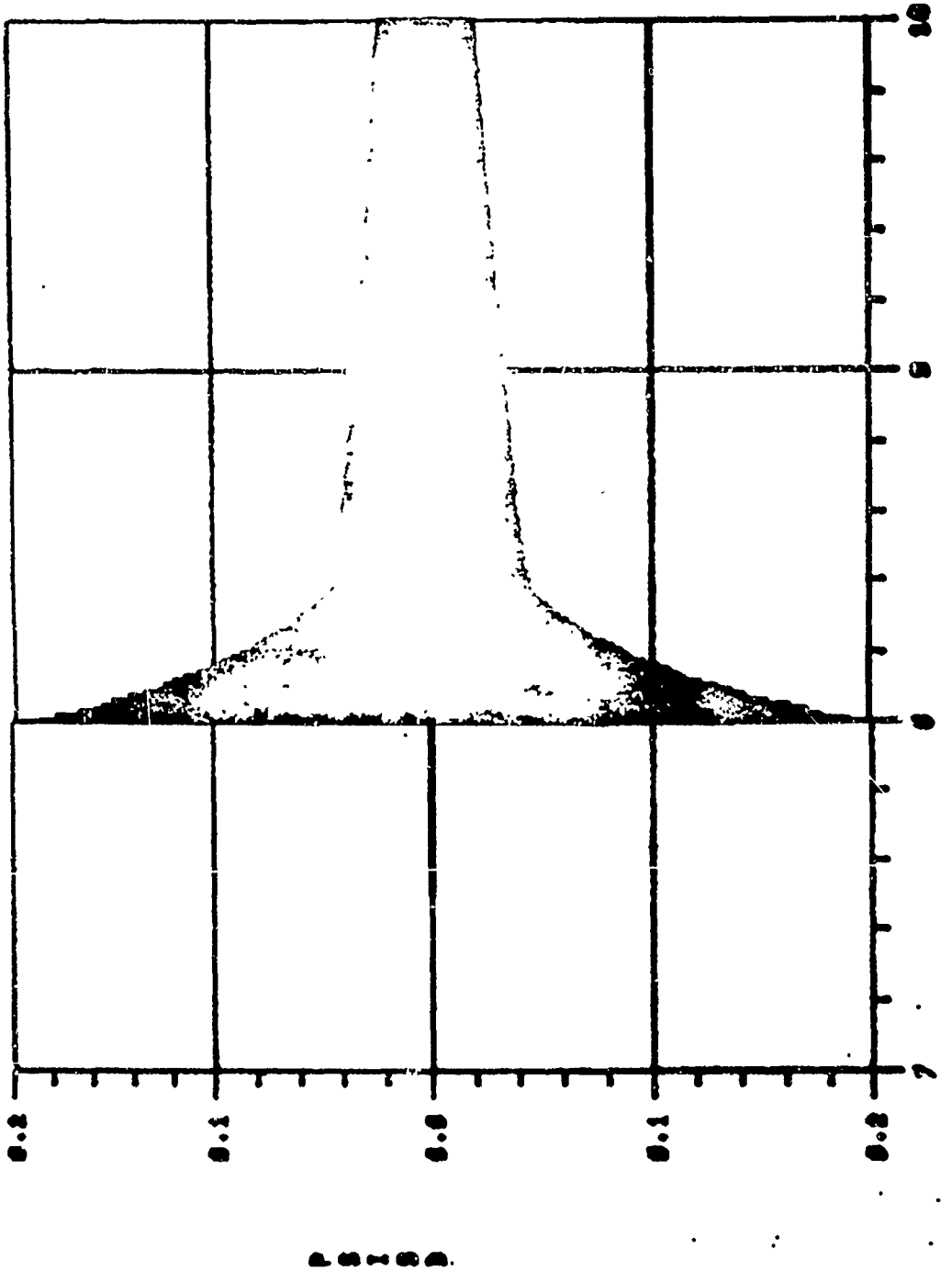

Figure 111.

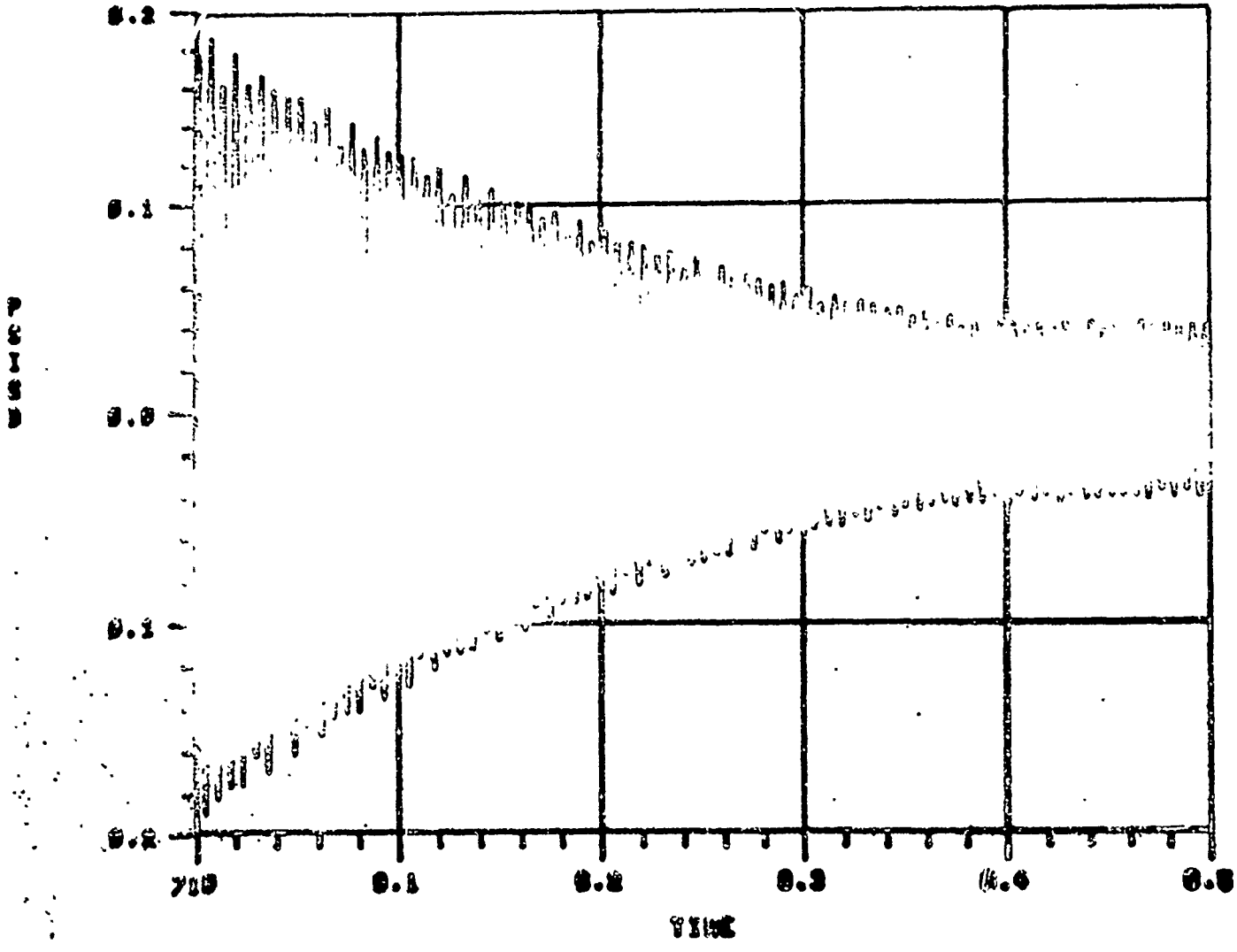

Figure 112.

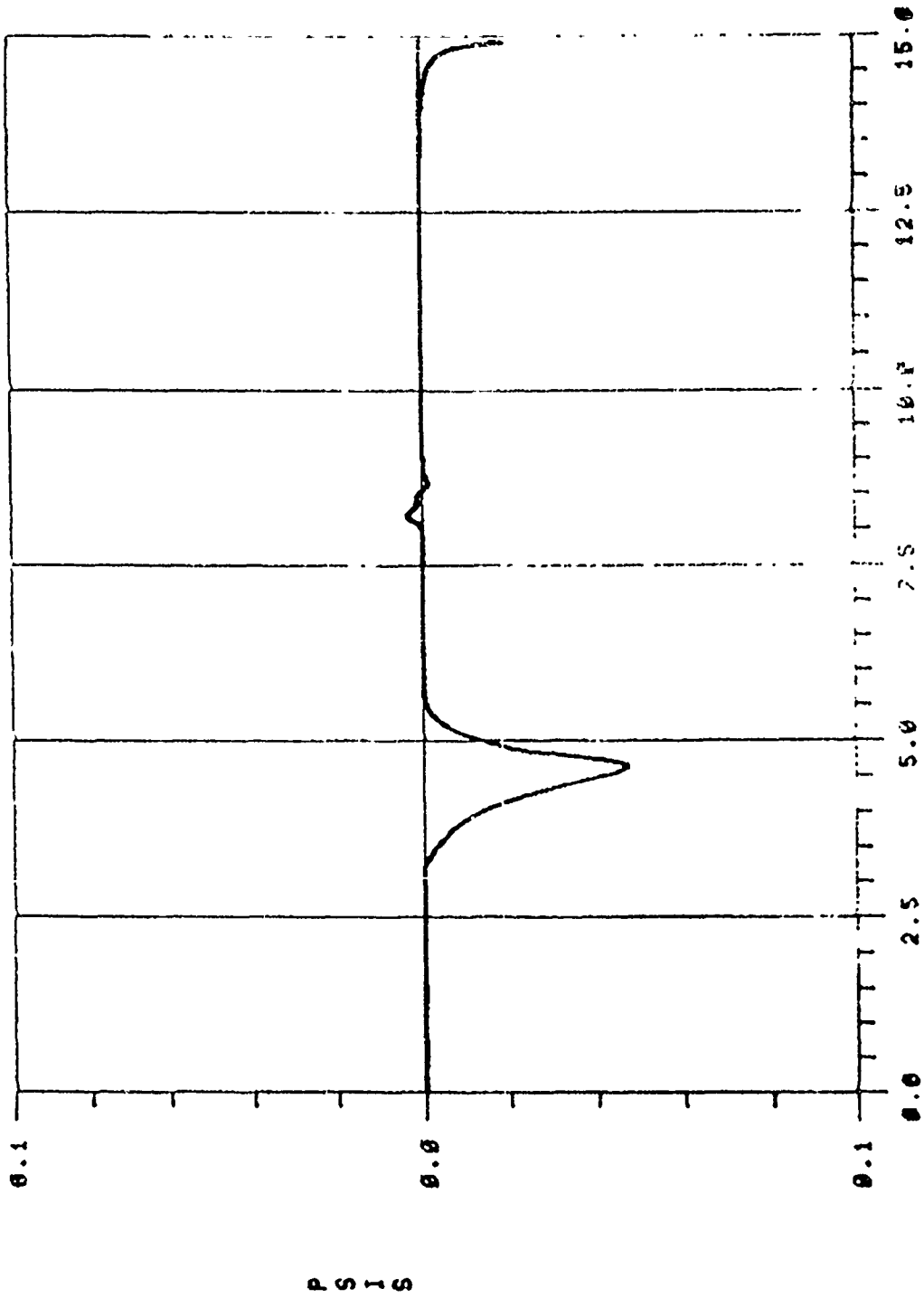

Figure 113.

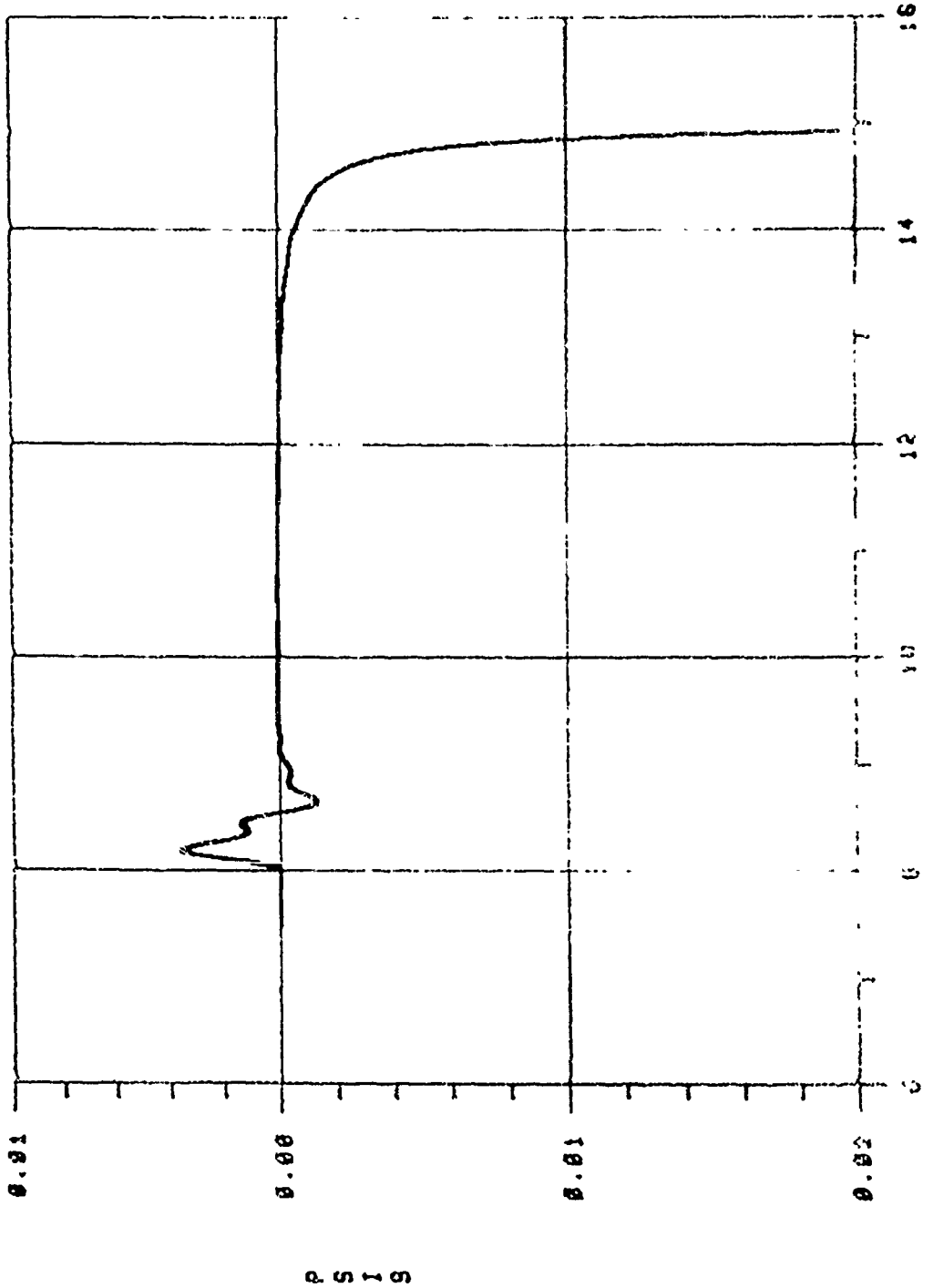

Figure 114.

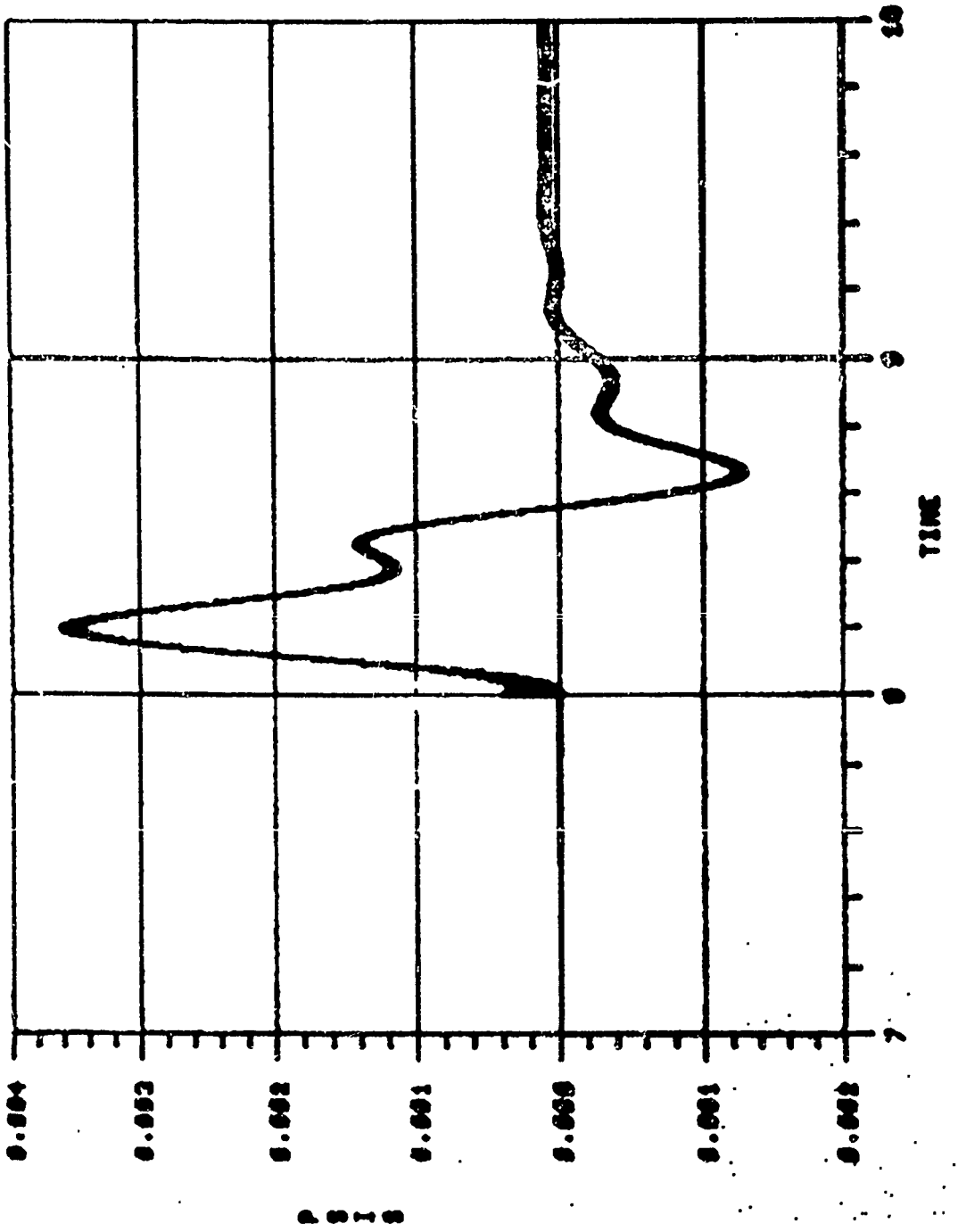

Figure 115.

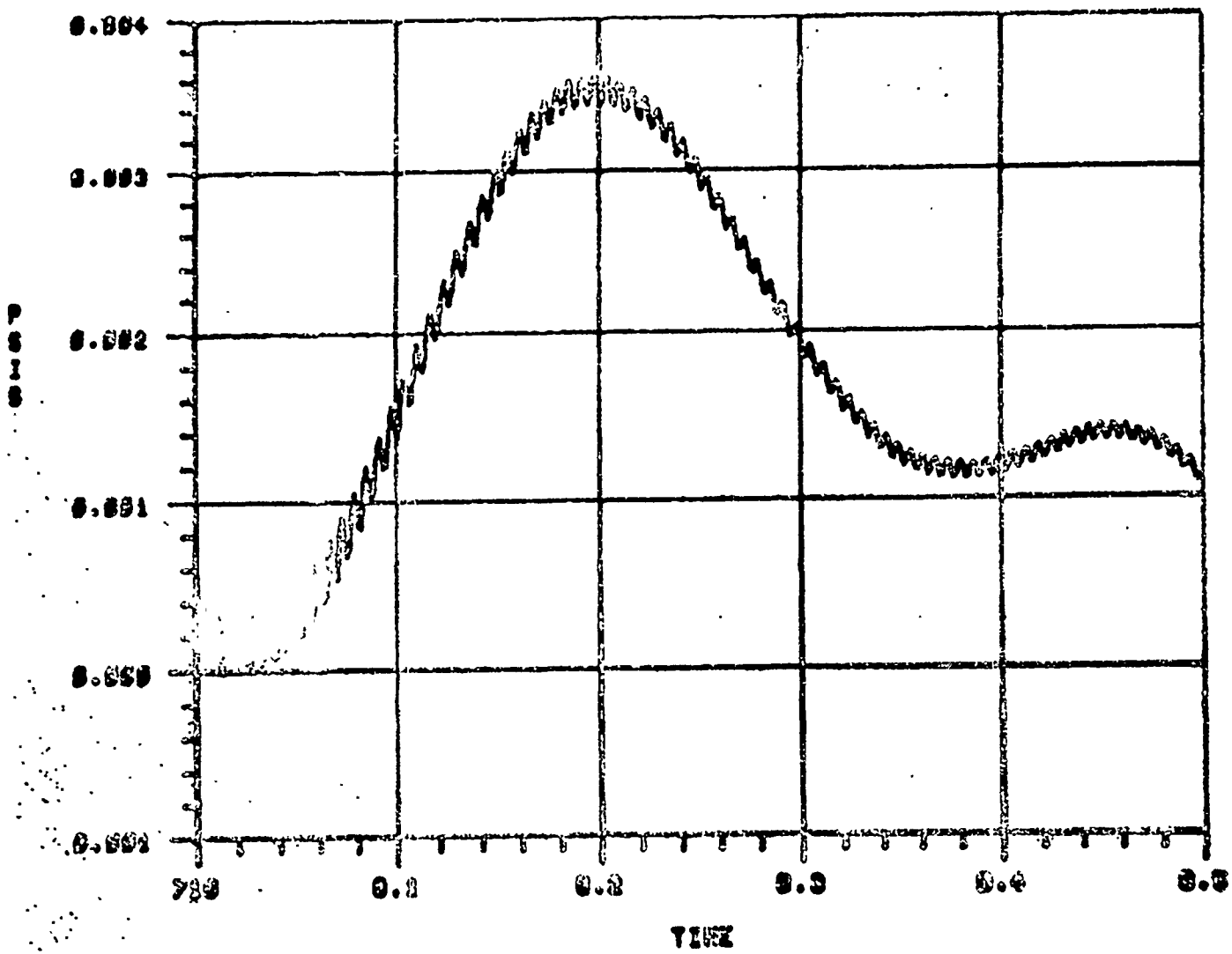

Figure 116.

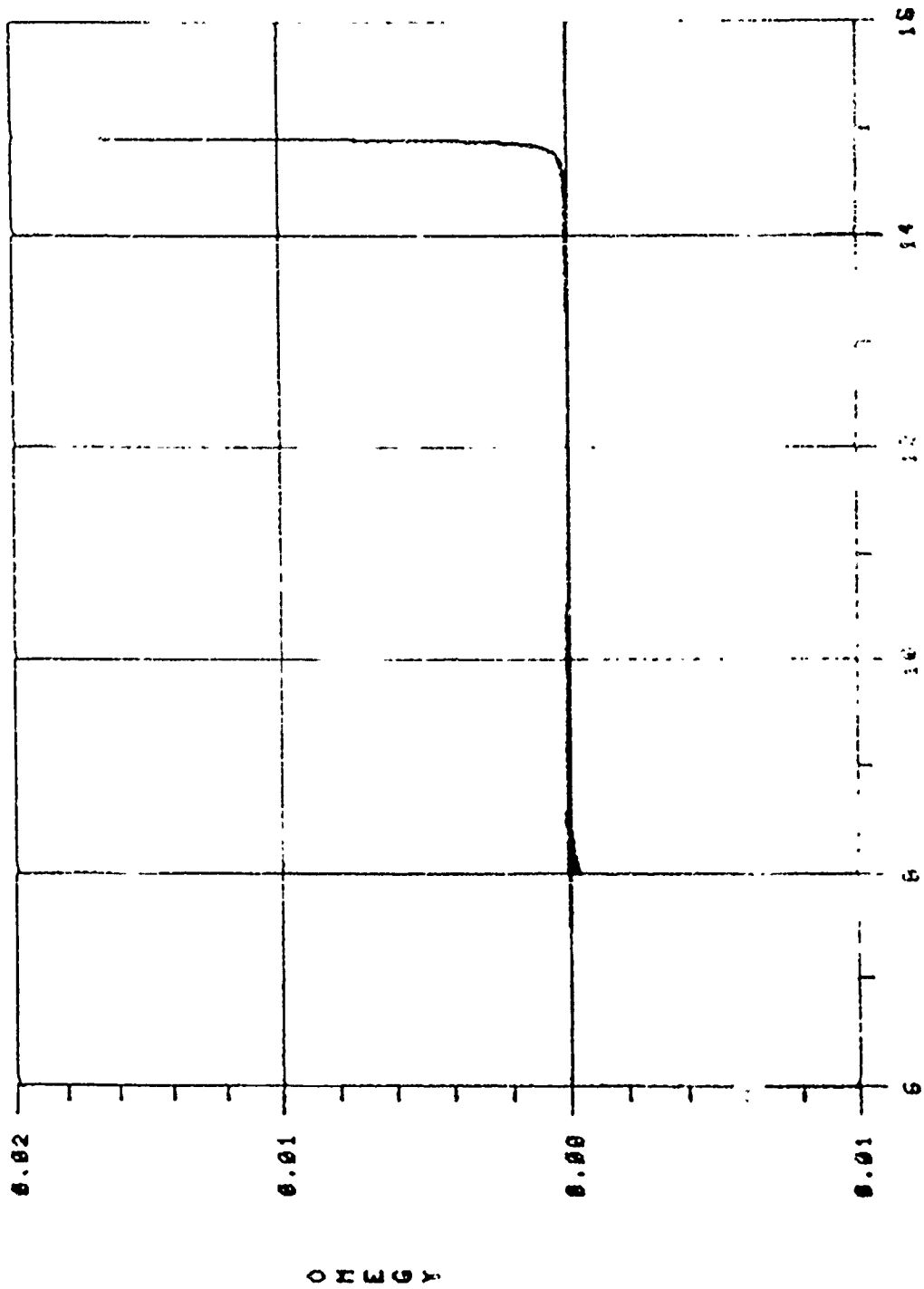

Figure 117.

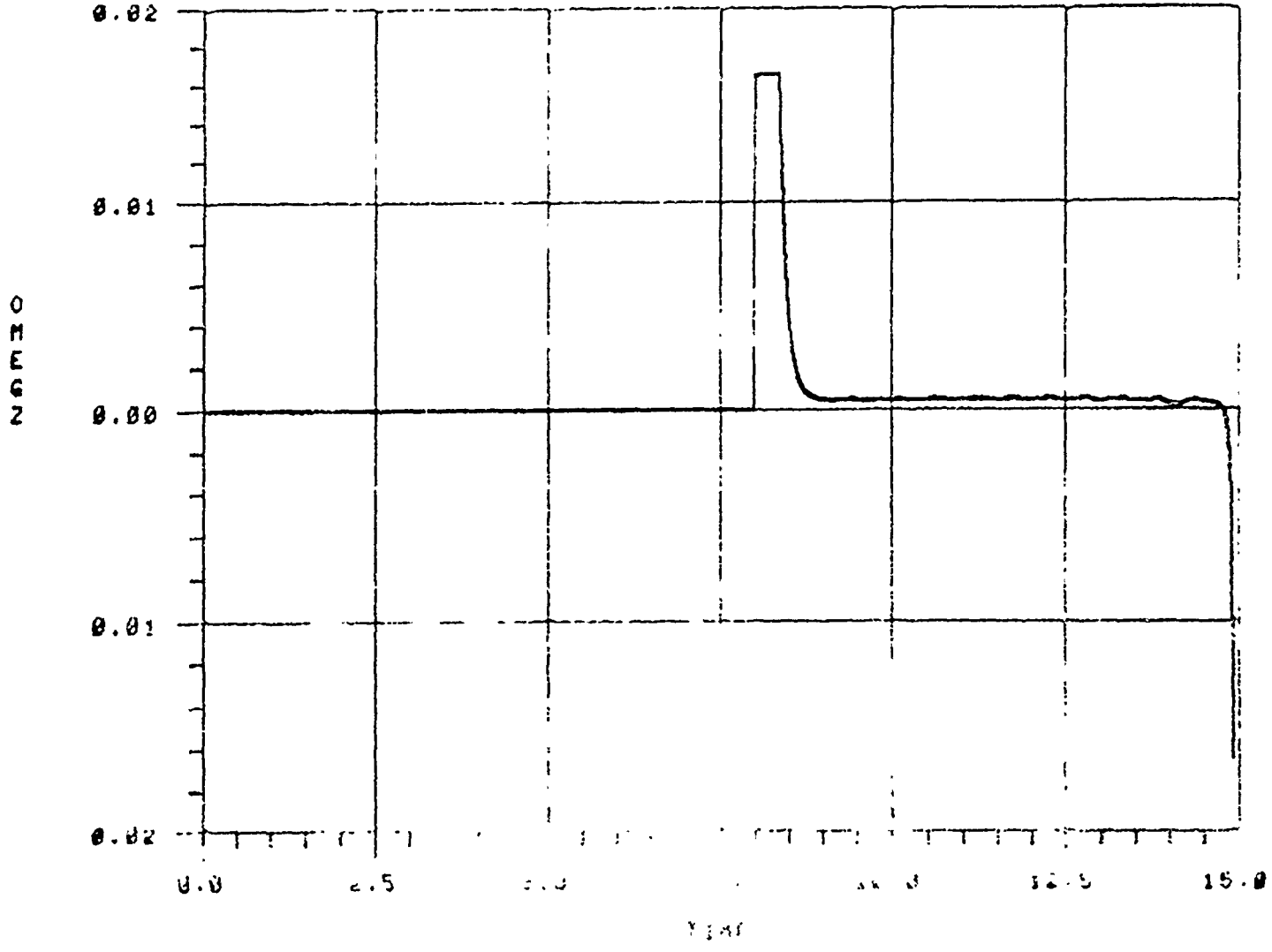

Figure 118.

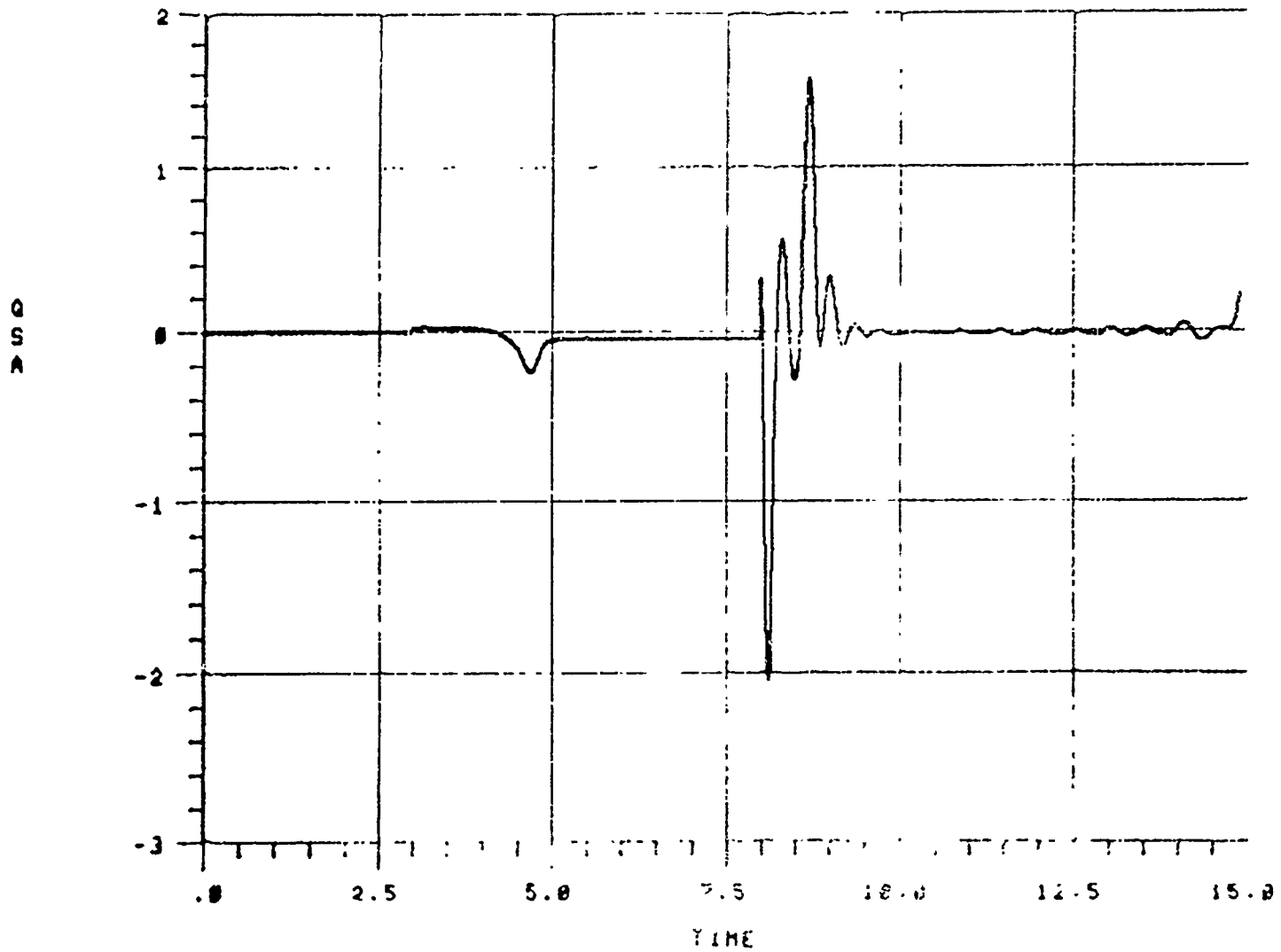

Figure 119.

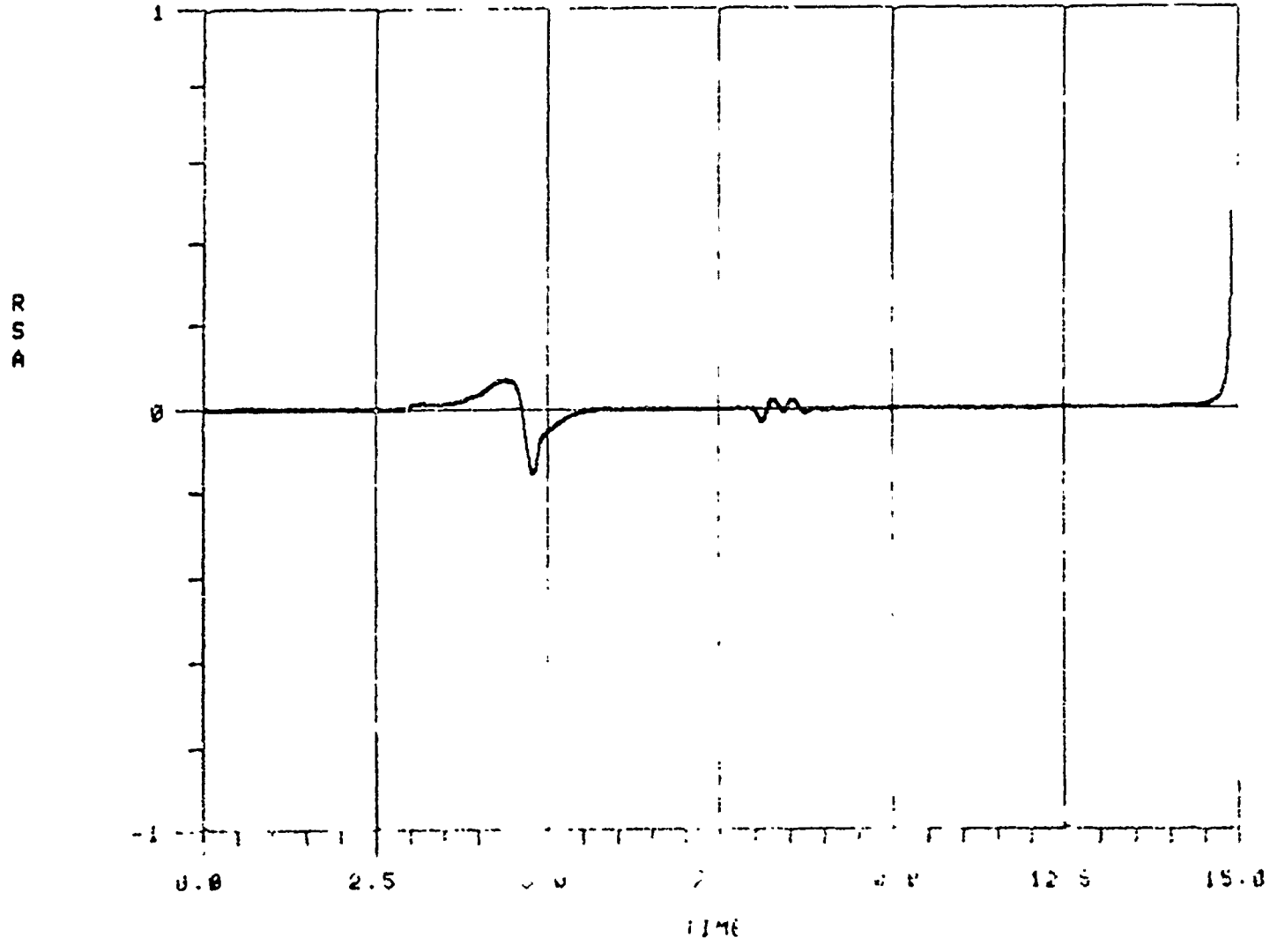

Figure 120.

REFERENCES

1. Greenwood, Donald T., Principle of Dynamics, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965.

2. Pastrick, H. L. and Hollman, H. C., Analysis and Digital Simulation Models for CLGP: Martin Marietta Aerospace Design, US Army Missile Command, Redstone Arsenal, Alabama, 35809, December 1974, Report No. RG-75-29.

3. Ogata, K., Modern Control Engineering, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970.

4. Pastrick, H. L. and York, R. J., Analysis and Digital Simulation Models for CLGP: Texas Instrument, Inc., Design, US Army Missile Command, Redstone Arsenal, Alabama, 35809, February 1973, Report No. RG-73-5.

5. Series Kearfott Technical Information for the Engineers, No. 2, Gyros, Platforms, Accelerometers, Seventh Edition, General Precision System, Inc., Wayne, New Jersey, 1967.

6. DelToro, V. and Parker, S. R., Principles of Control System Engineering, New York, New York: McGraw-Hill, Inc., 1960.

Appendix A.

6-DOF DIGITAL MISSILE TRAJECTORY SIMULATION WITH AN IDEAL GYROSCOPE MODEL

```
JAR 6D9F,DIGITAL MISSILE TRAJECTORY SIMULATION WITH AN IDEAL GYROSCOPE MODEL
ATLAST (FILE,X6),(FORMAT,C),(FSIZE,1950),SAVE
UPDATE
```

```
1               C ***          AERODYNAMICS AS AT 12/20/72 AND MEASURED SEEKER PERFOR-
2               C *** MANCE DATA AT 12/72.
3                     EXTERNAL DERIVATIVES
4                1    CALL INITIAL (IS,DERIVATIVES)
5                2    CALL RUNGK
6                     CALL FINISH
7                     GO TO 2
8                     END
```

```
      SUBROUTINE INITIAL (EMORLN,DERIVS)
      DOUBLE PRECISION DT,FSTSAM,SPER,TME,TIME0,TIME1,TIME2,TIME3,
     1TIME4,TST,DTA,TIME
      REAL KPC,KP,KC,KT,KTIO,KT2C
      REAL KT3C
      REAL KB,KGL,KP
      REAL KG,KRGL,KG,LAMPR,LAMYR,LAMBI
      REAL LP,KC,KS,KA,K5,KR                                          WILL
      REAL MACH,MASS,IX,IYZ,IT,IA
      REAL      XBA(33),   XBB(33)
      COMMON/INTEG/KUTTA,VX,DTRK,U,V,W,P,Q,R,PHI,THTA,PSI,X,Y,Z,RTHTA,
     1RPSI,THTAS,THASD,PSIS,PSISD,OMEGA,TXED,PXED,PEF,YEF,DEL1,DELVP,
     2DEL3,DDEL1,DDELVP,DDEL3,RLAMY,RLAMP,DPHIG,DPHIO,DU,DV,DW,DP,DQ,DR,
     3DPHI,DTHTA,DPSI,DX,DY,DZ,DRTHTA,DRPSI,DTHTAS,DTHASD,DPSIS,DPSISD,
     4OMEGA,DTXED,DPXED,DPSF,DYEF,DDELP1,DDELPP,DDELP3,DDDEL1,DDDELP,
     5DDDEL3,DRLAMY,DRLAMP,DRPHIG,DDD
      COMMON/ETB/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/STB/BS11,BS12,BS13,BS21,BS22,BS23,BS31,BS32,BS33
      COMMON/TDG/CPSI,SPSI,SPHI,CPHI
      COMMON/ IN/ GAMP,GAMY,DELXTR,DELYTR,DELZTR
      COMMON/RTV/DELXV,DELYV,DELZV
      COMMON/DEL/DELX,DELY,DELZ
      COMMON/STUFF/ DELXS,DELYS,DELZS
      COMMON/INPSKR/PITERR,YAWERR
      COMMON/MACL/MACH,VSND,UR,VR,WR,VRS,VRW,VJ
      COMMON/F/WXS,WYS,WZS
      COMMON/COEF/CAZ,CY,CN,CLP,CMCG,CYCG,CLD,CMC,CNR,ALPHA,BETA,CMAD,
     1CLXAC
      COMMON/TDCEQ/AXB,AYB,AZB,CLB,CNB,ALB,AMB,ANB,CMB
      COMMON/CD/DELVY,DELVR,DELR,DELR0L
      COMMON/JUNK/TIME,TIME3,RMB,S,D,SCUM,CAP,IRAP,RAPTM1,RAPTM2,IACT,
     1SLOPE1,RT1,RAPTM3,SLOPE2,RT2,CTT,CPT,SPT,XLTA,STT,QAPS,QAPSQ,
     2CAPSCM,TM
      COMMON/FF/FFCLB,FFCMB,FFCNB,FFAXB,FFAYB,FFAZB,FFALB,FFAMB,FFANB
      COMMON/GG/GXB,GYB,GZB
      COMMON/JUNK1/TNBLD,IRCLL,BG,MASS,IX,IYZ,XINTIA,NAVY
      COMMON/MO/GERALT,TB,TGRAD,RMBBL,ARG1,WTMBL,RBTAR,
     1RMBB,ARG2,GG,TMBL
      COMMON/TT/FSTSAM,TIME4,DT,DTA,TST,TME,SPER,TSAM,DQ,JMAX,IPRINT,T2
      COMMON/JUNK2/SRANGE,IPUPR,IACC,RDET,YAWERR,PITERR,PHFOV,BA,RMBLIN,
     1PITYAWSC,R2D,NULSKR,BRS,RFLECT,NULL,KAGE
      COMMON/BOW/RBL,KT,KT10,KT20,LAMPR,LAMYR,RTM,RTMIN,RBGE,ED1,FLG4,
     1RSA,FD4,QSA
      COMMON/PERV/OMEGY,OMEGZ
      COMMON/AUTAP/YEG,REG,PEG
      COMMON/XRROW/PHIO,FLG1,FLG2,FLG3,REF,RFL,YED,PED,THRBS,PSRBS,
     1THBS,PSBS,GBLV,PEFL,KPD,KC,KP,KG,LAMBI,PBLES
      COMMON/SS/S1,S2,S3,S4,S5,S6
      COMMON/GP/RB,RR,W,A,B,KT3O
      COMMON/STUFF1/DELXB,DELYB,DELZB
C
C     DICTIONARY
C
C     AERO
C
C     ALPHA
C
C     CAS
C
C
C     ALTAPLT
C
```

```
C
C
C     DEFAULT VALUES
C
      REAL REAL ??6)/
     1+2.89660000E+01,+5.18688000E+02,+3.21740000E+01,                  001--003
     2-3.56616000E-03,+2.08555313E+07,+2.37690000E-03,                  004--006
     3+4.97196257E+04,+5.31200000E+00,+4.48865000E+00,                  007--009
     4+2.01000000E-01,+5.72300000E+00,+5.08300000E-01,                  010--012
     5+5.00000000E+00,+3.14159265E+00,+0.00000000E+00,                  013--015
     6+0.00000000E+00,+0.00000000E+00,+0.00000000E+00,                  016--018
     7+4.00000000E+00,+8.00000000E-01,+0.00000000E+00,                  019--021
     8+1.50000000E-01,+8.00000000E-02,+6.00000000E-01,                  022--024
     9+1.49750000E+02,+4.00000000E+00,+6.25000000E+00,                  025--027
     A+2.50000000E+02,+2.50000000E+01,+2.00000000E+00,                  028--030
     B+1.00000000E+02,+1.00000000E-20,+0.00000000E+00,                  031--033
     C+0.00000000E+00,+5.00000000E-01,+1.50000000E+01,                  034--036
     D+1.00000000E+00,+1.00000000E+00,+1.00000000E+00,                  037--039
     E+1.00000000E+00,+1.00000000E+00,+1.00000000E+00,                  040--042
     F+1.00000000E+00,+1.00000000E+00,+1.00000000E+00,                  043--045
     G+1.00000000E+00,+8.00000000E+00,+1.50000000E+01,                  046--048
     H+1.50000000E+01,+7.50000000E+00,+5.00000000E+00,                  049--051
     I+5.00000000E-02,+2.35280000E-05,+1.62260000F-05,                  052--054
     J+8.00000000F-01,+1.50000000E+00,+1.25000000E+01,                  055--057
     K+1.25000000E+01,+1.50000000E+01,+2.00000000E+01,                  058--060
     L+3.00000000E+02,+1.00000000E+01,+0.00000000E+00,                  061--063
     M+1.00000000E-01,+6.00000000E+00,+3.14000000E+02,                  064--066
     N+2.00000000E+03,+1.24500000E+03,+0.00000000E+00,                  067--069
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      5+0.000000000E+00,+0.000000000E+00/                               205--206
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       INTEGER FIXED(030)/
      1+0000000014,+0000000000,+0000000002,+0000000020,+0000000128,     001--005
      1+0000000256,+0000000001,+0000000002,+0000000000,+0000000000,     006--010
      3+0000000000,+0000000000,+0000000000,+0000000000,+0000000000,     011--015
      3+0000000001,+0000000001,+0000000001,+0000000001,+0000000000,     016--020
      3+0000000006,+0000000006,+0000000006,+0000000000,+0000000000,     021--025
      3+0000000000,+0000000000,+0000000000,+0000000000,+0000000000/     026--030
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       LOGICAL LOGICAL(008)/
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      ARLAMP,RPHIG,RDET,LAMBI,BF,KQ,TIMEO,TIME1,TIME2,TIME3,TIME4,ZMIN,
      BXT,YT,ZT,VXT,VYT,VZT,
      CPHFOV,YHFOV,THTAC,CT,DTA,CO,PASS,IX,IYZ,S,TMF,BRG,DELROL,KB,KG,
      PKG,KRGL,HC,RF,RG,AF,PA,CS,KP,QC,KQL,GAMLB,PCL,YCL,CI,IT,IA,GF,
      ECLC,RNGLIN,DELMX,DELMY,VRATE,K4,K5,PBON,K6,RVBIAS,BR5,PHIMAX,IROLL
      F,RTOL,S1,S2,S3,S4,S5,ISKR,IROLLOC,IACT,IACC,IPRINT,JMAX,IRAM,
      RTHETAT,PSIT,SLOPE1,SLOPE2,BT1,BT2,XLTA,RAPTM1,RAPTM2,RAPTM3
      M,TB,TC,TC1,TC2,TC3,T04,T05,T06,T07,T1,T2,NULL,IFUF9,IGUIDE,TIP1,
      JTIP5,KPD,KM,KC,THTBL,CTRK,S6,S7,S8,S9,S10,S11,S12,KT,KT10,KT20
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      LSF15,RTMIN,KAGE,FFCLB,FFCMB,FFCNB,FFAXB,FFAYB,FFAZB,FFALB,FFAMB,
      MFFANB,FULL,THOLD,NAVY,KT30,KC
       REAL MDAC(16)/16*0./,POLES(001)/
      1+2.000000000E+01/
       LOGICAL FLG0/.TRUE./,FLG1/.TRUE./,FLG2/.TRUE./,FLG3/.TRUE./,FULL/.
      1FALSE./,FLG4/.TRUE./,IMPACT,ERROR,FLG5
       DATA KG,KC,KM,KP,KPD,KR/3.5,.05,2.,10.,.015,75./
       DATA TB,TC/.6,10./,KT,KT10,KT20/20.,10.,20./
       DATA S1,S2,S3,S4,S5,S6,S7,S8,S9,S10,S11,S12/-1.,1.,3*-1.,7*1./
       DATA SLOPE1,SLOPE2/36.7346938,-11.5384615/,XLTA/1.666667/
       DATA RAPTM1,RAPTM2,RAPTM3/1.0,6.5,13./
       DATA R2D/5.729577951E+01/,D2R/.01745329/
       DATA RB,RR,M,A,B/20.00017192,.0921875,.0000R418,.00009972/
       CALL ABRTSET(99995,1)                                             HH1074
       CALL EOFSET(99995,LUNIT)
     1 CONTINUE
X      CALL MYPLIB
X      CALL MODE('R')
X      CALL MODE('C')
       DO 1234 I=0,15000
X      CALL MDACS(0,16,MDAC)
 1234  CONTINUE
C
C  PASS ADDRESSES AND INITIALIZE LIBRARY RUNGE-KUTTA INTEGRATOR
C
        CALL RUNGKI(DL,U,DT,TIME,X*A,X*B,NX,DERIVS)
C
```

```
      C     INPUT VALUES
      C
      GATE(001) = RST; GATE(002) = RST; GATE(003) = RST; GATE(004) = RST;
      GATE(005) = RST; GATE(006) = RST; GATE(007) = RST;
      TIME     = DOUBLE(001)
      NX       = FIXED(001); NUM      = FIXED(002);
      IPRINT   = FIXED(003); NPRS     = FIXED(004);
      NDT      = FIXED(005); NDTA     = FIXED(006);
      KAGE     = FIXED(007); NULSKP   = FIXED(008);
      NAVM     = FIXED(009); IOUTPT   = FIXED(010);
      IFLFB    = FIXED(011); IRALL    = FIXED(012);
      ISKP     = FIXED(013); IRAP     = FIXED(014);
      IACT     = FIXED(015); IRALLOC  = FIXED(016);
      IACC     = FIXED(017); NULL     = FIXED(018);
      KAGE     = FIXED(019); IDUM     = FIXED(020);
      IDUM     = FIXED(021); IDUM     = FIXED(022);
      IDUM     = FIXED(023); IDUM     = FIXED(024);
      IDUM     = FIXED(025); IDUM     = FIXED(026);
      IDUM     = FIXED(027); IDUM     = FIXED(028);
      IDUM     = FIXED(029); IDUM     = FIXED(030);
      FLGS     = LOGICAL(001); IMPACT   = LOGICAL(002)
      ERROR    = LOGICAL(003)
      ATMPL    = REAL(001); TS        = REAL(002)
      GS       = REAL(003); TGRAD     = REAL(004)
      RS       = REAL(005); RWSL      = REAL(006)
      RSTAR    = REAL(007); CG        = REAL(008)
      MASS     = REAL(009); IX        = REAL(010)
      IYY      = REAL(011); IZ        = REAL(012)
      REFFCT   = REAL(013); PI        = REAL(014)
      WARP     = REAL(015); R2        = REAL(016)
      FSTSAM   = DBLE(REAL(017)); BRS       = REAL(018)
      DELRGL   = REAL(019); LAMBI     = REAL(020)
      KB       = REAL(021); KG        = REAL(022)
      KG       = REAL(023); KRGL      = REAL(024)
      RC       = REAL(025); RVBIAS    = REAL(026)
      RF       = REAL(027); BG        = REAL(028)
      AF       = REAL(029); BRS       = REAL(030)
      PHIMAX   = REAL(031); RTOL      = REAL(032)
      RA       = REAL(033); CS        = REAL(034)
      XP       = REAL(035); GC        = REAL(036)
      KGL      = REAL(037); FFCLB     = REAL(038)
      FFCMB    = REAL(039); FFCNB     = REAL(040)
      FFAXB    = REAL(041); FFAYB     = REAL(042)
      FFAZB    = REAL(043); FFALB     = REAL(044)
      FFAMB    = REAL(045); FFANB     = REAL(046)
      GAMLP    = REAL(047); PCL       = REAL(048)
      YCL      = REAL(049); THTAC     = REAL(050)
      GF       = REAL(051); CLD       = REAL(052)
      TA       = REAL(053); IY        = REAL(054)
      KC       = REAL(055); RVGLIM    = REAL(056)
      PHFBV    = REAL(057); YHFBV     = REAL(058)
      DELMX    = REAL(059); DFLMX     = REAL(060)
      VRATF    = REAL(061); K4        = REAL(062)
      K5       = REAL(063); FRGN      = REAL(064)
      KS       = REAL(065); OMEGA     = REAL(066)
      PCA      = REAL(067); U         = REAL(068)
      V        = REAL(069); W         = REAL(070)
      P        = REAL(071); Q         = REAL(072)
      R        = REAL(073); PSI       = REAL(074)
      THTA     = REAL(075); PHI       = REAL(076)
      X        = REAL(077); Y         = REAL(078)
      Z        = REAL(079); PSIS      = REAL(080)
```

```
THTAS  = REAL(081); DP     = REAL(082)
DG     = REAL(083); DR     = REAL(084)
DL     = REAL(085); DV     = REAL(086)
DX     = REAL(087); DELXB  = REAL(088)
DELYB  = REAL(089); DELZB  = REAL(090)
DELXS  = REAL(091); DELYS  = REAL(092)
DELZS  = REAL(093); PITERR = REAL(094)
YAWERR = REAL(095); PITER4 = REAL(096)
YAWERD = REAL(097); OMEGY  = REAL(098)
RFEDT  = REAL(099); PSR3   = REAL(100)
BT1    = REAL(101); BT2    = REAL(102)
THTOL  = REAL(103); KC     = REAL(104)
SFC    = REAL(105); SF1    = REAL(106)
SF2    = REAL(107); SF3    = REAL(108)
SF4    = REAL(109); SF5    = REAL(110)
SF6    = REAL(111); SF7    = REAL(112)
SF8    = REAL(113); SF9    = REAL(114)
SF10   = REAL(115); SF11   = REAL(116)
SF12   = REAL(117); SF13   = REAL(118)
SF14   = REAL(119); SF15   = REAL(120)
TIC    = REAL(121); TICI   = REAL(122)
PURO   = REAL(123); YSR3   = REAL(124)
CSA    = REAL(125); RSA    = REAL(126)
PEG    = REAL(127); YEG    = REAL(128)
REG    = REAL(129); RET    = REAL(130)
REN    = REAL(131); RED    = REAL(132)
T2     = REAL(133); DELXV  = REAL(134)
DELYV  = REAL(135); DELZV  = REAL(136)
DEL1   = REAL(137); DEL2   = REAL(138)
DEL3   = REAL(139); DEL4   = REAL(140)
DELVP  = REAL(141); DELMIS = REAL(142)
TH     = REAL(143); THBS   = REAL(144)
PSBS   = REAL(145); THRBS  = REAL(146)
PSRBS  = REAL(147); THTAO  = REAL(148)
REF    = REAL(149); PEF    = REAL(150)
YEF    = REAL(151); TXED   = REAL(152)
PXFD   = REAL(153); F1     = REAL(154)
F2     = REAL(155); F3     = REAL(156)
PSISC  = REAL(157); THASD  = REAL(158)
DRTHTA = REAL(159); DRPSI  = REAL(160)
DDEL1  = REAL(161); DDEL3  = REAL(162)
DDELP1 = REAL(163); DDELP3 = REAL(164)
DDELVP = REAL(165); DDELPP = REAL(166)
DDDEL1 = REAL(167); DDDEL3 = REAL(168)
DDDELP = REAL(169); DRLAMP = REAL(170)
DRLAMY = REAL(171); DRPHIO = REAL(172)
RLAMY  = REAL(173); RLAMP  = REAL(174)
RPHIO  = REAL(175); RPSI   = REAL(176)
RTHTA  = REAL(177); XT     = REAL(178)
YT     = REAL(179); ZT     = REAL(180)
DPSIS  = REAL(181); DTHTAS = REAL(182)
THETAT = REAL(183); PSIT   = REAL(184)
PEC    = REAL(185); YED    = REAL(186)
DPEF   = REAL(187); DYEF   = REAL(188)
PEFL   = REAL(189); PHIG   = REAL(190)
DPHIO  = REAL(191); TOTACC = REAL(192)
VM     = REAL(193); DPHIO  = REAL(194)
DDPHIO = REAL(195); THBLD  = REAL(196)
RCFT   = REAL(197); TIMEC  = REAL(198)
TIME1  = REAL(199); TIME2  = REAL(200)
TIME3  = REAL(201); TIME4  = REAL(202)
ZMIN   = REAL(203); RTMIN  = REAL(204)
```

```
      DUM      = REAL(205); DUM      = REAL(206)
     1DTHASC   = REAL(208); DPSISD   = REAL(206)
C
C     CALCULATED VALUES
C
      ARG1=1.+(GB*WTMPL)/(RSTAR*TORAD)
      XINTIA = (IYZ-IX)/IYZ
      S=.25*PI*D*D
      WANG=PI*R2
      SNWANG=SIN(WANG)
      CSWANG=COS(WANG)
      SPER=1.DO/DBLE(FLOAT(NPPS))
      TME=SPER
      DT=1.DO/DBLE(FLOAT(NDT))
      DTRK=SNGL(DT)
      DTA=1.DO/DBLE(FLOAT(NDTA))
      DELROL=REAL(C19)/R2D
      DELROL=DELROL/R2D
      LAMBI=LAMBI/R2D
      PHIMAX=PHIMAX/R2D
      GAMLB=GAMLB/R2D
      YCL=YCL/R2D
      PHFOV=PHFOV/R2D
      VRATE=VRATE/R2D
      RVBIAS=RVBIAS/R2D
      GC=GC/R2D
      PCL=PCL/R2D
      THTAC=THTAC/R2D
      CI=(IT-IA)/IT
      RI=IA/IT
      RNGLIN=RNGLIN/R2D
      YHFOV=YHFOV/R2D
      K4=K4/R2D
      THTA=THTA/R2D
      CPSIS=COS(PSIS)
C**** JMAX=PRINT CONTROL. PRINTING OCCURS EVERY JMAX INTERVALS.
      JMAX=1.DO/DT+.000001
      INPUT(105)
      ZHOLD=Z
      THTAO=THTA
      TC1=TO+.4;TO2=TC1+.4
      TC3=TO2+.2
      TC4=TC3+.2
      TC5=TC4+.2
      TC6=TC5+.2
      TC7=TC6+.2
      T1=TC+2.
      IF(T2.LT..01)T2=T1+4.
      CTT=COS(THETAT)
      STT=SIN(THETAT)
      CPT=COS(PSIT)
      SPT=SIN(PSIT)
      IF(IROLLOC.EQ.2)IACT=2
C**** RANGE TARGET FROM MISSILE=RTM IN FEET.
      RTM=SQRT((XT-X)**2+(YT-Y)**2+(ZT-Z)**2)
C****
C     WHITE SANDS ALTITUDE=4000. FT.
C**** IMPORTANT DEFINE TIMEO FOR EACH TRAJECTORY.
C****
C**** START ROLL GYRO(LINE358) AT TIME1
C*****START PITCH AND YAW GYROS(LINE 367)/ROLL CONTROL(LINE 399) AT TIME3
C**** ENABLE TRACK AT TIME4      IF TARGET IS WITHIN FOV AND ROEY
```

```
C**** BALLISTIC FLYOUT
      IF(HDET.LT.5.)TIME4=999.
      ITEMP=TIME+1.000001
C*****FIRST SCHEDULED PRINT TIME
      PRINTM=ITEMP
      DELX=XT-X
      DELY=YT-Y
      DELZ=ZT-Z
      DELXT=DELX
      DELYT=DELY
      DELZT=DELZ
      CMD=C.
      CND=O.
C*****
      EC0=T1
      EC1=T1+C.25
      EC2=T2
      EC3=EC1+.2
      EC4=EC3+3.8
      EC5=TIME3
      DELMX=DELMX/R2D                    ;DELMY=DELMY/R2D
90000 FORMAT(//2X,*A*,//,5(2X,2A*,' = ',G11.5))
90001 FORMAT(//2X,'NULL ROLL RATE SENSOR')
90002 FORMAT(//2X,'ROLL HOLD')
90003 FORMAT(//2X,'LATERAL ENABLE')
90004 FORMAT(//2X,'GUIDANCE ENABLE')
90005 FORMAT(//2X,'ACQUISITION')
90006 FORMAT(//2X,'UNCAGE GYRO FOR ROLL TO VERTICAL')                FLG*
90007 FORMAT(1H1)
90010 FORMAT(//2X,'BEGIN SEEKER CANT')
    9 CONTINUE
       KUTTA = C
       R E T U R N
C
       E N T R Y   D E R I V A T I V E S
C
       KUTTA = KUTTA + 1
C
      ALT=-Z
      G = GO*RO*RO/(RO+ALT)**2
      GEOALT=RO*ALT/(RO+ALT)
C**   METO CALCULATES VSND
      CALL METO
   13 CONTINUE
C
C** ECS TO BCS TRANSFORMATION
      CALL TRSFEB
C
C** BCS TO SCS TRANSFORMATION,SEQUENCE IS THTAS,PSIS
      CALL TRSFBS
  100 IF(KUTTA.NE.1) GO TO 105
      IF(TIME.LT.THOLD)NX=1
      IF(TIME.GE.THOLD)NX=14
      IF(GATE(OC3))GO TO 1235
      IF(TIME.LT.TIME3)GO TO 1235
      GATE(CO3)=SET
      IPRINT=2
 1235 CONTINUE
      IF(GATE(OC4))GO TO 1236
      IF(TIME.LT.TIME1)GO TO 1236
      GATE(CO4)=SET
      IPRINT=2
```

```
417             1236  CONTINUE
418                   IF(GATE(CC5))GO TO 1237
419                   IF(TIME.LT.TIME2)GO TO 1237
420                   GATE(CC5)=SET
421                   IPRINT=2
422             1237  CONTINUE
423                   IF(GATE(CC6))GO TO 1238
424                   IF(TIME.LT.TIME3)GO TO 1238
425                   GATE(CC6)=SET
426                   IPRINT=2
427             1238  IF(GATE(CC7))GO TO 1239
428                   IF(TIME.LT.T1)GO TO 1239
429                   GATE(CC7)=SET
430                   IPRINT=2
431             1239  CONTINUE
432             C
433             C     LOS ERROR IN SCS
434                   CALL LOSERR
435             C
436             C**   SUBROUTINE SEEK DETECTS TARGET WITHIN THE DETECTION RANGE OF SEEKER,
437             C     TARGET WITHIN THE FIELD OF VIEW,SQUASH,SEEKER WITHIN LINEAR RANGE
438                   CALL SEEK
439               10R CONTINUE
440             C
441             C** MISSILE VELOCITY WRT AIR MASS
442                   WNDV=.00007367*Z+5.236
443                   WND=WND0*(1.+0.6*SIN(WNDV))
444                   WXS = WND*CSWANG
445                   WYS = WND*SNWANG
446                   CALL MCALC
447             C
448             C** ANGLE OF ATTACK COMPONENTS
449             C** TERMS FOR EQUATIONS OF MOTION
450             C** AERO AND CONTROL FORCES AND MOMENTS
451             C**   SUBROUTINE FORMGN CALCULATES FORCES AND MOMENTS FOR THE DIFEQ EQUATIONS
452                   CALL FORMGN
453             C
454             C***SUBROUTINE DIFEQ CONSTRUCTS THE EQUATIONS OF MOTION
455                   CALL DIFEQ
456                   IF(IPCPAVE9.GT.0) TO 5150
457                   IF(TIME.LT.T1)GO TO 406
458                   IF(.NOT.FLG0)GO TO 6666
459                   PRINT 90001,IPRINT=2,FLG0,.NOT.FLG0
460             6666  CONTINUE
461                   NX=33
462             C
463             C**   SUBROUTINE EDSKRGYRO CONSTRUCTS THE SEEKER GYRO MODEL FOR ED
464                   CALL EDSKRGYRO
465             5203  CONTINUE
466             C
467             C**   FC AUTOPILOT
468                   CALL EOAP
469                   GO TO 226
470             C
471             C     ENGINEERING DESIGN AUTOPILOT
472             C
473             5150  IF(TIME.LT.T  E3)GO TO 401
474                   IF(.NOT.FLG5)GO TO 6671                                  FLG5
475                   PRINT 90010,IPRINT=2,FLG5,.FALSE.                        FLG5
476             6671  CONTINUE                                                 FLG5
477                   NX = 32
478                   DEFG7=KS*YAWERR
```

```
C***CANISEEKER
C**** CANISEEKER UNTIL ACQUISITION(IACQ=2)
      OMEGY=KS*(THTAC-THTAS)
      IF(IACQ.EQ.2) OMEGY=KS*PITERR
      IF(ABS(OMEGY).GT..10472) OMEGY=SIGN(.10472,OMEGY)
      IF(ABS(OMEGZ).GT..10472) OMEGZ=SIGN(.10472,OMEGZ)
C     IDEAL GYRO
      QSA=RS21*P+RS22*Q+RS23*R
      RSA=RS31*P+RS32*Q+RS33*R
      F1=(OMEGY-QSA)/COS(PSIS)
      F3=OMEGZ-RSA
      CPSIS=COS(PSIS)
      IF(ISKR.EQ.1)F1=(OMEGY-RSA)/CPSIS
      IF(ISKR.EQ.1)F3=OMEGZ-QSA
      F4=0.
      F5=0.
      LAMPR = OMEGY
      LAMYR = OMEGZ
      IF(IACQ.NE.2)LAMPR=LAMYR=0.
C        GYRO EQUATIONS FOLLOW
      DTHTAS=F1
      DTGAS=F2
      DPSIS=F3
      DPSISD=F4
      DOMEGA=F5
C
C***  ROLL RATE GYRO
 401  CONTINUE
      IF (TIME.LT.TIME1)GO TO 406
C***  ROLL GYRO EQS
      TMP3 = SIN(RTHTA)
      TMP4 = COS(RTHTA)
      DRTHTA = (P*TMP4-R*TMP3)*TAN(RPSI)-G
      DRPSI = -(P*TMP3+R*TMP4)
C***RATE DAMPING OF GIMBAL ANGLES
C     IF (TIME.LT.TIME4)GO TO 301
      IF (TIME.LT.TIME3)GO TO 301
      DTXED=-BD*(TXED-KG*THTAS)
      THRBS=BD*(KQ*THTAS-TXED)
      DPXED=-BD*(PXED-KG*PSIS)
      PSRBS=BD*(KQ*PSIS-PXED)
      THBS=KROL*THRBS+THTAS
      PSBS=KROL*PSRBS+PSIS
C***DEAD BAND ZONE FOR PSBS,THBS
      IF(ABS(THBS).LE.GAMLB) GO TO 160
      THBS = KOL*(THBS-SIGN(GAMLB,THBS))
      GO TO 161
  160 THBS=0.
  161 IF(ABS(PSBS).LE.GAMLB) GO TO 162
      PSBS = KOL*(PSBS-SIGN(GAMLB,PSBS))
      GO TO 163
  162 PSBS=0.
  163 CONTINUE                                                   WILL
C *** GUIDANCE FILTER
C***KO AND LAMBI ARE TIME CONTROLLED CONSTANTS
  164 CONTINUE
      PED=LAMPR+LAMBI+KB*THTAS
      YED=LAMYR
      DPEF=-BF*(PEF-KG*PED)
      DYEF=-BF*(YEF-KG*YED)
      IF(ABS(PEF).GT.GC)PEF=SIGN(GC,PEF)
      IF(ABS(YEF).GT.GC)YEF=SIGN(GC,YEF)
```

```
                PEG*THRBS+THBS+PFF
                YEG*PSRBS+PSBS+YFF
                PEG = -PEG
                IF(ABS(PEG).GT.PCL)PEG=SIGN(PCL,PEG)
                IF(ABS(YEG).GT.YCL)YEG=SIGN(YCL,YEG)
C***ROLL DECOUPLER
 301  CONTINUE
      IF (TIME.LE.TIME3)GO TO 406
      GO TO(1401,1402),IROLLDC
 1401 CONTINUE
C*****PREVIOUS ROLL DECOUPLER
      IF(IACC.EQ.2 .AND. TIME.GT.TIME4 .AND. NULSKR.EQ.2) GO TO 300
      RLAMY=-PSIS
      RLAMP=THTAS-RTHTA
      GO TO 302
 300  CONTINUE
      CRLAMY=LAMYR
      CRLAMP=LAMPR
 302  CONTINUE
      RICY=-PSIS
      RICP=THTAS-RTHTA
      REC=RICP-RLAMP
      REN=RICY-RLAMY+RPSI
 305  CONTINUE
      IF(RED.LT.-4363)RED=-4363
      IF(RED.GT.1.7453) RED=1.7453
      RET=REN/RED
      PHIG=2.*RET
      GO TO 1404
 1402 CONTINUE
C*****LATEST ROLL DECOUPLER
      DRLAMY=PRS*(PSIS-RLAMY)
      IF(IACC.EQ.2)DRLAMY=0.
      REN=S1*RPSI+S2*RLAMY+S3*PSIS
      RED=S4*THTAS-S5*RTHTA
      IF(ABS(RET).LT.RTOL)GO TO 304
C***CHECK FOR SATURATION
      IF(ABS(PHIMAX-ABS(RET)).LT.RTOL.AND.RED.LT.REN/RET)GO TO 306
C****
 304  RET=SIGN(1.57,REN)
      IF(RED.GT.0.)RET=REN/RED
 306  CONTINUE
      IF(ABS(RET).GT.PHIMAX)RET=SIGN(PHIMAX,RET)
      PHIG=RET
 1404 CONTINUE
      CRPHIG=-BG*RPHIG+RG*(1.-BG/AF)*PHIG
      REF=(RG/AF)*PHIG+RPHIG
      REF=-KP*REF
      IF(ABS(REF).GT..17453) REF=SIGN(.17453,REF)
 303  CONTINUE
      REG=REF+RVBIAS
C
C** CONTROL SYSTEM, CANARDS FOR EACH PLANE ON COMMON SHAFT
 307  CONTINUE
      IF(IACC.EQ.2 .AND. NULSKR.EQ.2) GO TO 226
 221  CONTINUE
      YEG=0.
      PEG=0.
 226  CONTINUE
      CALL CONTRL
C** 4TH ORDER RUNGE KUTTA INTEGRATION
 406  CONTINUE
```

```
603                IF(KUTTA .NE. 1)    38 TO 40
  18               CALL BSVGTAPE(IE,SNGL(TIME),GTHASD,THASD,GPSISD,PSISD,THTAS,PSIS)
604          29    CONTINUE
605          C
606          C     PROCESS TIC MARKS ON CHANNELS 0 AND A
607          C
608                TICL=0.
609                IF(TIME.LT.DBLE(TIC))GO TO 1777
610          C
611          C     SET EVENT LEVEL
612          C
613                IF(KAGE.EQ.2)TICL=TICL+.1
614                IF(NULL.EQ.2)TICL=TICL+.2
615                TICS=TIC+TICI
616                TICL=TICL+.05
617          C
618          C     SET ACQUISITION SIGN
619          C
620                IF(IACQ.EQ.2)TICL=-TICL
621          1777  CONTINUE
622                PHD=ATAN2(SIN(PHI),COS(PHI))
623          C
624          C     PROCESS MDAC BUFFER
625          C
626                MDAC(01)=TICL/SF0                    ;MDAC(09)=TICL/SF8
627                MDAC(02)=(ALT+4000.)/SF1             ;MDAC(10)=R2D*GMEGY/SF9
628                MDAC(03)=T0TACC/SF2                  ;MDAC(11)=R2D*PEFL/SF10
629                MDAC(04)=R2D*THTAS/SF3               ;MDAC(12)=R2D*THRBS/SF11
630                MDAC(05)=R2D*PSIS/SF4                ;MDAC(13)=R2D*PEG/SF12
631                MDAC(06)=R2D*DELR0L/SF5              ;MDAC(14)=R2D*THRBS/SF13
632                MDAC(07)=R2D*DELVY/SF6               ;MDAC(15)=R2D*ORLAMY/SF14
633                MDAC(08)=R2D*DELVP/SF7               ;MDAC(16)=R2D*THTA/SF15
634          C
635          C     LIMIT MDAC OUTPUT
636          C
637                DO 1492 I=1,16
638                IF(ABS(MDAC(I)).GT.0.9999)MDAC(I)=SIGN(.9999,MDAC(I))
639          1492  CONTINUE
640          C
641          C     OUTPUT MDAC VALUES
642          C
643          X     CALL MDACS(0,16,MDAC)
644          X     IERR=ISVGTAPE(SNGL(TIME),R2D*TXED)
645                PRNTNEXT=PRINTM+1.E-6
646                IF(TIME.LT.PRNTNEXT.AND.IPRINT.EQ.1)GO TO 72
647                IF(TIME.GE.PRNTNEXT)PRINTM=PRINTM+DINT(DT)
648                IPRINT=1
649             70 TMP1=SIN(PHI)
650                TMP2=COS(PHI)
651                PHD=ATAN2(TMP1,TMP2)
652          C----------------------------------------------------------------------C
653          C                                                                      C
654          C                        L I N E   P R I N T E R   I / O               C
655          C                                                                      C
656          C----------------------------------------------------------------------C
657                IF(GATE(001))GO TO 1661
658                PRINT 90007
659                PRINT 90000,4,4HBEGI,4HN-EX,4HECUT,4HION,
660               14HBF  ,4H    ,BF      ,4HRTOL,4H    ,RTOL,
661               14HBG  ,4H    ,BG      ,4HRA  ,4H    ,BA,
662               14HBRS ,4H    ,BRS     ,4HKP  ,4H    ,KP,
663               14HBRS ,4H    ,BRS     ,4HKQ  ,4H    ,KQ,
```

```
664   14HBT1 ,4H    ,BT1    ,4HBT2 ,4H    ,BT2    ,
665   14HCPT ,4H    ,CPT    ,4HSTT ,4H    ,STT    ,
666   14HCS  ,4H    ,CS     ,4HFFCM,4HB   ,FFCMB,
667   14HCTT ,4H    ,CTT    ,4HRAPT,4HM3  ,RAPTM3 ,
668   14HD   ,4H    ,D      ,4HKG  ,4H    ,KG,
669   14HDELM,4HY   ,DELMY  ,4HEDO ,4H    ,EDO    ,
670   14HED1 ,4H    ,ED1    ,4HED2 ,4H    ,ED2    ,
671   14HED3 ,4H    ,ED3    ,4HED4 ,4H    ,ED4    ,
672   14HED5 ,4H    ,ED5    ,4HKT10,4H    ,KT10   ,
673   14HFFAL,4HB   ,FFALB  ,4HYCL ,4H    ,YCL,
674   14HFFAN,4HB   ,FFANB  ,4HGF  ,4H    ,GF,
675   14HFFCL,4HB   ,FFCLB  ,4HFFAZ,4HB   ,FFAZB,
676   14HFFCN,4HB   ,FFCNB  ,4HFFAM,4HB   ,FFAMB,
677   14HGAML,4HB   ,GAMLB  ,4HPHFB,4HV   ,PHFBV,
678   14HGC  ,4H    ,GC     ,4HFFAX,4HB   ,FFAXB,
679   14HIACT,4H    ,IACT   ,4HIRBL,4HLDC ,IRBLLDC ,
680   14HIDUM,4H    ,IDUM   ,
681   14HIFUF,4HB   ,IFUFB  ,4HNULL,4H    ,NULL   ,
682   14HIRBL,4HL   ,IRBLL  ,4HKT20,4H    ,KT20   ,
683   14HISKR,4H    ,ISKR   ,4HS5  ,4H    ,S5     ,
684   14HIT  ,4H    ,IT     ,4HFBGN,4H    ,FBGN,
685   14HIX  ,4H    ,IX     ,4HBD  ,4H    ,BD,
686   14HIYZ ,4H    ,IYZ    ,4HR2  ,4H    ,R2     ,
687   14HK4  ,4H    ,K4     ,4HPCA ,4H    ,PCA,
688   14HKB  ,4H    ,KB     ,4HRVBI,4HAS  ,RVBIAS,
689   14HKC  ,4H    ,KC     ,4HTHTG,4HL   ,THTGL  ,
690   14HKGL ,4H    ,KGL    ,4HFFAY,4HB   ,FFAYB,
691   14HKPC ,4H    ,KPC    ,4HT1P5,4H    ,T1P5   ,
692   14HKRGL,4H    ,KRGL   ,4HAF  ,4H    ,AF,
693   14HKS  ,4H    ,KS     ,4HKM  ,4H    ,KM     ,
694   14HLAMB,4HI   ,LAMBI  ,4HJMAX,4H    ,JMAX   ,
695   14HMASS,4H    ,MASS   ,4HCG  ,4H    ,CG,
696   14HNRUN,4H    ,NRUN   ,
697   14HPCL ,4H    ,PCL    ,4HIA  ,4H    ,IA,
698   14HPHIM,4HAX  ,PHIMAX ,4HS8  ,4H    ,S8     ,
699   14HPRIN,4HTM  ,PRINTM ,4HJMAX,4H    ,JMAX   ,
700   14HRAPT,4HM2  ,RAPTM2 ,4HRAPT,4HM1  ,RAPTM1 ,
701   14HRDET,4H    ,RDET   ,4HDTA ,4H    ,DTA    ,
702   14HRFLE,4HCT  ,RFLECT ,4HPI  ,4H    ,PI,
703   14HRLAM,4HP   ,RLAMP  ,4HPSIT,4H    ,PSIT   ,
704   14HRLAM,4HY   ,RLAMY  ,4HRPSI,4H    ,RPSI   ,
705   14HRNGL,4HIN  ,RNGLIN ,4HVRAT,4HF   ,VRATF,
706   14HRTMI,4HN   ,RTMIN  ,4HKM  ,4H    ,KM     ,
707   14HS7  ,4H    ,S7     ,4HS6  ,4H    ,S6     ,
708   14HS10 ,4H    ,S10    ,4HS9  ,4H    ,S9     ,
709   14HS12 ,4H    ,S12    ,4HS11 ,4H    ,S11    ,
710   14HS4  ,4H    ,S4     ,4HS3  ,4H    ,S3     ,
711   14HS2  ,4H    ,S2     ,4HS1  ,4H    ,S1     ,
712   14HS   ,4H    ,S      ,4HDELM,4HX   ,DELMX  ,
713   14HSF0 ,4H    ,SF0    ,4HSF1 ,4H    ,SF1    ,
714   14HSF2 ,4H    ,SF2    ,4HSF3 ,4H    ,SF3    ,
715   14HSF4 ,4H    ,SF4    ,4HSF5 ,4H    ,SF5    ,
716   14HSF6 ,4H    ,SF6    ,4HSF7 ,4H    ,SF7    ,
717   14HSF8 ,4H    ,SF8    ,4HSF9 ,4H    ,SF9    ,
718   14HSF10,4H    ,SF10   ,4HSF11,4H    ,SF11   ,
719   14HSF12,4H    ,SF12   ,4HSF13,4H    ,SF13   ,
720   14HSF14,4H    ,SF14   ,4HSF15,4H    ,SF15,
721   14HSLAP,4HE2  ,SLAPE2 ,4HSLOP,4HF1  ,SLOPF1 ,
722   14HTC1 ,4H    ,TC1    ,4HTO  ,4H    ,TO     ,
723   14HTC3 ,4H    ,TC3    ,4HTO2 ,4H    ,TO2    ,
724   14HTC5 ,4H    ,TC5    ,4HTO4 ,4H    ,TO4    ,
725   14HTC7 ,4H    ,TC7    ,4HTO6 ,4H    ,TO6    ,
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                14HT2  ,4H     ,T2       ,4HT1  ,4H     ,T1       ,
                14HTB  ,4H     ,TB       ,4HSPT ,4H     ,SPT      ,
                14HTHPL,4HD    ,THPLD,
                14HTHTA,4HC    ,THTAC    ,4HKD  ,4H     ,KD,
                14HTHET,4HAT   ,THETAT   ,4HIRAP,4H     ,IRAP     ,
                14HTHBL,4HD    ,THBLC    ,
                14HTIC ,4H     ,TIC      ,4HTIC1,4H     ,TIC1,
                14HTIME,4H3    ,TIME3    ,4HTIME,4H2    ,TIME2    ,
                14HTIME,4H1    ,TIME1    ,4HTIME,4H0    ,TIME0    ,
                14HTIP1,4H     ,TIP1     ,4HDT  ,4H     ,DT       ,
                14HYMFB,4HV    ,YMFBV    ,4HK5  ,4H     ,K5,
                14HZMIN,4H     ,ZMIN     ,4HTIME,4H4    ,TIME4    ,
                14HWNCB,4H     ,WNCB     ,4HZMIN,4H     ,ZMIN
                GATE(001)=SET
          1661  CONTINUE
                PRINT 90007
                PRINT 90000,4,4HPRBJ,4HECTI,4HLE1 ,4H     ,
                14HTIME,4H     ,TIME     ,4HRSA ,4H     ,RSA      ,
                14HDELV,4HP    ,DELVP    ,4HU   ,4H     ,U        ,
                14HV   ,4H     ,V        ,4HW   ,4H     ,W        ,
                14HTHTA,4H     ,THTA     ,4HPHD ,4H     ,PHD      ,
                14HDELZ,4H     ,DELZ     ,4HTBTA,4HCC   ,TBTACC   ,
                14HDZ  ,4H     ,DZ       ,4HDY  ,4H     ,DY       ,
                14HDPHI,4H     ,DPHI     ,4HDTHT,4HA    ,DTHTA    ,
                14HDX  ,4H     ,DX       ,4HDPSI,4H     ,DPSI     ,
                14HDR  ,4H     ,DR       ,4HDQ  ,4H     ,DQ       ,
                14HDP  ,4H     ,DP       ,4HDW  ,4H     ,DW       ,
                14HDU  ,4H     ,DU       ,4HDV  ,4H     ,DV       ,
                14HVRW ,4H     ,VRW      ,4HMACH,4H     ,MACH     ,
                14HGAP ,4H     ,GAP      ,4HPSI ,4H     ,PSI      ,
                14HP   ,4H     ,P        ,4HQ   ,4H     ,Q        ,
                14HR   ,4H     ,R        ,4HDELV,4HY    ,DELVY    ,
                14HAZB ,4H     ,AZB      ,4HDELX,4HV    ,DELXV    ,
                14HDELY,4HV    ,DELVY    ,4HDELZ,4HV    ,DELZV    ,
                14HX   ,4H     ,X        ,4HY   ,4H     ,Y        ,
                14HZ   ,4H     ,Z        ,4HAMB ,4H     ,AMB      ,
                14HXT  ,4H     ,XT       ,4HYT  ,4H     ,YT       ,
              1*
                14HDTHT,4HA    ,DTHTA    ,
              1*
                14HCPHI,4H     ,CPHI     ,4HSPHI,4H     ,SPHI     ,
                14HCPSI,4H     ,CPSI     ,4HSPSI,4H     ,SPSI     ,
                14HCPSI,4HS    ,CPSIS    ,4HGZB ,4H     ,GZB      ,
              1*
                14HGYB ,4H     ,GYB      ,4HGXB ,4H     ,GXB
                PRINT 90000,4,4HAUTB,4HPILB,4HT1  ,4H     ,
                14HDDPH,4HIO   ,DDPHIO   ,
                14HDELX,4HS    ,DELXS    ,4HPEG ,4H     ,PEG      ,
                14HDELM,4HIS   ,DELMIS   ,4HTXED,4H     ,TXED     ,
                14HDELZ,4HS    ,DELZS    ,4HOMEG,4HA    ,OMEGA    ,
                14HDYEF,4H     ,DYEF     ,4HDPEF,4H     ,DPEF     ,
                14HDTHT,4HAS   ,DTHTAS   ,4HRTM ,4H     ,RTM      ,
                14HKT  ,4H     ,KT       ,4HPEFL,4H     ,PEFL,
                14HNULL,4H     ,NULL     ,4HDELP,4H     ,DELP     ,
                14HOMEG,4HZ    ,OMEGZ    ,4HPSPG,4H     ,PSPG     ,
                14HPED ,4H     ,PED      ,4HPEF ,4H     ,PEF      ,
                14HPITE,4HRB   ,PITERB   ,4HPHIG,4H     ,PHIG,
                14HPSIS,4H     ,PSIS     ,
                14HPXED,4H     ,PXED     ,4HTHBS,4H     ,THBS     ,
                14HPSBS,4H     ,PSBS     ,4HDEL1,4H     ,DEL1     ,
                14HRLAM,4HY    ,RLAMY    ,4HRLAM,4HP    ,RLAMP    ,
                14HTHTA,4HS    ,THTAS    ,4HTHRB,4HS    ,THRBS    ,
                14HYEF ,4H     ,YEF      ,4HPEF ,4H     ,PEF      ,
                14HYED ,4H     ,YED      ,4HPED ,4H     ,PED      ,
                14HYEF ,4H     ,YEF      ,4HYBRG,4H     ,YBRG     ,
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```
      14HYEG ,4H    ,YEG     ,4HDELY,4HS   ,DELYS   ,
      14HYAWE,4HRR  ,YAWERR  ,4HYAWE,4HRB  ,YAWERB  ,
      14HLAMY,4HR   ,LAMYR   ,4HLAMP,4HR   ,LAMPR   ,
      14HGSA ,4H    ,GSA     ,4HCAPS,4H    ,CAPS    ,
      14HDPSI,4HS   ,DPSIS   ,4HIACC,4H    ,IACC    ,
      14HPSRB,4HS   ,PSRBS   ,4HREN ,4H    ,REN
       PRINT 90000,2,4HLOGI,4HC!  ,
      14HGATE,4H   1,GATE(001),4HGATE,4H   2,GATE(002),
      24HGATE,4H   3,GATE(003),4HGATE,4H   4,GATE(004),
      24HGATE,4H   5,GATE(005),4HGATE,4H   6,GATE(006),
      34HGATE,4H   7,GATE(007)
       PRINT 90000,4,4HAERO,4HDYNA,4HMICS,4H!  ,
      14HCLD ,4H    ,CLD     ,4HALB ,4H    ,ALB     ,
      14HCNR ,4H    ,CNR     ,4HCMC ,4H    ,CMC     ,
      14HCY  ,4H    ,CY      ,4HCAZ ,4H    ,CAZ     ,
      14HCLP ,4H    ,CLP     ,4HCN  ,4H    ,CN      ,
      14HCYCG,4H    ,CYCG    ,4HCMCG,4H    ,CMCG    ,
      14HANB ,4H    ,ANB     ,4HCLB ,4H    ,CLB     ,
      14HCMB ,4H    ,CMB     ,4HCNB ,4H    ,CNB     ,
      14HTHAS,4HD   ,THASD   ,4HDTHA,4HSD  ,DTHASD  ,
      14HPSIS,4HD   ,PSISD   ,4HDPSI,4HSD  ,DPSISD  ,
      14HALPH,4HA   ,ALPHA   ,4HBETA,4H    ,BETA
       PRINT 90000,1,4HRAP!,
      14HSTT ,4H    ,STT     ,4HCTT ,4H    ,CTT     ,
      14HSPT ,4H    ,SPT     ,4HCPT ,4H    ,CPT    ,
      14HTH  ,4H    ,TH      ,4HXLTA,4H    ,XLTA
       PRINT 90000,3,4HDEBU,4HG PR,4HINT!,
      14HDELX,4HB   ,DELXB   ,4HDELY,4HB   ,DELYB,
      14HDELZ,4HB   ,DELZB   ,4HDELX,4HS   ,DELXS,
      14HDELY,4HS   ,DELYS   ,4HDELZ,4HS   ,DELZS,
      14HKUTT,4HA   ,KUTTA   ,
      14HPITE,4HRR  ,PITERR  ,4HYAWE,4HRR  ,YAWERR,
      14HPITE,4HRB  ,PITERB  ,4HYAWE,4HRB  ,YAWERB,
      34HDRLA,4HMY  ,DRLAMY  ,4HF3  ,4H    ,F3      ,
      34HDRPS,4HI   ,DRPSI   ,4HDRTH,4HTA  ,DRTHTA  ,
      34HDRPH,4HIG  ,DRPHIG  ,4HRPHI,4HG   ,RPHIG   ,
      14HDELV,4HR   ,DELVR   ,4HDPHI,4HC   ,DPHIC   ,
      14HG   ,4H    ,G       ,4HVSND,4H    ,VSND    ,
      14HISKR,4H    ,ISKR    ,4HIACT,4H    ,IACT    ,
      14HIOUI,4HCE  ,IOUICE  ,4HIRAP,4H    ,IRAP    ,
      14HKAGE,4H    ,KAGE    ,4HNAVY,4H    ,NAVY    ,
      34HF1  ,4H    ,F1      ,4HDRLA,4HMP  ,DRLAMP  ,
      14HNUM ,4H    ,NUM     ,4HIPRI,4HNT  ,IPRINT  ,
      14HNPPS,4H    ,NPPS    ,4HNDT ,4H    ,NDT     ,
      14HNDTA,4H    ,NDTA    ,4HNULS,4HKR  ,NULSKR  ,
      34HPEFL,4H    ,PEFL    ,4HPHIG,4H    ,PHIG    ,
      14HRHO ,4H    ,RHO     ,
      14HS2  ,4H    ,S2      ,4HDELR,4HAL  ,DELRAL  ,
      14HRED ,4H    ,RED     ,4HRET ,4H    ,RET     ,
      14HREG ,4H    ,REG     ,4HRPSI,4H    ,RPSI    ,
      14HRTHT,4HA   ,RTHTA   ,
      14HOMEG,4HY   ,OMEGY   ,4HOMEG,4HZ   ,OMEGZ   ,
      14HNX  ,4H    ,NX
   72  IF(IMPACT)PRINT 90000,2,4HIMPA,4HCT! ,
      14HPCAT,4H    ,PCAT    ,4HPCAX,4H    ,PCAX    ,
      14HPCAY,4H    ,PCAY    ,4HPCAZ,4H    ,PCAZ    ,
      14HPCA ,4H    ,PCA
       IF(IMPACT .OR. ERROR)            R E T U R N          END RUN
   50  C O N T I N U E
C
C      DISPLACEMENT ERRORS FROM AIM POINT
C
```

```
851             C       DISPLACEMENT ERRORS FROM SPOT
852                     DELX=XT-X
853                     DELY=YT-Y
854                     DELZ=ZT-Z
855                     IF (TIME.LT.TIME3)GO TO 51
856             C
857                     IF (ABS(DEL1 ).GT.DELMY)DEL1 =SIGN(DELMY,DEL1 )
858                     IF (ABS(DELVP).GT.DELMX)DELVP=SIGN(DELMX,DELVP)
859                     IF (ABS(DEL3 ).GT.DELMY)DEL3 =SIGN(DELMY,DEL3 )
860                     IF (ABS(DDELVP).GT.VRATE)DDELVP=SIGN(VRATE,DDELVP)
861                     IF (ABS(DDEL1 ).GT.VRATE)DDEL1 =SIGN(VRATE,DDEL1 )
862                     IF (ABS(DDEL3 ).GT.VRATE)DDEL3 =SIGN(VRATE,DDEL3 )
863                     IF(IACT.GT.0)GO TO 51
864                   . DEL1 = YEG*REG
865                     DELVP = PEG
866                     DEL3 = -YEG*REG
867                     IF(IACT.EQ.2)DEL1=REG-YEG
868                     IF(IACT.EQ.2)DEL3=REG+YEG
869                51   CONTINUE
870                      R E T U R N
871             C
872                     E N T R Y   F I N I S H
873             C
874             C
875                     IF (IACC.EQ.1)GO TO 40
876                     XT = XT+DTRK*VXT
877                     YT = YT+DTRK*VYT
878                40   CONTINUE
879                     VMS=U*U+V*V+W*W
880                     VM=SQRT(VMS)
881                     TOTACC=(SQRT(AYB*AYB+AZB*AZB))/MASS
882             C*****TRAJECTORY TERMINATION
883                     IF(TIME.GT.5..AND.Z.GT.ZMIN)GO TO 45
884                     IF(Z.LT.ZMIN)GO TO 157
885                45   CONTINUE
886                     DELXT = XT-X
887                     DELYT = YT-Y
888                      ELZT = ZT-Z
889                     DELXTB=EB11*DELXT+EB12*DELYT+EB13*DELZT
890                     DELYTB=EB21*DELXT+EB22*DELYT+EB23*DELZT
891                     DELZTB=EB31*DELXT+EB32*DELYT+EB33*DELZT
892             C** LOS IN ECS
893                     VERLAM=ATAN2(-DELZ,SQRT(DELX*DELX+DELY*DELY))
894                     HORLAM=ATAN2(DELY,DELX)
895             C** TOTAL MISSILE NON-FIELD ACCELERATION
896             C
897                     GAMP=-ATAN2(W,U)
898                     RTUWS=SQRT(U*U+W*W)
899                     GAMY=ATAN2(V,RTUWS)
900             C** RCS TO VCS TRANSFORMATION
901                     CALL TRSFRV
902                     DELM1B=SQRT(DELYV**2+DELZV**2)
903                     GO TO 73
904               157   CONTINUE
905             C**** RANGE TARGET FROM MISSILE-RTM IN FEET.
906                     RTM=SQRT((XT-X)**2+(YT-Y)**2+(ZT-Z)**2)
907             C**** POINT OF CLOSEST APPROACH COMPUTATION-PCA IN FEET.
908                     IF(RTM.GT.PCA)GO TO 55
909                     PCAT=SNGL(TIME);PCAX=X;PCAY=Y;PCAZ=Z;PCA=RTM
910                55   CONTINUE
911                     GO TO 9
912               73    IMPACT=.TRUE.
```

```
                IPRINT=2
                PRINT 90000,2,4HIMPA,4HCTI  ,4HTIME,4H     ,TIME
                GO TO 9
 9999           GATE(002)=OFF
                ERROR=.TRUE.
                GO TO 70
 9998           PRINT 90000,5,4HEND=,4HOF=F,4HILE  ,4HON U,4HNITI,
               14HLS\I,4HT    ,LUNIT
                DO 3121 I=1,16
 3121           MDAC(I)=0
                DO 3122 I=1,1500
       X        CALL WDACS(0,16,MDAC)
 3122           CONTINUE
  1=            CALL BERF(IE)
  2=            CALL WERF=80
                CALL WERF=80
       X        CALL MODE('R')
       X        CALL MODE('P')
       X        CALL WERF
       X        CALL PLOT(1,'  TIME',2,'  TXED  ')
       X        CALL SGSRLS('AV      ')
                STOP
                END
```

```
      SUBROUTINE SEEKER(SRNGE,REFLEC,ERR,ERR)
      DIMENSION TRNGE(18),TRFLEC(2),THS(18,2),T ...,TER...(13),...
      DIMENSION TRAC(6)
      DATA TRNGE/100.,200.,300.,400.,500.,600.,800.,1000.,2000.,3000.,
     14000.,5000.,6000.,8000.,10000.,12000.,14000.,16000./
      DATA TRFLEC /1.25,5./
      DATA TLOS /-1.5,-1.333,-1.167,-1.,-.833,-.667,-.5,-.333,-.167,0.,
     1.167,.333,.5,.667,.833,1.,1.167,1.333,1.5/
      DATA TRAC /4.3E-14,4.6E-13,4.5E-12,4.1E-11,4.1E-10,2.6E-9/
      DATA THS/9.3E-11,2.6E-11,9.4E-12,5.6E-12,3.6E-12,2.5E-12,...,
     19.0E-13,2.1E-13,9.3E-14,5.0E-14,3.0E-14,2.2E-14,1.4E-14,7.5E-15,
     25.0E-15,3.6E-15,2.6E-15,
     33.7E-9,9.0E-10,3.7E-11,2.1E-11,1.4E-11,9.2E-12,5.0E-12,3.3E-12,
     48.4E-13,3.7E-13,2.0E-13,1.4E-13,8.4E-14,4.6E-14,3.0E-14,2.0E-14,
     51.8E-14,1.05E-14/
      DATA TERO/-2.,-2.,-1.95,-1.86,-1.8,-1.72,-1.5,-1.29,-.65,...,
     1.75,1.05,1.2,1.3,1.4,1.5,1.5,1.6,
     2-4.,-4.,-3.95,-3.85,-3.6,-3.35,-2.8,-2.1,-.85,.6,2.15,3.1,3.45,
     33.7,3.75,3.9,3.95,4.,4.,
     4-4.7,-4.7,-4.65,-4.5,-4.5,-4.2,-3.2,-2.6,-1.15,.7,2.3,3.2,3.5,3.7,
     53.75,3.8,3.9,3.9,3.9,
     6-3.5,-3.4,-3.25,-3.1,-2.9,-2.8,-2.5,-2.05,-1.15 0.,1.3,1.7,1.95,
     72.1,2.4,2.5,2.6,2.6,2.6,
     8-3.55,-3.55,-3.5,-3.4,-3.2,-3.0,-2.55,-2.5,-1.8,-.9,-.4,.05,.25,
     9.5,.7,.9,1.,1.05,1.1,
     A-2.4,-2.4,-2.35,-2.3,-2.2,-2.,-1.85,-1.,-1.1,-.95,-.8,-.5,-.35,
     B-.2,-.1,-.05,.025,.05,.05/
      DIMENSION AHS(4), AEND(4)
      DATA  IS,IR, JH/3*0/
      I =IS
      CALL FIND(I,TRNGE,18,SRNGE)
      IF(I.EQ.IS)  GO TO 10
      IS=I
      CALL  NTERP (AHS,THS,I,TRNGE,18,J,TRFLEC)
   10 HS=FUNCTION(AHS,SRNGE,REFLEC)
      RRR=ERR*57.296
      I=IS;  J=JH
      CALL FIND(I,TLOS,19,RRR)
      CALL FIND(J,TRAC,6,HS)
      IF(I.NE.IS)  GO TO 20
      IF(J.EQ.JH)  GO TO 30
   20 IS=I;  JH=J
      CALL  NTERP (AEND,TERO,I,TLOS,19,J,TRAC)
   30 END=FUNCTION(AEND,RRR,HS)
      ERR = END/4./57.296
      RETURN
      END
```

```
      SUBROUTINE AERO (T1,T2,FMACH,ALPHA,BETA,DELPIT,DELYAW,DELROL,
     1   CN,CMCG,CY,CLNCG,CA,CLP,CLD,CMQ,CMAD,CLNR,CLNAD)
C     **
C
C     INPUTS
C     T1       = TIME - SEC.
C     T2       = TIME TO START CONTROL PHASE - SEC.
C     FMACH    = FREE STREAM MACH NUMBER
C     ALPHA    = ANGLE OF ATTACK (PITCH PLANE) - DEG.
C     BETA     = ANGLE OF ATTACK (YAW PLANE) - DEG.
C     DELPIT   = CONTROL DEFLECTION ANGLE (PITCH PLANE) - DEG.
C     DELYAW   = CONTROL DEFLECTION ANGLE (YAW PLANE) - DEG.
C     DELROL   = CONTROL DEFLECTION (ROLL) - DEG)
C
C     OUTPUT
C     CN       = NORMAL FORCE COEFF.
C     CMCG     = PITCHING MOMENT COEFF.
C     CY       = YAW FORCE COEFF.
C     CLNCG    = YAW MOMENT COEFF.
C     CA       = AXIAL FORCE COEFF.
C     CLP      = ROLL DAMPING COEFF. - (1/RAD)
C     CLD      = ROLL MOMENT COEFF. - (1/DEG)
C     CMQ      = PITCH DAMPING COEFF. DUE TO THETA DOT
C     CMAD     = PITCH DAMPING COEFF. DUE TO ALPHA DOT
C     CLNR     = YAW DAMPING COEFF. DUE TO PSI DOT
C     CLNAD    = YAW DAMPING COEFF. DUE TO ALPHA DOT
C
C     TABLES
C     TCA1     = TABLE OF CN   FOR CONTROL PHASE
C     TCMCG1   = TABLE OF CMCG FOR CONTROL PHASE
C     TCA1     = TABLE OF CA   FOR CONTROL PHASE
C     TCN2     = TABLE OF CN   FOR BALLISTIC PHASE
C     TCMCG2   = TABLE OF CMCG FOR BALLISYIC PHASE
C     TCA2     = TABLE OF CA   FOR BALLISTIC PHASE
C     TDELT1   = TABLE OF DELTA FOR CN,CMCG
C     TMACH1   = TABLE OF FMACH FOR CONTROL PHASE
C     TMACH2   = TABLE OF FMACH FOR BALLISTIC PHASE
C     TMACH3   = TABLE OF FMACH FOR CLP,CLD
C     TMACH4   = TABLE OF FMACH FOR CMQ
C     TMACH5   = TABLE OF FMACH FOR CA (BALLISTIC PHASE)
C
      DOUBLE PRECISION T1,T2
      DIMENSION TALP(6),TDEL(7),          TCN1(6,7,3),TCA2(6,5)
      DIMENSION TCMCG1(6,7,3),TCMCG2(6,5),TCA1(6,7,3),TCA2(15)
      DIMENSION TCLP(8),TCLD(8),TCMQ(10,5),TALP4(10)
      DIMENSION TMACH1(3),TMACH2(5),TMACH3(8),TMACH4(8),TMACH5(15)
      DIMENSION ACN(8),   ACMCG(8), ACY(8),ACLNCG(8),ACAP(8),
     1 ACAB(8),  ACAB(8),ACLP(2),    ACLD(2),  ACMQ(6),  ACLNR(6)
      DIMENSION ISAVE(13)
      DATA      ISAVE     /13*0/
      DATA TCN1  /
     X    -1.25     ,-.9      ,-.1      ,.94      ,1.96     ,3.19     ,  -20 ,A
     X    -1.2      ,-.6      ,.4       ,1.35     ,2.4      ,3.39     ,  -15 ,A
     X    -1.       ,-.06     ,.87      ,1.81     ,2.72     ,3.45     ,  -10 ,A
     X    -.44      ,.35      ,1.32     ,2.19     ,2.74     ,3.6      ,   -5 ,A
     X     .0       ,.93      ,1.8      ,2.29     ,2.96     ,3.8      ,    0 ,A
     X     .4       ,1.3      ,1.84     ,2.3      ,2.95     ,3.95     ,    5 ,A
     X     .95      ,1.4      ,1.85     ,2.43     ,3.2      ,4.03     ,   10 ,A
     X    -1.35     ,-.9      ,-.2      ,1.05     ,2.1      ,3.3      ,  -20 ,B
     X    -1.25     ,-.65     ,.4       ,1.48     ,2.54     ,3.67     ,  -15 ,B
     X    -1.1      ,-.29     ,.95      ,1.9      ,2.89     ,3.89     ,  -10 ,B
     X    -.56      ,.4       ,1.45     ,2.29     ,3.1      ,4.08     ,   -5 ,B
```

```
     X    .0      ,1.05     ,1.85     ,2.54     ,3.31     ,4.28     ,      [illegible] .[illegible]
     X    .48     ,1.38     ,1.95     ,2.64     ,3.4[illegible]     ,4.39     ,      [illegible] .[illegible]
     X    1.      ,1.56     ,2.1      ,2.8      ,3.56     ,4.5      ,      1 .[illegible]
     X    -.2.    ,-1.17    ,.62      ,1.23     ,2.5      ,4.13     ,    -20 1.[illegible]
     X    -1.7    ,-.64     ,.59      ,1.7      ,3.26     ,4.65     ,    -15 1.[illegible]
     X    -1.2    ,.0       ,1.       ,2.24     ,3.62     ,5.05     ,    -10 1.[illegible]
     X    -.6     ,.48      ,1.56     ,2.75     ,4.05     ,5.23     ,     -5 1.
     X    .0      ,1.05     ,2.2      ,3.3      ,4.25     ,5.32     ,      0 1.0
     X    .43     ,1.6      ,2.6      ,3.44     ,4.28     ,5.38     ,      5 1.0
     X    1.      ,2.1      ,2.85     ,3.5      ,4.34     ,5.41     /     10 1.0
      DATA TCN2 /
     X    .0      ,.93      ,1.8      ,2.29     ,2.94     ,3.8      ,      0 .4
     X    .0      ,1.05     ,1.85     ,2.64     ,3.31     ,4.28     ,      0 .8
     X    .0      ,1.05     ,2.2      ,3.3      ,4.25     ,5.32     ,      0 1.0
     X    .0      ,.85      ,1.8      ,2.85     ,4.2      ,5.6      ,      0 1.3
     X    .0      ,.69      ,1.4      ,2.5      ,3.5      ,5.5      /      0 1.8
      DATA TCMC01 /
     X    3.6     ,4.       ,3.35     ,2.35     ,1.8      ,1.3      ,    -20 .4
     X    3.4     ,3.12     ,1.9      ,1.1      ,.8       ,.4       ,    -15 .4
     X    2.84    ,1.57     ,.53      ,-.25     ,-.5      ,.2       ,    -10 .4
     X    1.28    ,.37      ,-.75     ,-1.32    ,-.70     ,-.3      ,     -5 .4
     X    .0      ,-1.25    ,-2.1     ,-1.82    ,-1.2     ,-.96     ,      0 .4
     X    -1.1    ,-2.35    ,-2.2     ,-1.7     ,-1.5     ,-1.35    ,      5 .4
     X    -2.7    ,-2.9     ,-2.28    ,-2.05    ,-1.94    ,-1.65    ,     10 .4
     X    3.25    ,4.       ,3.6      ,2.16     ,1.7      ,1.8      ,    -20 .8
     X    3.6     ,3.2      ,1.95     ,.88      ,.3       ,.41      ,    -15 .8
     X    3.1     ,1.68     ,.35      ,-.4      ,-.7      ,-.25     ,    -10 .8
     X    1.88    ,.3       ,-1.08    ,-1.5     ,-1.15    ,-.83     ,     -5 .8
     X    .0      ,-1.7     ,-2.28    ,-2.2     ,-1.98    ,-1.82    ,      0 .8
     X    -1.2    ,-2.87    ,-2.56    ,-2.5     ,-2.35    ,-1.8     ,      5 .8
     X    -3.94   ,-3.1     ,-3.      ,-2.98    ,-2.7     ,-2.16    ,     10 .8
     X    5.9     ,4.96     ,3.17     ,1.98     ,1.3      ,1.       ,    -20 1.0
     X    4.98    ,3.32     ,1.82     ,.53      ,.4       ,-.79     ,    -15 1.0
     X    3.05    ,1.4      ,.27      ,-1.12    ,-2.2     ,-2.1     ,    -10 1.0
     X    1.7     ,.02      ,-1.42    ,-3.0     ,-3.5     ,-2.72    ,     -5 1.0
     X    .0      ,-1.65    ,-3.32    ,-4.4     ,-4.1     ,-3.04    ,      0 1.0
     X    -1.23   ,-3.3     ,-4.57    ,-4.75    ,-4.3     ,-3.2     ,      5 1.0
     X    -2.98   ,-4.7     ,-5.27    ,-4.9     ,-4.45    ,-3.38    /     10 1.0
      DATA TCMC02 /
     X    .0      ,-1.25    ,-2.1     ,-1.82    ,-1.2     ,-.96     ,      0 .4
     X    .0      ,-1.7     ,-2.28    ,-2.2     ,-1.98    ,-1.82    ,      0 .8
     X    .0      ,-1.68    ,-3.32    ,-4.4     ,-4.1     ,-3.04    ,      0 1.0
     X    .0      ,-.9      ,-1.8     ,-2.38    ,-2.17    ,-.65     ,      0 1.3
     X    .0      ,-.28     ,-.48     ,-.87     ,-.87     ,-.67     /      0 1.8
      DATA TCA1 /
     X    .71     ,.69      ,.55      ,.383     ,.176     ,-.03     ,    -20 .4
     X    .585    ,.506     ,.382     ,.26      ,.173     ,-.02     ,    -15 .4
     X    .435    ,.38      ,.275     ,.169     ,.102     ,.09      ,    -10 .4
     X    .328    ,.311     ,.26      ,.26      ,.245     ,.22      ,     -5 .4
     X    .295    ,.294     ,.313     ,.341     ,.323     ,.19      ,      0 .4
     X    .32     ,.366     ,.412     ,.496     ,.425     ,.404     ,      5 .4
     X    .42     ,.47      ,.502     ,.57      ,.529     ,.5       ,     10 .4
     X    .75     ,.767     ,.652     ,.419     ,.24      ,.061     ,    -20 .8
     X    .64     ,.386     ,.435     ,.298     ,.151     ,.068     ,    -15 .8
     X    .51     ,.419     ,.348     ,.25      ,.196     ,.153     ,    -10 .8
     X    .375    ,.352     ,.305     ,.301     ,.29      ,.26      ,     -5 .8
     X    .338    ,.338     ,.381     ,.390     ,.403     ,.387     ,      0 .8
     X    .373    ,.429     ,.482     ,.51      ,.599     ,.519     ,      5 .8
     X    .475    ,.53      ,.581     ,.635     ,.65      ,.66      ,     10 .8
     X    1.23    ,1.11     ,.88      ,.685     ,.47      ,.216     ,    -20 1.0
     X    1.06    ,.855     ,.705     ,.56      ,.363     ,.175     ,    -15 1.0
     X    .79     ,.673     ,.61      ,.515     ,.356     ,.226     ,    -10 1.0
```

```
125                 X    .643     ,.605     ,.58      ,.54      ,.456     ,.382     ,   .5 1.
126                 X    .582     ,.61      ,.595     ,.58      ,.54      ,.50      ,   .3 1.
127                 X    .63      ,.685     ,.753     ,.775     ,.769     ,.74      ,   .5 1.
128                 X    .73      ,.83      ,.90      ,.918     ,.92      ,.89      ,  1.0 1.
129                  DATA TCA2               / .31,.314,.32,.332,.347,.428,.505,.58,
130                 X  .615,.639,.645,.639,.628,.60,.565/
131                  DATA TALP              /0.,5.,10.,15.,20.,25./
132                  DATA TALPA              /0.,4.,6.,8.,10.,12.,14.,16.,18.,20./
133                  DATA TDELT1             /-20.,-15.,-10.,-8.,-6.,-5.,10./
134                  DATA TMACH1             /.4,.8,1.0/
135                  DATA TMACH2             /.4,.8,1.0,1.3,1.8/
136                  DATA TMACH4             /.4,.8,1.0,1.3,1.8/
137                  DATA TMACH3             /.4,.6,.8,1.0,1.2,1.4,1.6,1.8/
138                  DATA TMACH5             / .4,.5,.6,.7,.8,.85,.9,.95/1.0,1.1/1.2,
139                 X  1.3,1.4,1.6,1.8/
140                  DATA TCLP              /-18.6,-17.7,-21.0,-29.,-26.,-21.,-17.,-14./
141                  DATA TCLD              /.085,.087,.090,.097,.086,.073,.061,.049/
142                  DATA TCMO /
143                 X  -.145,-.165,-.168,-.125,-.100,-.101,-.102,-.104,-.105,-.107,
144                 X  -.150,-.185,-.190,-.165,-.135,-.108,-.75,-.75,-.75,-.75,
145                 X  -.160,-.205,-.218,-.220,-.234,-.240,-.246,-.227,-.180,-.107,
146                 X  -.178,-.196,-.195,-.195,-.194,-.192,-.183,-.176,-.146,-.110/
147                 X  -.130,-.156,-.162,-.155,-.150,-.143,-.134,-.120,-.105,-.87*/
148                  ABALP = ABS(ALPHA)*57.296
149                  ABBET = ABS(BETA )*57.296
150                  IF(T1.LT.T2) GO TO 2
151                  DELP = DELPIT*57.296
152                  DELY = DELTAW*57.296
153                  IF(ALPHA.LT.0.) DELP=-DELP
154                  IF(BETA.LT.0.) DELY=-DELY
155                   I = ISAVE(1)
156                   J = ISAVE(2)
157                   K = ISAVE(3)
158                  CALL FIND(I,TALP,6,ABALP)
159                  CALL FIND(J,TDELT1,7,DELP)
160                  CALL FIND(K,TMACH1,3,PMACH)
161                  IF(I .NE. ISAVE(1))           GO TO 50
162                  IF(J .NE. ISAVE(2))           GO TO 60
163                  IF(K .NE. ISAVE(3))           GO TO 70
164                  GO TO 80
165            50    ISAVE(1) = I
166            60    ISAVE(2) = J
167            70    CONTINUE
168                  CALL NTERP (ACN,TCN1,I,TALP,6,J,TDELT1,7,K,TMACH1)
169                  CALL  NTERP (ACMCG,TCMCG1)
170                  CALL  NTERP (ACAP,TCA1)
171            80    I = ISAVE(4)
172                  J = ISAVE(5)
173                  CALL FIND(I,TALP,6,ABBET)
174                  CALL FIND(J,TDELT1,7,DELY)
175                  IF(I .NE. ISAVE(4))           GO TO 150
176                  IF(J .NE. ISAVE(5))           GO TO 160
177                  IF(K .NE. ISAVE(3))           GO TO 170
178                  GO TO 180
179            150   ISAVE(4) = I
180            160   ISAVE(5) = J
181            170   CONTINUE
182                  CALL NTERP (ACY,TCN1,I,TALP,6,J,TDELT1,7,K,TMACH1)
183                  CALL  NTERP (ACLNCG,TCMCG1)
184                  CALL  NTERP (ACAB,TCA1)
185            180   IF(K .EQ. ISAVE(3))           GO TO 190
186                C
```

```
C  SET I & J FOR ALPHA = DELTA = 0.0 IN TALP & TDELT1
C
      I = 1
      J = 5
      CALL NTERP (ACAB,TCA3,I,TALP,6,J,TDELT1,7,K,TMACH1)
      ACAB(2) = ACAB(5)
      ISAVE(3) = K
  190 CONTINUE
      CN          = FUNCTION(ACN,ABALP,DELP,FMACH)
      CMCG        = FUNCTION(ACMCG)
      CAP         = FUNCTION(ACAP)
      CY          = FUNCTION(ACY,ABBET,DELY,FMACH)
      CLNCG       = FUNCTION(ACLNCG)
      CAB         = FUNCTION(ACAB)
      CA8         = FUNCTION(ACA8,FMACH)
      CA = CAP + CAB + CA8
      GO TO 3
C
    2 I = ISAVE(6)
      J = ISAVE(7)
      K = ISAVE(8)
      CALL FIND(I,TALP,6,ABALP)
      CALL FIND(J,TMACH2,6,FMACH)
      CALL FIND(K,TALP,6,ABBET)
      IF(J .NE. ISAVE(7))           GO TO 250
      IF(I .EQ. ISAVE(6))           GO TO 260
  250 ISAVE(6) = I
      CALL NTERP (ACN,TCN2,I,TALP,6,J,TMACH2)
      CALL  NTERP (ACMCG,TCMCG2)
  260 IF(J .NE. ISAVE(7))           GO TO 270
      IF(K .EQ. ISAVE(8))           GO TO 280
  270 ISAVE(7) = J
      ISAVE(8) = K
      CALL NTERP (ACY,TCN2,K,TALP,6,J,TMACH2)
      CALL  NTERP (ACLNCG,TCMCG2)
  280 I = ISAVE(9)
      CALL FIND(I,TMACH5,15,FMACH)
      IF(I .EQ. ISAVE(9))           GO TO 290
      ISAVE(9) = I
      CALL NTERP (ACAP,TCA2,I,TMACH5)
  290 CONTINUE
      CN          = FUNCTION(ACN,ABALP,FMACH)
      CMCG        = FUNCTION(ACMCG)
      CY          = FUNCTION(ACY,ABBET,FMACH)
      CLNCG       = FUNCTION(ACLNCG)
      CA          = FUNCTION(ACAP,FMACH)
C
    3 I = ISAVE(10)
      CALL FIND(I,TMACH3,8,FMACH)
      IF(I .EQ. ISAVE(10))          GO TO 350
      ISAVE(10) = I
      CALL NTERP (ACLP,TCLP,I,TMACH3)
      CALL  NTERP (ACLD,TCLD)
  350 I = ISAVE(11)
      J = ISAVE(12)
      K = ISAVE(13)
      CALL FIND(I,TMACH4,5,FMACH)
      CALL FIND(J,TALP4,10,ABALP)
      CALL FIND(K,TALP4,10,ABBET)
      IF(I .NE. ISAVE(11))          GO TO 360
      IF(J .EQ. ISAVE(12))          GO TO 370
  360 ISAVE(12) = J
```

```
249                 CALL NTERP (ACMG,TCMG,J,TALP4,10,I,TMACH4)
250           370   IF(I .NE. ISAVE(11))                    GO TO 380
251                 IF(K .EQ. ISAVE(13))                    GO TO 390
252           380   ISAVE(11) = I
253                 ISAVE(13) = K
254                 CALL NTERP (ACLNR,TCMG,K,TALP4,10,I,TMACH4)
255           390   CONTINUE
256                 CLP       = FUNCTION(ACLP,FMACH)
257                 CLD       = FUNCTION(ACLD)
258                 CMG       = FUNCTION(ACMG,ABALP,FMACH)
259                 CLNR      = FUNCTION(ACLNR,ABBET,FMACH)
260                 IF(ALPHA .LT. 0.0)  CN = -CN                CMCG=-CMCG
261                 IF(BETA .LT. 0.0)   CY=-CY                  CLNCG=-CLNCG
262                CMAD=C.
263                CLNAD=0.
264                RETURN
265                END
```

```
      SUBROUTINE TRSFEB
C *** THIS SUBROUTINE PERFORMS THE EARTH TO BODY CARDINATE SYS. TRANSFORMATION
C
      DIMENSION DUM(7),DUMY(57)
      COMMON/INTEG/I,J,DUM,PHI,THTA,PSI,DUMY
      COMMON/ETB/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/TDC/CPSI,SPSI,SPHI,CPHI
      CPSI=COS(PSI)
      SPSI=SIN(PSI)
      CTHTA=COS(THTA)
      STHTA=SIN(THTA)
      CPHI=COS(PHI)
      SPHI=SIN(PHI)
      EB11=CPSI*CTHTA
      EB12=SPSI
      EB13=-CPSI*STHTA
      EB21=SPHI*STHTA-CPHI*SPSI*CTHTA
      EB22=CPHI*CPSI
      EB23=SPHI*CTHTA+CPHI*SPSI*STHTA
      EB31=CPHI*STHTA+SPHI*SPSI*CTHTA
      EB32=-SPHI*CPSI
      EB33=CPHI*CTHTA-SPHI*SPSI*STHTA
      RETURN
      END
```

```
      SUBROUTINE TRSFBS
C *** THIS SUBROUTINE PERFORMS THE BODY TO SEEKER COORDINATE SYS. TRANSFORMATION
C
      DIMENSION DUM(15),DUMR(9)
      COMMON/INTEG/I,J,DUM,THTAS,GC,PSIS,DUMR
      COMMON/BTS/BS11,BS12,BS13,BS21,BS22,BS23,BS31,BS32,BS33
      BS12=SIN(PSIS)
      BS22=COS(PSIS)
      BS31=SIN(THTAS)
      BS33=COS(THTAS)
      BS11=BS22*BS33
      BS13=-BS22*BS31
      BS21=-BS12*BS33
      BS23=BS12*BS31
      BS32=0.
      RETURN
      END
```

```
      SUBROUTINE TRSFBV
C *** THIS SUBROUTINE PERFORMS THE BCS TO VCS  TRANSFORMATION
C
      COMMON/ INV/ GAMP,GAMY,DELXTB,DELYTB,DELZTB
      COMMON/BTV/DELXV,DELYV,DELZV
      BV12=SIN(GAMY)
      BV22=COS(GAMY)
      BV31=SIN(GAMP)
      BV33=COS(GAMP)
      BV11=BV22*BV33
      BV13=-BV22*BV31
      BV21=-BV12*BV33
      BV23=BV12*BV31
      BV32=0.
      DELXV=BV11*DELXTB+BV12*DELYTB+BV13*DELZTB
      DELYV=BV21*DELXTB+BV22*DELYTB+BV23*DELZTB
      DELZV=BV31*DELXTB+BV32*DELYTB+BV33*DELZTB
      RETURN
      END
```

```
      SUBROUTINE LOSERR
C***  THIS SUBROUTINE TRANSFORMS MISSLE TO TARGET DISPLACEMENTS
C***  FROM ECS TO BCS, FROM BCS TO SCS AND COMPUTES LOS ERROR IN SCS
C
      COMMON/BTS/BS11,BS12,BS13,BS21,BS22,BS23,BS31,BS32,BS33
      COMMON/ETB/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/INPSKR/PITERR,YAWERR
      COMMON/DEL/DELX,DELY,DELZ
      COMMON/STUFF/ DELXS,DELYS,DELZS
      COMMON/STUFF1/DELXB,DELYB,DELZB
      DELXB=EB11*DELX+EB12*DELY+EB13*DELZ
      DELYB=EB21*DELX+EB22*DELY+EB23*DELZ
      DELZB=EB31*DELX+EB32*DELY+EB33*DELZ
      DELXS=BS11*DELXB+BS12*DELYB+BS13*DELZB
      DELYS=BS21*DELXB+BS22*DELYB+BS23*DELZB
      DELZS=BS31*DELXB+BS32*DELYB+BS33*DELZB
      PITERR=ATAN2(-DELZS,DELXS)
      YAWERR=ATAN2(DELYS,SQRT(DELXS*DELXS+DELZS*DELZS))
      RETURN
      END
```

```
      SUBROUTINE MCALC
C***  THIS SUBROUTINE CALCULATES THE MACH NUMBER
C
      DIMENSION RUM(63)
      REAL MACH
      COMMON/ETC/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/MACL/MACH,VSND,UR,VR,WR,VRS,VRW,VW
      COMMON/INTEG/I,J,CC,U,V,W,RUM
      COMMON/F/WXS,WYS,WZS
      UW=EB11*WXS+EB12*WYS
      VW=EB21*WXS+EB22*WYS
      WW=EB31*WXS+EB32*WYS
      UR=U-UW
      VR=V-VW
      WR=W-WW
      VRS=UR*UR+VR*VR+WR*WR
      VRW=SQRT(VRS)
      MACH=VRW/VSND
      RETURN
      END
```

```
      SUBROUTINE FORMAN
C**   SUBROUTINE FORMAN CALCULATES FORCES AND MOMENTS FOR THE DIFEQ S ROUTINES
C
      DOUBLE PRECISION TIME,TIME3
      REAL MACH
      DIMENSION HOMO(8),HOMI(17),HIMI(40)
      COMMON/TODEQ/AXB,AYB,AZB,CLB,CNB,ALB,AMB,ANB,CMB
      COMMON/COEF/CAZ,CY,CN,CLP,CMCG,CYCG,CLD,CMC,CNR,ALPHA,BETA,CMAC,
     1CLAAD
      COMMON/MACL/MACH,AA,UR,VR,WR,VRS,VRW,VW
      COMMON/DD/DELVY,DELVR,DELR,DELROL
      COMMON/JUNK/TIME,TIME3,RHO,S,D,SCUR,GAP,IRAP,RAPTM1,RAPTM2,IACT,
     1SLOPE1,BT1,RAPTM3,SLOPE2,BT2,CTT,CPT,SPT,XLTA,STT,GAPS,GAPSD,
     2GAPSDM,TM
      COMMON/INTEG/I,J,HOMO,P,Q,R,HOMI,DEL1,DELVF,DEL3,HIMI
      COMMON/FF/FFCLB,FFCMB,FFCNB,FFAXB,FFAYB,FFAZB,FFALB,FFAMB,FFANB
      ALPHA=ATAN2(WR,UR)
      SQLW=SQRT(UR*UR+WR*WR)
      BETA=ATAN2(VR,SQLW)
      GAP=.5*RHO*VRS
      GAPS=GAP*S
      GAPSD=GAPS*D
      IF(VRW.EQ.0.)GO TO 121
      GAPSDM=GAPSD*D/(2.*VRW)
      GO TO 122
  121 GAPSDM=0.
  122 CONTINUE
      DELVY=(DEL1+DEL3)/2.
      DELVR=(DEL1+DEL3)/2.
      IF(IACT.EQ.2)DELVY=(DEL3+DEL1)*.5
      IF(TIME.GE.TIME3)DELROL=DELVR
      DELR=DELROL*57.2957795
      CALL AERO(TIME,TIME3,MACH,ALPHA,BETA,DELVP,DELVY,DEL R,CN,CMCG,CY,
     1CYCG,CAZ,CLP,CLD,CMC,CMAD,CNR,CLNAD)
      CLB=GAPSD*CLD*DELR+FFCLB
      CMB = GAPSDM*CMC*G+FFCMB
      CNB = GAPSDM*CNR*R+FFCNB
      AXB = -GAPS*CAZ+FFAXB
      AYB = -GAPS*CY+FFAYB
      AZB = -GAPS*CN+FFAZB
      ALB=GAPSDM*CLP*P+FFALB
      AMB = GAPSD*CMCG+FFAMB
      ANB=-GAPSD*CYCG+FFANB
      IF(IRAP.EQ.0.OR.TIME.LT.RAPTM1)GO TO 123
      IF(TIME.LE.RAPTM2)TM=SLOPE1*TIME+BT1
      IF(TIME.GT.RAPTM2.AND.TIME.LE.RAPTM3)TM=SLOPE2*TIME+BT2
      IF(TIME.GT.RAPTM3)TM=0.
      IF(TIME.GT.RAPTM3)IRAP=0
  123 AXB=AXB+TM*CTT*CPT
      AYB=AYB+TM*CTT*SPT
      AZB=AZB+TM*STT
      AMB=AMB+TM*STT*XLTA
      ANB=ANB+TM*CTT*SPT*XLTA
      RETURN
      END
```

```
      SUBROUTINE DIFEQ
C***SUBROUTINE DIFEQ CONSTRUCTS THE EQUATIONS OF MOTION
      DOUBLE PRECISION TIME
      DIMENSION DUG(27),UNW(21)
      REAL MASS,IX,IYZ
      COMMON/ETB/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/TODEQ/AXB,AYB,AZB,CLB,CNB,ALB,AMB,ANB,CMB
      COMMON/INTEG/I,J,GG,U,V,W,P,Q,R,DUG,DU,DV,DW,DP,DQ,DR,
     1DPHI,DTHTA,DPSI,DX,DY,DZ,C9W
      COMMON/JUNK/TIME
      COMMON/JUNK1/THOLD,IROLL,G,MASS,IX,IYZ,XINTIA,NAVY
      COMMON/TOC/CPSI,SPSI,SPHI,CPHI
      COMMON/GG/GXB,GYB,GZB
C**   GRAVITY RESOLUTION TO BCS
      GXB=EB13*G
      GYB=EB23*G
      GZB=EB33*G
C**   EQUATIONS OF MOTION
      DU=AXB/MASS+R*V-Q*W+GXB
      IF(TIME.LT.THOLD.AND.NAVY.EQ.1)DU=0.
      DV=AYB/MASS+P*W-R*U+GYB
      DW=AZB/MASS+Q*U-P*V+GZB
      DP=(ALB+CLB)/IX
      DQ=(AMB+CMB)/IYZ+P*R*XINTIA
      DR=(ANB+CNB)/IYZ-P*Q*XINTIA
      DTHTA=(Q*CPHI-R*SPHI)/CPSI
      DPHI=P-DTHTA*SPSI
      DPSI=R*CPHI+Q*SPHI
      IF(IROLL.NE.0)DP=0.
      IF(IROLL.NE.0)P=0.
C**   MISSILE VELOCITY IN ECS
      DX=EB11*U+EB21*V+EB31*W
      DY=EB12*U+EB22*V+EB32*W
      DZ=EB13*U+EB23*V+EB33*W
      RETURN
      END
```

```
      SUBROUTINE METO
C**   SUBROUTINE METO CALCULATES THE VELACITY OF SOUND
C
      DOUBLE PRECISION TIME,TIME3
      DIMENSION DUM(22),DUMY(6)
      REAL MACH
      COMMON/MO/GEOALT,T0,TGRAD,RH0SL,ARG1,ATMOL,RSTAR,
     1RH0B,ARG2,G0,TMOL
      COMMON/JUNK/TIME,TIME3,RHO,DUM
      COMMON/MACL/MACH,VSND,DUMY
      IF(GEOALT.GT.36089.2389) GO TO 12
      TMOL=T0+TGRAD*GEOALT
      RHO=RH0SL*(T0/TMOL)**ARG1
      RH0B=RHO
      VSND=SQRT(1.4*RSTAR*TMOL/WTMOL)
      GO TO 13
   12 CONTINUE
      ARG2=-G0*WTMOL*(GEOALT-36089.2389)/(RSTAR*TMOL)
      RHO=RH0B*EXP(ARG2)
   13 RETURN
      END
```

```
1                SUBROUTINE SEEK
2             C**   THIS SUBROUTINE DETECTS TARGET WITHIN THE DETECTION RANGE OF SEEKER,
3             C     TARGET WITHIN THE FIELD OF VIEW,S-A-M,SEEKER WITHIN LINEAR RANGE
4             C
5                COUBLE PRECISION TIME,FSTSAM,TIME4,DT,DTA,TST,TME,SPER
6                DIMENSION CAT(14),RAT(49)
7                COMMON/STUFF/DELXS,DELYS,DELZS
8                COMMON/JUNK2/SRNGE,IFUFR,IACC,RDET,YAWERR,PITERR,PHFOV,BA,RNGLIN,
9               1PITYAWGC,R2D,NULSKR,BRS,REFLECT,NULL,KAGE
10               COMMON/INPSKR/PITERR,YAWERR
11               COMMON/JUNK/TIME
12               COMMON/INTEG/I,J,DTRK,CAT,THTAS,THASC,PSIS,RAT
13               COMMON/TT/FSTSAM,TIME4,DT,DTA,TST,TME,SPER,TSAM,DO,JMAX,IPRINT,T2
14               SRNGE=SQRT(DELXS*DELXS+DELYS*DELYS+DELZS*DELZS)
15               DATA IACC1/0/
16               IF(IFUFR.EQ.0)GO TO 560
17               IF(TIME.LT.T2)GO TO 105
18               IF(IACC1.NE.0)GO TO 11
19               IF(IACC.NE.1)GO TO 10
20               FSTSAM=TIME
21            10 IF(IACC.EQ.2)IACC1=1
22            11 CONTINUE
23               GO TO(565,107),IACC
24            560 CONTINUE
25               IF(ACC.EQ.2)GO TO 107
26               FSTSAM=TIME
27               IF(TIME.GE.TIME4)GO TO 565
28               IF(TIME.LT.TIME4)GO TO 105
29            C**** ACQUISTION(IACC=2) WHEN TARGET IS WITHIN PHFOV AND RDET
30            565 CONTINUE
31            C
32            C**   LINEAR SEEKER,NO OUTPUT WHEN OUT OF FOV
33               IF(SRNGE.GT.RDET)GO TO 101
34               IF(SQRT(YAWERR*YAWERR+PITERR*PITERR).GT.PHFOV)GO TO 101
35               IF(SQRT(PITERR**2+YAWERR**2).GT.0.0872664)GO TO 101
36               IF(SQRT(PSIS*PSIS+THTAS*THTAS).LT.BA)GO TO 101
37            567 CONTINUE
38            C**** PRINT EVERY JMAX INTERVALS
39               JMAX=1.00/DTA+.000001
40               DT=DTA
41               DTRK=SNGL(DT)
42               IACC=2
43               IPRINT=2
44               PRINT 90005
45            90005 FORMAT(//,2X,'ACQUISTION')
46               GO TO 103
47              107 CONTINUE
48            C**** NULL SEEKER
49               PITERR=ATAN2(-DELZS,DELXS)
50               YAWERR=ATAN2(DELYS,SQRT(DELXS*DELXS+DELZS*DELZS))
51            C
52            C**   LOSS OF ACQUISTION
53            C
54               IF(SQRT(PITERR*PITERR+YAWERR*YAWERR).GT.PHFOV)GO TO 101
55               PITYAWGC=SQRT(PITERR*PITERR+YAWERR*YAWERR)
56               IF(PITYAWGC.LE.0.5/R2D)NULSKR=2
57              103 CONTINUE
58            C**   SAMPLE AND HOLD IF FSTSAM=TIME IS INCLUDED AFTER STATEMENT 107
59               TST=TIME-FSTSAM
60               TSAM=TST+TME
61               IF(TSAM-SPER)104,104,104
62              104 TME=TME-SPER
```

```
58                IF(SRNGE.LT.BRS)GO TO 108
59                IF(SQRT(YAWERR*YAWERR+PITERR*PITERR).GT.PHEBV)GO TO 108
60                IF(SQRT(PSIS*PSIS+THTAS*THTAS).LT.BA)GO TO 108
61                CALL SEEKER(SRNGE,RFLECT,PITERR,PITER0)
62                CALL SEEKER(SRNGE,RFLECT,YAWERR,YAWER0)
63                PITER0=PITERR
64                YAWER0=YAWERR
65                GO TO 109
66              101 IACQ=NULL=KAGE=1
67              108 YAWER0=0.
68                PITER0=0.
69              109 CONTINUE
70            C
71            C**   SEEKER WITH LINEAR RANGE
72                IF(ABS(YAWER0).GE.RNGLIN)YAWER0=SIGN(RNGLIN,YAWER0)
73                IF(ABS(PITER0).GE.RNGLIN)PITER0=SIGN(RNGLIN,PITER0)
74              105 RETURN
75                END
```

```
      SUBROUTINE EDSKRGYRO
C     THIS SUBROUTINE CONSTRUCTS THE SEEKER GYRO MODEL FOR ED
C
      DOUBLE PRECISION TIME
      REAL KT,KT10,KT20,LAMPR,LAMYR
      REAL KG,KT30
      LOGICAL FLG4/.TRUE./
      COMMON/INTEG/KUTTA,NX,DTRK,U,V,W,P,Q,R,PHI,THTA,PSI,X,Y,Z,RTHTA,
     1RPSI,THTAS,THTASD,PSIS,PSISD,OMEGA,TXFD,PXFD,PFF,YEF,DEL1,DELVP,
     2DEL3,DDEL1,DDELVP,DDEL3,RLAMY,RLAMP,RPHIG,DPHIO,DU,DV,DW,DP,DQ,DR,
     3DPHI,DTHTA,DPSI,DX,DY,DZ,DRTHTA,DRPSI,DTHTAS,DTHASD,DPSIS,DPSISD,
     4COMEGA,DTXED,DPXED,DPEF,DYEF,DDELP1,DDELPP,DDELP3,DDEL1,DDUELP,
     5DDDEL3,DRLAMY,DRLAMP,DRPHIG,DDPHIO
      COMMON/JUNK/TIME
      COMMON/TT/FSTSAM,TIMEA,DT,DTA,TST,TMF,SPER,TSAM,CO,JMAX,IPRINT,T2
      COMMON/PERV/ DGV,OMEGZ
      COMMON/BOW/RSL,KT,KT10,KT20,LAMPR,LAMYR,RTM,RTMIN,RSGE,ED1,FLG4,
     1RSA,ED4,GSA
      COMMON/BTS/BS11,BS12,BS13,BS21,BS22,BS23,BS31,BS32,BS33
      COMMON/JUNK2/SRANGE,IFUSE,IACQ,RDET,YAWERR,PITERR,PHPOV,BA,RNGLIM,
     1PITYAWSG,R2D,NULSKR,BRS,REFLCT,NULL,KAGE
      COMMON/GP/RO,RR,PH,A,B,KT30
      DPHIO=DPHI
      RSL=125./R2D;IF(ABS(DPHIO).GT.RSL)DPHIO=SIGN(RSL,DPHIO)
      IF(TIME.LT.T2)GO TO 5005
C
C*****CHECK FOR NULL SEEKER
      IF(TIME.GT.10..AND.RTM.LT.RTMIN)GO TO 5000
      IF(NULL.EQ.2)GO TO 5000
      NULL=1
      RSGE=SQRT(THTAS*THTAS+PSIS*PSIS);IF(RSGE.LE.0.5/R2D.AND.IACQ.EQ.2)
     1NULL=2
C*****IF(SQRT(PITERR**2+YAWERR**2).GT.PHPOV)IACQ=NULL=1
 5000 IF(IACQ.EQ.1)NULL=1
C
      IF(NULL.EQ.1)LAMPR=LAMYR=0.
C
      IF(NULL.EQ.1)KT=KT20
      IF(NULL.EQ.2)KT=KT10
      IF(ABS(RLAMY).GT..872664)RLAMY=SIGN(.872664,RLAMY)
      OMEGY=KT*PITERR
      OMEGZ=KT*YAWERR
      IF(ABS(OMEGY).GT..1745329)OMEGY=SIGN(.1745329,OMEGY)
      IF(ABS(OMEGZ).GT..1745329)OMEGZ=SIGN(.1745329,OMEGZ)
      LAMPR=OMEGY
      LAMYR=OMEGZ
C     SEEKER GYRO FOR ED
C
 5005 CONTINUE
      IF(TIME.LT.ED1)GO TO 6670
      IF(.NOT.FLG4)GO TO 6670
      KAGE=2;FLG4=.NOT.FLG4;PRINT 9000A
 9000A FORMAT(/,2X,'UNCAGE GYRO FOR ROLL TO VERTICAL')
 6670 CONTINUE
      IF(TIME.GT.ED4.AND.IACQ.NE.2.AND.IFUSE.NE.2)KAGE=1
      IF(IACQ.EQ.2)KAGE=2
      GSA=BS21*P+BS22*Q+BS23*R
      RSA=BS31*P+BS32*Q+BS33*R
      GO TO(5200,5201),KAGE
C
C     CAGE
C
```

```
                5200  DTHTAS=-10.*THTAS/DPSIS=-10.*PSIS
                      GO TO 5203
                5201  GO TO(5202,5204),IACC
                C
                C     LNCAGE
                C
                C     FREE GYRO
                C
                5202  DTHTAS=-OSA/COS(PSIS)
                      DPSIS=-RSA
                      GO TO 5203
                C
                C     TRACK
                C
                5204  DTHTAS=(OMEGY-OSA)/COS(PSIS)
                      DPSIS=OMEGZ-RSA
                5203  RETURN
                      END
```

```
      SUBROUTINE EDAP
C**   THIS SUBROUTINE CONSTRUCTS THE AUTOPILOT MODEL FOR ED VERSION
      DOUBLE PRECISION TIME
      LOGICAL FLG1/.TRUE./,FLG2/.TRUE./,FLG3/.TRUE./
      COMMON/JUNK/TIME
      COMMON/SS/S1,S2,S3,S4,S5,S6
      REAL POLES(01)/+20./
      REAL KPD,KQ,KM,LAMBI,LAMPR,LAMYR,KG
      COMMON/AUTAP/YEG,REG,PEG
      COMMON/BOW/ISL,KT,KT10,KT20,LAMPR,LAMYR,RTM,RTMIN,RSGE,EDI,FLG4,
     1RSA,ED4,QSA
      COMMON/JUNK2/SRNGE,IFUPR,IACQ,RDFT,YAWERR,PITERR,PHFBV,BA,RNGLIM,
     1PITYAWSG,R2D,NULSKR,BRS,REFLECT,NULL,KAGE
      COMMON/ARROW/PHIG,FLG1,FLG2,FLG3,REF,RFL,YED,PED,THRBS,PSRBS,
     1THBS,PSBS,GBLV,PEFL,KPD,KG,KM,KG,LAMBI,POLES
      COMMON/INTEG/KUTTA,NX,DTRK,U,V,W,P,Q,R,PHI,THTA,PSI,X,Y,Z,RTHTA,
     1RPSI,THTAS,THASD,PSIS,PSISD,OMEGA,TXED,PXED,PEF,YEF,DEL1,DELVP,
     2DEL3,DDEL1,DDELVP,DDEL3,RLAMY,RLAMP,RPHIG,DPHIO,DU,DV,DW,DP,DQ,DR,
     3DPHI,DTHTA,DPSI,DX,DY,DZ,DRTHTA,DRPSI,DTHTAS,DTHASD,DPSIS,DPSISD,
     4DOMEGA,DTXED,DPXED,DPEF,DYEF,DDELP1,DDELPP,DDELP3,DDDEL1,DDVELP,
     5DDDEL3,DRLAMY,DRLAMP,DRPHIG,DDPHIO
      COMMON/IT/PSTSAM,TIME4,DT,DTA,TSY,TME,SPER,TSAM,CO,JMAX,IPRINT,T2
C     ROLL AUTOPILOT
C
      IF(TIME.GE.ED4)GO TO 5025
      PHIG=-DPHIO*S1*75.*PSIS*S2
      GO TO 5030
 5015 IF(IFUPR.EQ.2)GO TO 5025
      IF(IACQ.EQ.2)GO TO 5025
      PHIG=-DPHIO*S1*75.*PSIS*S2
      GO TO 5030
 5025 IF(.NOT.FLG1)GO TO 6667
      PRINT 90002,IPRINT*2,FLG1,.NOT.FLG1
90002 FORMAT(/,2X,'ROLL HOLD')
 6667 CONTINUE
      DRLAMY=10.*DPHIO
      PHIG=-DPHIO*S1-RLAMY*S3
C
C.    LEAD LAG ROLL AUTOPILOT REG/PHIG=KPD*(S+5)/S+12.5)
 5030 CONTINUE
      CALL FLTR(PHIG,RPHIG,DRPHIG,REG,12.5,5.,KPD)
      RFL=7./R2D;IF(ABS(REG).GT.RFL)REG=SIGN(RFL,REG)
C
C**   PITCH YAW AUTOPILOT
C**   RATE DAMPING OF GIMBAL ANGLES THRBS/THTAS=KG*S/(.0067*S+1)
      CALL EDRTDAMP(THTAS,TXED,DTXED,THRBS,POLES(01),KG,KM,THBS)
      CALL EDRTDAMP(PSIS,PXED,DPXED,PSRBS,POLES(01),KG,KM,PSBS)
C     INPUT TO GUIDANCE FILTER=PED,YED
 5065 CONTINUE
      PED=LAMPR
      YED=LAMYR
C**   GUIDANCE FILTER PEF/PED=KG/(.01*S+1)
 5075 CONTINUE
      CALL FTLG(PED,PEF,DPEF,KG,10.)
      CALL FTLG(YED,YEF,DYEF,KG,10.)
      PEFL=PEF+LAMBI
      GBLV=8./R2D
      IF(ABS(PEFL).GT.GBLV)PEFL=SIGN(GBLV,PEFL)
      IF(ABS(YEF).GT.GBLV)YEF=SIGN(GBLV,YEF)
      IF(TIME.LT.T2.OR.IACQ.EQ.1)GO TO 5100
      IF(.NOT.FLG2)GO TO 6668
      PRINT 90003,IPRINT*2,FLG2,.NOT.FLG2
```

```
90003 FORMAT(/,2X,'LATERAL ENABLE')
 6668 CONTINUE
      GO TO (5080,5085),NULL
 5080 PEG=(PEFL*THRBS*S6+YHRBS*S4)*S5
      YEG=YEF+PSBS*S6-PSRBS*S4
      GO TO 5100
 5085 IF(.NOT.FLG3)GO TO 6669
      PRINT 90004,IPRINT=2,FLG3=.NOT.FLG3
90004 FORMAT(/,2X,'GUIDANCE ENABLE')
 6669 CONTINUE
      PEG=(PEFL-THRBS*S4)*S5
      YEG=YEF-PSRBS*S4
 5100 IF(ABS(PEG).GT..2094394B)PEG=SIGN(.2094394B,PEG)
      IF(ABS(YEG).GT..2094394B)YEG=SIGN(.2094394B,YEG)
      RETURN
      END
```

```
      SUBROUTINE FLTR(X,Y,Z,A,B,C,D)
      Z=X-B*Y
      A=(C*Y+Z)*D
      RETURN
      END
```

```
      SUBROUTINE EDRTDAMP(X,Y,Z,A,B,C,D,E)
      Z=B*(C*X-Y)
      A=B*(C*X-Y)
      E=C*(X+A)
      RETURN
      END
```

```
      SUBROUTINE FTLG(X,Y,Z,A,B)
      Z=B*(A*X-Y)
      RETURN
      END
```

```
1                SUBROUTINE CONTRL
2          C***  THIS SUBROUTINE CONTAINS THE CONTROL SYSTEM,GAINARDS FOR EACH PLANE AN
3          C     COMMON SHAFT,SECOND ORDER ACTUATOR MODEL
4                DIMENSION ACT(24),ACT0(24),ACTRT(
5                COMMON/JUNK2/SRANGE,IFUEL,IACC,RDET,YAWERR,PITERR,PHIERV,BA,RNGLIN,
6               1PITYAWSC,R2D,NULSKR,BRS,REFLECT,NULL,XAGE
7                COMMON/AUTAP/YEG,REG,PEG
8                COMMON/INTEG/I,J,XCT,DEL1,DELVP,DEL3,DDEL1,DDELVP,DDEL3,ACT0,
9               1DDELP1,DDELPP,DDELP3,DDDEL1,DDDELP,DDDEL3,ACTR
10               COMMON/JUNK/TIME,TIME3,RMC,S,D,SCOW,GAP,INAP,RAPTM1,RAPTM2,IACT,
11              1SLOPE1,BT1,RAPTM3,SLOPE2,BT2,CTT,CPT,SPT,XLTA,BTT,GAPS,GAPSU,
12              2GAPSDM,TM
13               DDDEL1=60.*(60.*(YEG-REG-DEL1)-DDEL1)
14               DDDELP=60.*(60.*(PEG-DELVP)-DDELVP)
15               DDDEL3=60.*(60.*(-YEG-REG-DEL3)-DDEL3)
16               IF(IACT.EQ.2)DDDEL1=60.*(60.*(REG-YEG-DEL1)-DDEL1)
17               IF(IACT.EQ.2)DDDEL3=60.*(60.*(REG+YEG-DEL3)-DDEL3)
18               DDELP1=DDEL1
19               DDELPP=DDELVP
20               DDELP3=DDEL3
21               RETURN
22               END
```

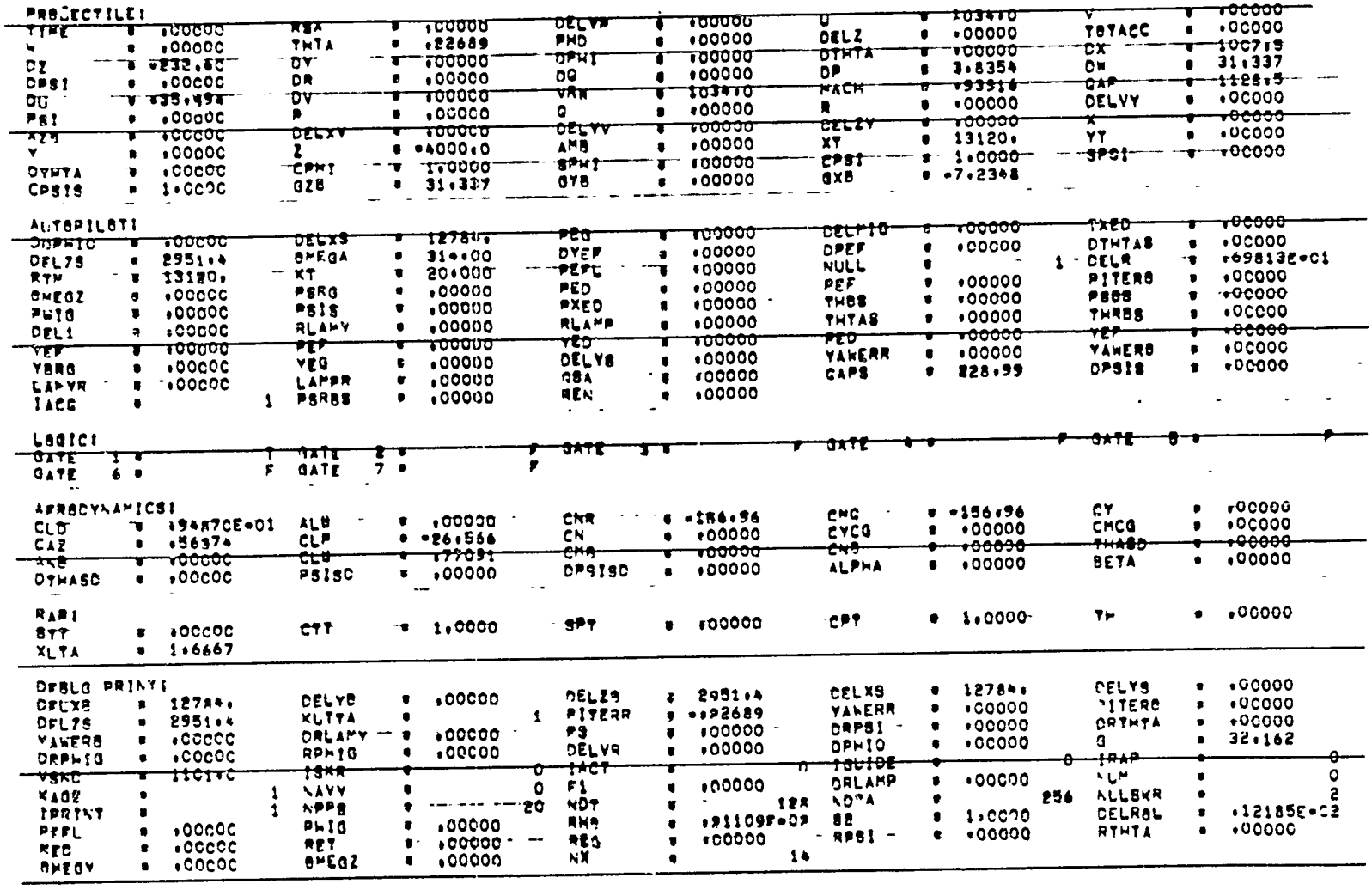
```
 ALLOCAT (FILE,X1),(FORMAT,U),(RSIZE,202),(FSIZE,240)
 ALLOCAT (FILE,X2),(FORMAT,U),(RSIZE,202),(FSIZE,100)
 ASSIGN (MISI,RT,X6)
-------------------------------------------------------------
 FORTRAN SI,GO,NS,EC
 RLOAD (TEMP,ECC),(LIB,USER,SYSTEM)
!RBAT (FILE,RT,GO,EOD)!
!(FILE,D1,$SYSLIB,EOD)
   L SREF  LL     7DPT
   L SREF  LL     7DFDT
-------------------------------------------------------------
LOADING WAS COMPLETED

WARNING: UNSATISFIED REFS
 REWIND 9TAPC
 RAV

-------------------------------------------------------------
```

BEGIN EXECUTION

BF	=	6.2500	RYBL	=	.10000E-19	BQ	=	240.08	RA	=	.00000	BR5	=	2.0000	
KB	=	10.000	BR5	=	.00000	KQ	=	.50000E-01	BT1	=	211.22	BT2	=	525.00	
CPT	=	1.0000	BTT	=	.00000	CB	=	.00000	FFCMB	=	1.0000	CTT	=	1.0000	
RAPTM3	=	13.000	D	=	.50830	KG	=	3.5000	DELMY	=	.34907	EDO	=	3.0000	
ED1	=	3.2500	ED2	=	8.0000	ED3	=	3.4500	ED4	=	7.2500	ED5	=	3.0000	
KTIC	=	10.000	FFALB	=	1.0000	VCL	=	.26180	FFANB	=	1.0000	GF	=	5.0000	
FFCLB	=	1.0000	FFAZB	=	1.0000	FFCNB	=	1.0000	FFAMB	=	1.0000	GAMLB	=	.13983	
PHFBV	=	.21817	GC	=	.26180	FFAXB	=	1.0000	IACT	=	0	IRBLLDC	=	1	
ICLP	=	0	IFLFB	=	1	NULL	=		IRBLL	=	0	KT20	=	20.000	
ISKP	=	0	SS	=	1.0000	IT	=	.16226E-04	FBGN	=	.10000	IX	=	.20100	
BD	=	149.25	IYZ	=	5.7230	R2	=	.00000	K4	=	.17453	PCA	=	2000.0	
KR	=	.00000	RVBIAS	=	.00000	KC	=	1.0000	THTGL	=	.87266E-02	KGL	=	1.0000	
FFAVB	=	1.0000	KPD	=	.15000E-01	TIP5	=	.00000	KRGL	=	.60000	AP	=	25.000	
KS	=	6.0000	KM	=	2.0000	LAMBI	=	.12651	JMAX	=	128	MASS	=	4.4887	
CG	=	5.3125	ARLA	=	1081984843	PCL	=	.26180	IA	=	.23528E-04	PHIMAX	=	1.7453	
BR	=	1.0000	PRINTM	=	1.0000	JMAX	=	128	RAPTM2	=	6.5000	RAPTM1	=	.00000	
RDET	=	7000.0	DTA	=	.39063E-02	RFLECT	=	5.0000	PI	=	3.1416	RLAMP	=	.00000	
PSIT	=	.00000	RLAMY	=	.00000	RPSI	=	.00000	RNGLIN	=	.26180E-01	VRATE	=	5.2360	
RYPIK	=	1000.0	KP	=	2.0000	S7	=	1.0000	S6	=	1.0000	S10	=	1.0000	
S9	=	1.0000	S12	=	1.0000	S11	=	1.0000	S4	=	-1.0000	S3	=	-1.0000	
S2	=	1.0000	S1	=	-1.0000	S	=	.20292	DELMX	=	.26180	SF0	=	1.0000	
SF1	=	100.00	SF2	=	100.00	SF3	=	20.000	SF4	=	20.000	SF5	=	15.000	
SF6	=	15.000	SF7	=	15.000	SF8	=	1.0000	SF9	=	50.000	SF10	=	20.000	
SF11	=	20.000	SF12	=	50.000	SF13	=	125.00	SF14	=	15.000	SF15	=	12.000	
SLOPE2	=	-11.538	SLOPE1	=	36.735	TO1	=	1.4000	TO	=	1.0000	TO3	=	2.0000	
TO2	=	1.8000	TO5	=	2.4000	TO4	=	2.2000	TO7	=	2.8000	TO6	=	2.6000	
T2	=	2.0000	T1	=	3.0000	T8	=	.40000	SPT	=	.00000	THBLD	=	.00000	
THTAC	=	-.13080	KD	=	.20000	THETAT	=	.00000	IRAP	=	0	THBLC	=	.00000	
TIC	=	.12500	TIC1	=	.12500	TIME3	=	3.0000	TIME2	=	.65000	TIME1	=	.60000	
TIMEC	=	.30000	TIP1	=	.00000	DT	=	.78125E-03	YHFBV	=	.21817	K5	=	.00000	
ZPIK	=	.40000	TIME4	=	6.6000	WNDB	=	.00000	ZMIN	=	-.40000				


PROJECTILE:
TIME = .00000 RSX = .00000 DELVP = .00000 U = 1034.0 V = .00000
W = .00000 THTA = .22689 PHD = .00000 DELZ = .00000 T8TACC = .00000
DZ = -232.60 DY = .00000 DPHI = .00000 DTHTA = .00000 DX = 10071.5
DPSI = .00000 DR = .00000 DQ = .00000 DP = 3.8354 DW = 31.337
DU = -35.496 DV = .00000 VRN = 1034.0 MACH = .93516 GAP = 1128.5
PSI = .00000 P = .00000 Q = .00000 R = .00000 DELVY = .00000
XYS = .00000 DELXV = .00000 DELVV = .00000 DELZV = .00000 X = .00000
V = .00000 Z = -4000.0 AMB = .00000 XT = 13120. YT = .00000
DTHTA = .00000 CPHI = 1.0000 SPHI = .00000 CPSI = 1.0000 SPSI = .00000
CPSIS = 1.0000 GZB = 31.337 GYB = .00000 GXB = -7.2348
AUTOPILOT:
DPHIC = .00000 DELXS = 12784. PED = .00000 DELPIC = .00000 TXED = .00000
DFL7S = 2951.4 OMEGA = 314.00 DYEF = .00000 DPEF = .00000 DTHTAS = .00000
RTM = 13120. KT = 20.000 PEFL = .00000 NULL = 1 DELR = .69813E-01
OMEGZ = .00000 PSRG = .00000 PED = .00000 PEF = .00000 PITERS = .00000
PHIC = .00000 PSIS = .00000 PXED = .00000 THBS = .00000 PSBS = .00000
DEL1 = .00000 RLAMY = .00000 RLAMP = .00000 THTAS = .00000 THRBS = .00000
YEF = .00000 PEF = .00000 YED = .00000 PED = .00000 YEF = .00000
YBRG = .00000 YEG = .00000 DELYS = .00000 YAWERR = .00000 YAWERS = .00000
LAPYR = .00000 LAMPR = .00000 QBA = .00000 CAPS = 828.99 DPSIS = .00000
IACC = 1 PSRBS = .00000 REN = .00000
LOGIC:
GATE 1 = 1 GATE 2 = F GATE 3 = F GATE 4 = F GATE 5 = F
GATE 6 = F GATE 7 = F
AERODYNAMICS:
CLO = .94R7CE-01 ALB = .00000 CNR = -156.96 CMC = -156.96 CY = .00000
CAZ = .56374 CLP = -26.566 CN = .00000 CYCG = .00000 CMCG = .00000
AXB = .00000 CLD = .77091 CMB = .00000 CNB = .00000 THABD = .00000
DTHASC = .00000 PSISC = .00000 DPSISC = .00000 ALPHA = .00000 BETA = .00000
RAR:
STT = .00000 CTT = 1.0000 SPT = .00000 CPT = 1.0000 TM = .00000
XLTA = 1.6667
DEBUG PRINT:
DELXB = 12784. DELYB = .00000 DELZB = 2951.4 DELXS = 12784. DELYS = .00000
DFL7S = 2951.4 XLTTA = 1 PITERR = -.22689 YAWERR = .00000 PITERS = .00000
YAWERB = .00000 DRLAMY = .00000 PB = .00000 DRPSI = .00000 DRTHTA = .00000
DRPHIB = .00000 RPHIB = .00000 DELVR = .00000 DPHIO = .00000 Q = 32.162
VSKC = 11C1.C ISKR = 0 IACT = 0 ISLIDE = 0 IRAP = 0
KADZ = 1 NAVY = 0 F1 = .00000 DRLAMP = .00000 NLM = 0
IPRINT = 1 NPPB = 20 NDT = 12R NDMA = 256 ALLSKR = 2
PFFL = .00000 PHIB = .00000 RHB = .21109E-02 B2 = 1.0000 DELRBL = .12185E-02
REC = .00000 RET = .00000 RBS = .00000 RPSI = .00000 RTHTA = .00000
OMEGV = .00000 OMEGZ = .00000 NX = 14

```
PROJECTILE:
TYPE   =  .60156        RSA    =  .00000        DELVP  =  .00000        U      =  1013.3        V      = -.26C48
W      = -.69896        THTA   =  .20775        PHD    =  .36714        DELZ   =  132.98        TOTACC =  .43231
DY     = -209.73        DY     = -.74777E-03    DPHI   =  .90425        DTHTA  = -.18184E-01    DX     =  991.37
DPSI   =  .78131E-04    DR     = -.85931E-01    DQ     =  .27547        DP     =  .39867        DW     =  12.844
DU     = -32.813        DV     =  4.1270        VRW    =  1013.3        MACH   =  .92080        GAP    =  1079.4
PSI    = -.84193E-05    P      =  .90485        Q      = -.16944E-01    R      =  .65999E-02    DELVY  =  .00000
AZB    =  1.8179        DELXV  =  .00000        DELYV  =  .00000        DELZV  =  .00000        X      =  601.14
Y      = -.13185E-03    Z      = -4133.0        AMB    =  1.4695        XT     =  13120.        YT     =  .00000
DTHTA  = -.18184E-01    CPHI   =  .93335        SPHI   =  .35895        CPSI   =  1.0000        SPSI   = -.84193E-05
CPSIS  =  1.0000        GZB    =  89.373        GYB    =  11.296        GXB    = -6.6334

AUTOPILOT:
DCPHYC =  .00000        DELXS  =  12222.        PZO    =  .00000        DELMIS =  .00000        TXEO   =  .00000
DFLYS  =  2531.4        OMEGA  =  314.00        DYEF   =  .00000        DPEF   =  .00000        DTHTAS =  .00000
RTM    =  12520.        KT     =  20.000        PEFL   =  .00000        NULL   =            1  DELR   =  .69813E-01
OMEGZ  =  .00000        PSRG   =  .00000        PED    =  .00000        PEF    =  .00000        PITERO =  .00000
PHIG   =  .00000        PSIS   =  .00000        PXEO   =  .00000        THBS   =  .00000        PSBS   =  .00000
DFL1   =  .00000        RLAMY  =  .00000        RLAMP  =  .00000        THTAS  =  .00000        THRBS  =  .00000
VFF    =  .00000        PEP    =  .00000        YEO    =  .00000        PED    =  .00000        YEP    =  .00000
YBRG   =  .00000        VEO    =  .00000        DELYS  =  973.63        YAWERR =  .77846E-01    YAWERO =  .00000
LAMYR  =  .00000        LAMPR  =  .00000        GSA    =  .00000        CAPS   =  219.04        DPSIS  =  .00000
IACC   =            1   PSRBS  =  .00000        REN    =  .00000

LOGIC:
GATE  1 =            T  GATE  2 =            F  GATE  3 =            F  GATE  4 =            T  GATE  5 =            F
GATE  6 =            F  GATE  7 =            F

AERODYNAMICS:
CLO    =  .94223E-01    ALB    = -.65229        CNR    = -156.19        CMG    = -156.45        CY     = -.30928E-02
CAZ    =  .53620        CLP    = -25.832        CN     = -.82996E-02    CYCG   =  .49184E-02    CMCG   =  .13199E-01
AKN    = -.54760        CLB    =  .73242        CMB    =  .74023E-01    CNE    = -.25786E-01    THASD  =  .00000
DTHASD =  .00000        PSISD  =  .00000        DPSISD =  .00000        ALPHA  = -.68978E-03    BETA   = -.25704E-03

RAP:
STT    =  .00000        CTT    =  1.0000        SPT    =  .00000        CPT    =  1.0000        TH     =  .00000
XLTA   =  1.6667

DEFLG PRINT:
DFLXB  =  12222.        DELYB  =  973.03        DELZB  =  2931.4        DELXB  =  12222.        DELYS  =  973.63
DFLYS  =  2531.4        KLTTA  =            1    PITERR = -.20423        YAWERR =  .77846E-01    PITERO =  .00000
YAWERO =  .00000        DRLAMY =  .00000        P9     =  .00000        DRPSI  =  .00000        DRTHTA =  .00000
DRPHIG =  .00000        RPHIG  =  .00000        DELVR  =  .00000        DPHIO  =  .00000        G      =  32.161
VSKC   =  110C.5        ISKR   =            0    IACT   =            0  IOSIDE =            0  IRAP   =            0
KAGF   =            1   NAVY   =            0    F1     =  .00000        DRLAMP =  .00000        NUM    =            0
IPRINT =            1   NPPS   =           20    NDT    =          128  NDTA   =          256  NULSKR =            2
PFFI   =  .00000        PHIG   =  .00000        RH9    =  .21025E-02    S2     =  1.0000        DELRBL =  .12155E-02
RFO    =  .00000        RET    =  .00000        REG    =  .00000        RPSI   =  .00000        RTHTA  =  .00000
OMEGY  =  .00000        OMEGZ  =  .00000        NX     =           14
```

PROJECTILE:

TIME	.65625	RSA	.00000	DELVP	.00000	U	1011.5	V	.98837E-01		
W	.22079	THTA	.20701	PHD	.41718	DELZ	144.38	TOTACC	.13970		
D?	.207.67	DY	-.88549E-03	DPHI	.92402	DTHTA	-.12038E-01	DX	989.98		
DPSI	.1427CE-03	DR	.42198E-01	DQ	-.68173E-01	DP	.32663	DW	17.482		
DU	-32.456	DV	7.8336	VRW	1011.5	MACH	.91921	GAP	1075.3		
PSI	-.17735E-05	P	.92402	Q	-.10948E-01	R	.50078E-02	DELVY	.00000		
AZS	-.57304	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	655.32		
Y	-.17748E-03	Z	-.4144.4	AMB	-.46329	XT	13120.	YT	.00000		
DTHTA	-.12038E-01	CPHI	.91485	SPHI	.40515	CPSI	1.0000	SPSI	-.17735E-05		
CPSIS	1.0000	GZS	28.776	GYB	12.752	GXB	-6.6103				

AUTOPILOT:

DCPHIC	.00000	DELXS	12169.	PEC	.00000	DELMIS	.00000	TX2D	.00000		
DELZS	2471.4	OMEGA	314.00	DYEF	.00000	DPEF	.00000	DTHTAS	.00000		
RTM	12468.	KT	20.000	PEPL	.00000	NULL	1	DELR	.69813E-01		
OMEGZ	.00000	PSRG	.00000	PED	.00000	PEF	.00000	PITERR	.00000		
PHIC	.00000	PSIS	.00000	PXED	.00000	THRS	.00000	PSS	.00000		
DEL1	.00000	RLAMY	.00000	RLAMP	.00000	THTAS	.00000	THRSS	.00000		
YEP	.00000	PEP	.00000	YEC	.00000	PEC	.00000	YEF	.00000		
YERG	.00000	YEG	.00000	DELYS	1095.3	YAWERR	.87975E-01	YAWERS	.00000		
LAMYR	.00000	LAMPR	.00000	QBA	.00000	QAPS	218.19	DPSIS	.00000		
IACC	1	PSRBS	.00000	REN	.00000						

LOGIC:

GATE 1	T	GATE 2	T	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	F	GATE 7	F								

AERODYNAMICS:

CLO	.94172E-01	ALB	-.66350	CNR	-156.02	CMG	-156.09	CY	.11757E-02		
CAZ	.53382	CLP	-25.768	CN	.26263E-02	CYCG	-.18701E-02	CMCG	-.41776E-02		
AKB	.20741	CLB	.72916	CMB	.67819E-01	CNB	-.21772E-01	THASD	.00000		
DTHASD	.00000	PSISD	.00000	DPSIGD	.00000	ALPHA	.21827E-03	BETA	.97711E-04		

RAM:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6667										

DEBUG PRINT:

DELXB	12169.	DELYB	1095.3	DELZB	2471.4	DELXS	12169.	DELYS	1095.3		
DELZS	2471.4	KUTTA	1	PITERR	-.00037	YAWERR	.87975E-01	PITERS	.00000		
YAWERS	.00000	DRLAMY	.00000	P3	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIC	.00000	RPHIC	.00000	DELVR	.00000	DPHIO	.00000	G	32.161		
YSNG	1100.4	ISKR	0	IACT	0	ISLIDE	0	IRAP	0		
KAGE	1	NAVV	0	F1	.00000	DRLAMP	.00000	NUM	0		
IPRINT	1	NPPS	20	NDT	128	NDTA	256	NULSKR	2		
PEPL	.00000	PHIC	.00000	RHO	.21013E-02	S2	1.0000	DELRSL	.12185E-02		
REC	.00000	RET	.00000	RES	.00000	RPSI	.00000	RTHTA	.00000		
OMEGY	.00000	OMEGZ	.00000	NX	14						

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PROJECTILE:
TYPE   =  1.0000        HSA    =  .00000        DELVP  =  .00000        U      =  1000.6        V      =  .29457
W      =  .32080        THTA   =  .19646        PHD    =  .74807        DELZ   =  213.48        TOTACC =  .24847
DZ     = -194.89        DY     = -.14745E-02    DPHI   =  .98850        DTHTA  = -.17827E-01    DX     =  981.65
DPSI   =  .18288E-03    DR     =  .10995        DQ     = -.94910E-01    DP     =  .96090E-01    DW     =  9.6959
DU     = -30.919        DV     =  9.3372        VRW    =  1000.6        MACH   =  .90952        GAP    =  1050.0
PSI    =  .82042E-06    P      =  .98850        Q      = -.18943E-01    R      =  .12260E-01    DELVY  =  .00000
AXB    = -.82192        DELXV  =  .00000        DELYV  =  .00000        DELZV  =  .00000        X      =  994.13
V      = -.50416E-03    Z      = -4213.5        AMB    = -.66551        XT     =  13120.        YT     =  .00000
DTHTA  = -.17827E-01    CPHI   =  .73300        SPHI   =  .68023        CPSI   =  1.0000        SPSI   =  .82042E-06
CPSIS  =  1.0000        DZB    =  23.121        DYB    =  21.456        DXB    = -4.2778

ALTSPILOT:
DPPHIC =  .00000        DELXS  =  11851.        PEG    =  .00000        DELPTS =  .00000        TXEO   =  .00000
DELZS  =  1868.5        OMEGA  =  314.00        DYEF   =  .00000        DPEF   =  .00000        DTHTAS =  .00000
RTW    =  12128.        KT     =  20.000        PEFL   =  .00000        NULL   =       1        DELR   =  .69813E-01
OMEGZ  =  .00000        PSRG   =  .00000        PED    =  .00000        PEF    =  .00000        PITERO =  .00000
PHIG   =  .00000        PSIS   =  .00000        PXED   =  .00000        THBS   =  .00000        PSBS   =  .00000
DFL1   =  .00000        RLAMY  =  .00000        RLAMP  =  .00000        THTAS  =  .00000        THRBS  =  .00000
YEP    =  .00000        PEP    =  .00000        YED    =  .00000        PED    =  .00000        YEP    =  .00000
YBRG   =  .00000        YEG    =  .00000        DELYS  =  1752.5        YAWERR =  .14501        YAWERO =  .00000
LAMYR  =  .00000        LAMPR  =  .00000        GBA    =  .00000        GAPS   =  213.07        DPSIS  =  .00000
IACC   =       1        PSRBS  =  .00000        REN    =  .00000

LOGIC:
GATE  1 =          T    GATE  2 =          F    GATE  3 =          F    GATE  4 =          T    GATE  5 =          T
GATE  6 =          F    GATE  7 =          F

AERODYNAMICS:
CLP    =  .93833E-01    ALB    = -.69015        CNR    = -155.65        CMQ    = -155.66        CY     =  .35421E-02
CAZ    =  .51928        CLP    = -25.331        CN     =  .38575E-02    CYCG   = -.56425E-02    CMCG   = -.61450E-02
AKE    =  .61110        CLO    =  .70946        CMB    =  .65419E-01    CNP    = -.52492E-01    THASD  =  .00000
DTHASD =  .00000        PSISD  =  .00000        DPSIRD =  .00000        ALPHA  =  .32060E-03    BETA   =  .29439E-03

RAR:
STT    =  .00000        CTT    =  1.0000        SPT    =  .00000        CPT    =  1.0000        TH     =  .00000
XLTA   =  1.6667

DEBUG PRINT:
DELXB  =  11851.        DELYB  =  1752.5        DELZR  =  1888.5        DELXB  =  11851.        DELYS  =  1752.5
DELZS  =  1888.5        XLTTA  =       1        PITERR = -.15802        YAWERR =  .14501        PITERO =  .00000
YAWERO =  .00000        DRLAMY =  .00000        P3     =  .00000        DRPSI  =  .00000        DRTHTA =  .00000
DRPHIG =  .00000        RPHIG  =  .00000        DELVR  =  .00000        DPHIO  =  .00000        G      =  32.161
VSRC   =  1100.2        TSKR   =       0        IACT   =       0        IGUIDE =       0        TRAP   =       0
KAGE   =       1        NAVY   =       0        F1     =  .00000        DRLAMP =  .00000        NUM    =       0
IPRINT =       1        NRPS   =      20        NDT    =     128        NDTA   =     256        NULSKR =       2
PEFL   =  .00000        PHIG   =  .00000        RHO    =  .20974E-02    S2     =  1.0000        DELRBL =  .12185E-02
REC    =  .00000        RET    =  .00000        REG    =  .00000        RPSI   =  .00000        RTHTA  =  .00000
OMEGY  =  .00000        OMEGZ  =  .00000        NX     =      14
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PROJECTILE:
TYPE   =  2.0000        RSA    =  .00000        DELVP  =  .00000        U      =  971.87        V      =  .22227
W      = -.40001E-01    THTA   =  .16421        PHD    =  1.7570        DELZ   =  389.91        TOTACC =  .12449
DZ     = -158.65        DY     = -.32146E-02    DPHI   =  1.0169        DTHTA  = -.25166E-01    CX     =  958.84
DPSI   =  .23012E-03    DR     =  .55655E-01    DQ     =  .34787E-01    DP     =  .56183E-02    DW     = -1.3301
DU     = -26.645        DV     =  7.0222        VRW    =  971.87        MACH   =  .88395        GAP    =  985.29
PSI    = -.14109E-05    P      =  1.0169        Q      =  .48855E-09    R      =  .24688E-01    DELVY  =  .00000
AZB    =  .99015E-01    DELXV  =  .00000        DELYV  =  .00000        DELZV  =  .00000        X      =  1964.0
Y      = -.25355E-02    Z      = -4389.9        AMB    =  .80480E-01    XT     =  13120.        YT     =  .00000
DTHTA  = -.25166E-01    CPHI   =  .18518        SPHI   =  .98271        CPSI   =  1.0000        SPSI   = -.14109E-05
CPSIS  =  1.0000        GZB    = -5.8743        GYB    =  31.179        GXB    = -5.2573

AUTOPILOT:
DOPHIO =  .00000        DELXS  =  10942.        PEQ    =  .00000        DELPHIO=  .00000        TXED   =  .00000
DELZS  = -408.88        OMEGA  =  314.00        DYEF   =  .00000        DPEF   =  .00000        DTHTAS =  .00000
RTN    =  11163.        KT     =  20.000        PEPL   =  .00000        NULL   =         1      DELR   = -.69813E-01
OMEGZ  =  .00000        PSRG   =  .00000        PED    =  .00000        PEF    =  .00000        PITERS =  .00000
PHIG   =  .00000        PSIS   =  .00000        PXED   =  .00000        THBS   =  .00000        PSBS   =  .00000
DFL1   =  .00000        RLAMY  =  .00000        RLAMP  =  .00000        THTAS  =  .00000        THRBS  =  .00000
YFF    =  .00000        PEP    =  .00000        YED    =  .00000        PED    =  .00000        YEF    =  .00000
YBRG   =  .00000        YEG    =  .00000        DELYS  =  2170.1        YAWERR =  .19565        YAWERS =  .00000
LAMYY  =  .00000        LAPRR  =  .00000        CSA    =  .00000        GAPS   =  199.94        DPSIS  =  .00000
IACC   =         1      PSRBS  =  .00000        REN    =  .00000

LOGIC:
GATE 1 =          T     GATE 2 =          F     GATE 3 =          F     GATE 4 =          T     GATE 5 =          T
GATE 6 =          F     GATE 7 =          F

AERODYNAMICS:
CLD    = -.92938E-01    ALB    = -.65827        CNR    = -184.33        CMQ    = -154.22        CY     =  .27518E-02
CAZ    =  .48028        CLP    = -24.358        CN     = -.49523E-09    CYCG   = -.44004E-02    CMCG   =  .79190E-03
AKP    =  .44720        CLB    =  .65940        CMB    = -.70024E-01    CNB    = -.10126        THASD  =  .00000
DTHASD =  .00000        PSISD  =  .00000        DPSISD =  .00000        ALPHA  = -.41159E-04    BETA   =  .22871E-03

RAP:
STT    =  .00000        CTT    =  1.0000        SPT    =  .00000        CPT    =  1.0000        TH     =  .00000
XLTA   =  1.6667

DEBUG PRINT:
DELXB  =  10942.        DELYB  =  2170.1        DELZB  = -408.88        DELXS  =  10942.        DELYS  =  2170.1
DELZS  = -408.88        KLTTA  =         1      PITERR =  .37350E-01    YAWERR =  .19565        PITERS =  .00000
YAWERR =  .00000        DRLAMY =  .00000        PS     =  .00000        DRPSI  =  .00000        DRTHTA =  .00000
DRPHIG =  .00000        RPHIG  =  .00000        DELVR  =  .00000        DPHIO  =  .00000        G      =  32.161
VRKD   =  10945         ISKR   =         0      IACT   =         0      IGUIDE =         0      IRAP   =         0
KAGF   =         1      NAVY   =         0      F1     =  .00000        DRLAMP =  .00000        NLM    =         0
IPRINT =        -1      NPPS   =        20      NOT    =       198      NOTA   =       256      NULSKR =         2
PEFL   =  .00000        PHIG   =  .00000        RHS    =  .90863E-09    S2     =  1.0000        CELRSL =  .12185E-02
RED    =  .00000        RET    = -.00000        REQ    =  .00000        RPSI   =  .00000        PTHTA  =  .00000
ENERGY =  .00000        OMEGZ  =  .00000        NX     =        14

NULL ROLL RATE SENSOR
```

PROJECTILE:

TIME	3.0000	RSA	.10344E-01	DELVP	.00000	U	947.05	V	.11052E-02		
W	-.19455E-01	THTA	.13087	PHD	2.7758	DELZ	530.70	TOTACC	.10403E-01		
DZ	-123.57	DY	-.48758E-02	DPHT	1.0164	DTHTA	-.29447E-01	DX	938.99		
DPSI	.20222E-03	DR	-.33790E-01	DQ	-.92232E-02	DP	-3.0612	DW	-3.6535		
DU	-21.611	DV	1.5877	VRW	947.09	MACH	.86184	CAP	931.71		
PSI	-.11365E-04	P	1.0164	Q	.27572E-01	R	.10344E-01	DELVY	.00000		
AZB	.46721E-01	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	2912.7		
Y	.62355E-02	Z	.4530.7	AMB	.38078E-01	XT	13120.	YT	.00000		
DTHTA	-.29447E-01	CPHI	-.93384	SPHI	.35769	CPSI	1.0000	SPSI	-.11365E-04		
CPSIS	1.0000	GZB	-29.776	GYB	11.405	GXB	-4.1967				

ALTSPILOT:

DPHIG	.00000	DELXS	10051.	PEG	.00000	DELMIS	.00000	TXED	.00000
DELZS	-1735.3	OMEGA	.10180E-19	DYEF	.00000	DPEF	.00000	DTHTAS	.00000
RTM	10221.	KT	20.000	PEFL	.12651	NULL	1	DELR	.00000
OMEGZ	.00000	PSRG	.00000	PED	.00000	PEF	.00000	PITERS	.00000
PHIG	1.0164	PSIS	.00000	PXED	.00000	THBS	.00000	PSBS	.00000
DFL1	.00000	RLAMY	.00000	RLAMB	.00000	THTAS	.00000	THRBS	.00000
YEF	.00000	PEF	.00000	YED	.00000	PED	.00000	YEF	.00000
YBRG	.00000	YEG	.00000	DELYS	664.53	YAWERR	.65061E-01	YAWERS	.00000
LAMYR	.00000	LAMBR	.00000	DSA	.27572E-01	GAPS	189.07	DPSIS	.00000
IACC	1	PSRBS	.00000	REN	.00000				

LOGIC:

GATE	1	T	GATE	2	F	GATE	3	T	GATE	4	T	GATE	5	T	
GATE	6	F	GATE	7	T										

AERODYNAMICS:

CLC	.92164E-01	ALB	-.61531	CNR	-153.09	CPC	-153.10	CY	.14510E-04
CAZ	.41344	CLP	-23.473	CN	-.24712E-03	CYCG	-.23051E-04	CMCG	.39623E-03
AXB	.22152E-02	CLB	.00000	CMB	-.10886	CNB	-.40802E-01	TWA3D	.00000
DTWA3D	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	-.20541E-04	BETA	.12094E-05

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DERLG PRINT:

DELXS	10051.	DELYS	664.53	DELZS	-1735.3	DELXS	10051.	DELYS	664.53
DFL7S	-1735.3	KLTTA	1	PITERR	.17096	YAWERR	.65061E-01	PITERS	.00000
YAWERS	.00000	DRLAMY	.00000	P3	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIG	.99994	RPHIG	.13287E-02	DELVR	.00000	DPHIO	1.0164	G	32.160
VERC	1C9x+9	ISKR	0	IACT	0	IGUIDE	0	IRAP	0
KASE	1	NAVY	0	F1	.00000	DRLAMP	.00000	NUM	0
IPRINT	1	NPPS	20	NDT	188	NDTA	256	NULSKR	2
PEFI	.12651	PHIG	1.0164	RHA	.20774E-02	S2	1.0000	DELRBL	.00000
RED	.00000	RET	.00000	REG	.15097E-01	RPSI	.00000	RTHTA	.00000
OMEGY	.00000	OMEGZ	.00000	NX	33				

UNCAGE GYRO FOR ROLL TO VERTICAL

PROJECTILE!

TYPE	4.0000	RSA	.33398E-01	DELVP	.00000	U	926.87	V	-.61312E-01		
W	.2364CE-01	THTA	.96730E-01	PHD	2.6132	DELZ	636.95	TOTACC	.24350E-01		
DZ	-89.863	DY	-.42008E-02	CPHI	.73937	DTHTA	-.33811E-01	DX	922.54		
DPSI	.12182E-04	DR	.69240E-03	DQ	-.44627E-01	DP	-1.9467	DH	-.61291		
DU	918.846	DV	.33294	VRW	926.87	MACH	.86376	GAP	869.80		
PSI	-.78606E-05	P	-.73937	Q	-.99206E-01	R	.17036E-01	DELVY	.00000		
AZS	-.90531E-01	DELAY	.00000	DELYY	.00000	DELZY	.00000	X	38.373		
Y	-.10762E-01	Z	4637.0	AMB	-.74012E-01	XT	13120.	YT	.00000		
DTHTA	-.33811E-01	CPHI	.86360	SPHI	.50418	CPSI	1.0000	SPSI	-.78606E-05		
CPSIS	1.0000	GZB	27.643	GYB	14.138	GXB	-3.1060				

AUTOPILOT!

DCMMIC	.00000	DELXS	9129.6	PEC	.00000	DELMIS	.00000	TXED	-.10481E-03		
DFL7S	1523.9	OMEGA	.78282E-17	DYEF	.00000	DPEF	.00000	DTHTAS	-.19664E-01		
RTM	9298.5	KT	20.000	PEPL	.12651	ALLL	1	DELR	-.56984E-01		
OMEGZ	.00000	PSRG	.00000	PED	.00000	PEF	.00000	PITERS	.00000		
PHIG	.22919	PSIS	-.12918E-01	PXED	-.56946E-09	THBS	-.46611E-01	PSBS	-.28878E-01		
DEL1	-.16927E-02	RLAMY	.00000	RLAMP	.00000	THTAS	-.22134E-01	THRBS	-.11718E-02		
YES	.00000	PEP	.00000	YED	.00000	PED	.00000	YEF	.00000		
YBRG	.00000	YEG	.00000	DELYS	889.24	YAWERR	.95778E-01	YAWERS	.00000		
LAMYR	.00000	LAMPR	.00000	QSA	.19682E-01	GAPS	180.50	DPSIS	-.83396E-01		
IACC	1	PSRBS	-.15250E-02	REN	.00000						

LOGIC!

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	F	GATE 7	T								

AERODYNAMICS!

CLD	.91532E-01	ALS	.42317	CNR	-152.20	CPQ	-152.21	CY	-.33917E-03		
CAZ	.39139	CLP	-22.780	CN	.50156E-01	CYCQ	.54546E-03	CMCQ	-.80669E-03		
AKB	.95054E-01	CLQ	-.81448	CMS	-.11183	CNR	-.65233E-01	TWASD	.00000		
DTWASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.41689E-04	BETA	-.28192E-04		

RAP!

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6667										

OFBLG PRINT!

DFLXR	9171.8	DELVB	771.87	DELZB	-1321.3	DELXB	9129.6	DELYB	889.24		
DFL7S	-1523.9	KLTTA	1	PITERR	.16540	YAWERR	.95778E-01	PITERB	.00000		
YAWERB	.00000	ORLAMY	.00000	P3	.00000	CRPSI	.00000	DRTHTA	.00000		
DRPHIG	.37823E-01	RPHIG	.15309E-01	DELVR	-.16927E-02	DPHIO	-.73937	G	32.160		
YBRC	109.49	ISKR	0	IACT	0	IGUIDE	0	IGAP	0		
KAGF	2	NAVY	0	P1	.00000	DRLAMP	.00000	NUM	0		
IPRINT	1	NPPS	20	NDT	128	NDTA	256	NLLSKR	2		
PEFL	.12651	PHIG	.22919	RHO	.20704E-02	S2	1.0000	DELREL	-.16927E-02		
RFC	.00000	RET	.00000	REG	.17156E-02	RPSI	.00000	RTHTA	.00000		
RVERY	.00000	OMEGZ	.00000	NX	33						

PROJECTILE1

TYPE	5.0000	RSA	-.56117E-01	DELVP	.00000	U	909.28	V	.13678E-01
W	.39976E-01	THTA	.61939E-01	PHD	.23285	DELZ	709.55	TOTACC	.21595E-01
DZ	456.242	DY	.33309E-03	DPHI	-1.0972	DTHTA	-.36423E-01	DX	907.54
DPSI	-.50776E-04	DR	-.38482E-01	DQ	.11251E-09	DP	4.1207	DH	-1.0090
DU	-16.358	DV	-.24139	VRW	909.28	MACH	.82795	GAP	854.18
PSI	-.41257E-05	P	-1.0972	Q	-.35451E-01	R	.83550E-02	DELVY	.00000
AZM	-.91682E-01	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	4758.1
Y	-.13141E-01	Z	-4709.5	AMB	-.75136E-01	XT	13120.	YT	.00000
DTHTA	-.36423E-01	CPHI	.97301	SPHI	.23075	CPSI	1.0000	SPSI	-.41257E-05
CPSIB	1.0000	GZB	31.232	GYB	7.4065	GXB	-1.9907		

AUTOPILOT1

DOPHIC	.00000	DELXS	8212.8	PEC	.00000	DELPIB	.00000	TXEC	.27817E-02
DFL2S	1678.4	OMEGA	.15646E-16	DYEF	.00000	DPEF	.00000	DTHTAS	.5C730E-01
RTH	8392.0	KT	20.000	PEPL	.12651	NULL	1	DELR	.28776E-01
OMEGZ	.00000	PSRG	.00000	PED	.00000	PEF	.00000	PITERO	.00000
PHIG	-.51484E-01	PSIS	-.13942E-01	PXED	-.86988E-03	THBS	.12387	PSBS	-.20974E-01
DFL1	.50223E-03	RLAMY	.00000	RLAMB	.00000	THTAS	.58784E-01	THRBS	.31490E-02
YEF	.00000	PEF	.00000	YEC	.00000	PED	.00000	YEF	.00000
YBRG	.00000	YEG	.00000	DELYS	397.43	YAWERR	.47376E-01	YAWERO	.00000
LAMYR	.00000	LAMPR	.00000	CSA	-.50725E-01	CAPS	173.93	DPSIS	.D6117E-01
IACC	1	PSRBS	.34554E-02	REN	.00000				

LOGIC1

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T
GATE 6	F	GATE 7	T						

AERODYNAMICS1

CLC	.90978E-01	ALB	.59760	CNR	-151.41	CMC	-151.42	CY	.18094E-03
CAZ	.37210	CLP	-22.118	CN	.52894E-03	CYCG	-.29170E-03	CMCG	-.85280E-03
AKR	.25100E-01	CLB	.23065	CMB	.13219	CNB	-.31182E-01	TWASD	.00000
DTWASC	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.43965E-04	BETA	.15043E-04

RAP1

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DEBUG PRINT1

DELXB	8302.0	DELYB	332.69	DELZB	1192.7	DELXS	8212.8	DELYS	397.43
DFL2S	1678.4	KLTTA	1	PITERR	-.20158	YAWERR	.47376E-01	PITERO	.00000
YAWERB	.00000	DRLAMY	.00000	P3	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIG	-.21192E-01	RPHIG	-.24233E-02	DELVR	.80223E-03	DPHIO	-1.0972	G	32.160
VSSC	1094.2	ISKP	0	IACT	0	IGLIDE	0	IRXP	0
KAGE	2	NAVY	0	F1	.00000	DRLAMP	.00000	NCM	0
IPRINT	1	NPPS	20	KDT	128	KDTA	256	NULSKP	2
PEPL	.12651	PHIG	-.51484E-01	RHO	.20663E-02	S2	1.0000	DELRAL	.5C223E-03
RED	.00000	RET	.00000	REG	-.49964E-03	RPSI	.00000	RTHTA	.00000
SMEGY	.00000	SMEGZ	.00000	NX	33				

PROJECTILE1

TIME	= 6.0000	XBA	= .18510E-03	DELVB	= .00000	U	= 894.05	V	= -.17714E-02		
W	= .1092C	THTA	= .26414E-01	PHD	= -.14625E-02	DELZ	= 749.12	T8TACC	= .54807E-01		
DI	= 23.504	DY	= .80333E-03	DPHI	= .33487E-02	DTHTA	= -.36143E-01	DX	= 893.75		
DPSI	= -.82613E-04	DR	= -.36851E-03	DQ	= -.12269E-01	DP	= .11417E-01	DW	= -.22059		
DU	= 814.095	DV	= .75358E-01	VRW	= 894.05	MACH	= .81421	QAP	= 824.83		
P8I	= .27012E-05	P	= .33486E-02	Q	= -.36143E-01	R	= -.13547E-03	DELVY	= .00000		
AZB	= -.24597	DELXV	= .00000	DELYV	= .00000	DELZV	= .00000	X	= 5658.4		
Y	= -.12544E-01	Z	= -4749.1	AMB	= -.20200	XT	= 13120.	YT	= .00000		
DTHTA	= -.36143E-01	CPHI	= 1.0000	SPHI	= -.14625E-02	CPSI	= 1.0000	SPSI	= .27012E-05		
CPSIS	= 1.0000	GZB	= 32.168	GYB	= -.47015E-01	GXB	= -.84936				

AUTOPILOT1

DPHIC	= .00000	DELXS	= 731.04	PEQ	= .00000	DELMIS	= .00000	TXEQ	= -.47075E-02		
DELZS	= 1654.2	AMEGA	= .23402E-16	DYEF	= .00000	DPEF	= .00000	DTHTAS	= .36144E-01		
RTM	= 7499.2	KT	= 20.000	PEFL	= .12651	NULL	= 1	DELR	= .52493E-03		
AMEGZ	= .00000	PSRG	= .00000	PED	= .00000	PEF	= .00000	PITERS	= .00000		
PHIC	= -.58505E-02	PSIS	= .12206E-03	PXED	= .44498E-04	THSS	= .19543	PSSS	= .23265E-03		
DEL1	= .91618E-05	RLAMY	= .00000	RLAMP	= .00000	THTAS	= .95934E-01	THRBS	= .17833E-02		
YEF	= .00000	PEF	= .00000	YED	= .00000	PED	= .00000	YEF	= .00000		
YBRG	= .00000	YEG	= .00000	DELYS	= 2.2882	YAWERR	= -.30513E-03	YAWERS	= .00000		
LAMYR	= .00000	LAMPR	= .00000	GBA	= -.36144E-01	GAPS	= 167.38	DPSIS	= -.18590E-03		
IACC	= 1	PSRSS	= -.63350E-05	REN	= .00000						

LOGIC1

GATE 1	= 0	T	GATE 2	=	F	GATE 3	=	T	GATE 4	= 0	T
GATE 6	=	F	GATE 7	=	T						

AERODYNAMICS1

CLD	= .90497E-01	ALB	= -.17487E-02	CNR	= .180.71	CMB	= -150.77	CY	= -.23784E-04		
CAZ	= .35933	CLP	= -21.558	CN	= .14696E-03	CYCG	= .36448E-04	CMCG	= -.23744E-02		
AKR	= -.32711E-02	CLR	= .40418E-02	CMB	= .13179	CNB	= -.99379E-03	THASD	= .00000		
DTHASD	= .00000	PSISD	= .00000	DPSISD	= .00000	ALPHA	= .12214E-03	BETA	= -.19813E-05		

RAP1

STT	= .00000	CTT	= 1.0000	SPT	= .00000	CPT	= 1.0000	TH	= .00000		
XLTA	= 1.6A67										

DPRLG PRINT1

DELXB	= 7439.3	DELYB	= -1.3910	DELZR	= 945.93	DELXS	= 731.04	DELYS	= -2.2882		
DELZS	= 1654.2	KUTTA	= 1	PITERR	= -.P2241	YAWERR	= -.30513E-03	PITERS	= .00000		
YAWERS	= .00000	DRLAMY	= .00000	PB	= .00000	DRPSI	= .00000	DRTHTA	= .00000		
DRPHIG	= .29148E-02	RPHIG	= -.70125E-03	DELVR	= .91618E-05	DPHIO	= .33487E-02	G	= 32.159		
VRKD	= 109.61	ISKR	= 0	IACT	= 0	IGUIDE	= 0	IRAP	= 0		
KAGE	= 2	KAVY	= 0	P1	= .00000	DRLAMP	= .00000	POM	= 0		
IPRINT	= 1	NPPS	= 20	NDT	= 128	NDTA	= 256	NULSKR	= 2		
PEPL	= .12651	PHIG	= -.58508E-02	RHS	= .90638E-03	S2	= 1.0000	DELRAL	= .91618E-05		
REG	= .00000	RET	= .00000	REG	= -.88714E-03	RPSI	= .00000	RTHTA	= .00000		
AMEGY	= .00000	AMEGZ	= .00000	NX	= 39						

PROJECTILE:

TIME	6.6016	RSA	.982811E-04	DELVP	.00000	U	885.95	V	-.127022E-02		
W	.59683E-01	THTA	.466464E-02	PHD	-.19077E-03	DELZ	757.25	TOTACC	.29674E-01		
DZ	-4.0568	DY	.58412E-03	DPHI	.40578E-03	DTHTA	-.35802E-01	DX	889.99		
DPSI	.57822E-04	DR	-.42480E-03	DQ	.34067E-02	DP	-.61901E-02	DM	.41067		
DU	-12.826	DV	-.50658E-01	VRW	885.95	MACH	.80685	GAP	809.74		
PSI	.20802E-05	P	.40571E-03	Q	-.35802E-01	R	.50992E-04	DELVY	.00000		
AZB	-.13318	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	6193.5		
Y	-.12136E-01	Z	-4757.3	AMB	-.10950	XT	13120.	YT	.00000		
DTHTA	-.35802E-01	CPHI	1.0000	SPHI	-.19077E-03	CPSI	1.0000	SPSI	.20802E-05		
CPSIB	1.0000	GZB	32.159	GYB	-.61366E-02	GXB	-.14943				

ALTPILOT:

DCPRTO	.00000	DELXS	6782.3	PEQ	.00000	DELMIS	.00000	TXEO	.57947E-02		
DFL2S	1596.9	OMEGA	.28164E-16	DYEF	.00000	DPEF	.00000	DTHTAS	.35802E-01		
RTM	6967.8	KT	20.000	PEPL	.12651	NULL	1	DELR	-.13764E-03		
OMEGZ	.00000	PSRG	.00000	PED	.00000	PEF	.00000	PITERB	.00000		
PHIG	-.13853E-04	PSIS	.55952E-05	PXED	.57785E-04	THBS	.23901	PSBS	-.73330E-06		
DEL1	-.24023E-05	RLAMY	.00000	RLAMP	.00000	THTAS	.11770	THRBS	.18045E-04		
YFP	.00000	PEP	.00000	YEQ	.00000	PEQ	.00000	YEF	.00000		
YBRG	.00000	YEG	.00000	DELYS	-.19081	YAWERR	-.27385E-04	YAWERB	.00000		
LAMYR	.00000	LAMBR	.00000	QBA	-.35802E-01	GAPS	164.32	DPSIS	-.98281E-04		
IACC	1	PSRBS	-.59618E-05	MEN	.00000						

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T						
GATE 6	T	GATE 7	T												

AERODYNAMICS:

CLD	.90246E-01	ALB	-.20680E-03	CNR	-150.34	CMC	-150.38	CY	-.17193E-04		
CAZ	.34636	CLP	-21.274	CN	-.81051E-03	CYCG	.27869E-04	CMCG	-.13110E-02		
AXM	-.23277E-02	CLB	-.10374E-02	CPB	12899	CNB	-.16368E-03	TMASD	.00000		
DTMASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.67366E-04	BETA	-.14337E-05		

RAR:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6667										

DEBUG PRINT:

DELXB	6922.9	DELYB	-.15286	DELZB	789.43	DELXS	6752.3	DELYS	-.19081		
DFL2S	1596.9	KLTTA	1	PITERR	-.23184	YAWERR	-.27385E-04	PITERB	.00000		
YAWERB	.00000	DRLAMY	.00000	PB	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIG	.26813E-03	RPHIG	-.22558E-04	DELVR	-.24023E-05	DPHIO	.40578E-03	G	32.159		
VSND	1099.0	ISWR	0	IACT	0	IGUIDE	0	IRAP	0		
KASE	2	NAVY	0	F1	.00000	DRLAMP	.00000	NUM	0		
IPRINT	1	NPPS	20	NDT	128	NDTA	256	NULSKP	2		
PFFL	.12651	PHIG	-.13853E-04	RHB	.20633E-02	BE	1.0000	DELRBL	-.24023E-05		
RED	.00000	RET	.00000	REG	.93005E-04	RPSI	.00000	RTHTA	.00000		
AMEGY	.00000	AMEGZ	.00000	NX	39						

PROJECTILE1

TYPE	7.0000	RBA	.21807E-04	DELVP	.00000	D	881.00	V	-.19054E-02
W	.70985E-01	THTA	-.98282E-02	PHD	-.11718E-03	DELZ	756.21	TOTACC	.35103E-01
DZ	8.7295	DY	.81439E-03	DPHI	-.63273E-05	DTHTA	-.36047E-01	DX	88C.96
DPSI	.34448E-04	DR	-.62890E-03	DQ	-.11007E-03	DP	-.24185E-02	DH	.3657+
DU	.12.02C	DV	-.29638E-01	VRW	8R1.CO	MACH	.80234	GAP	80C.7*
PSI	.28807E-05	P	-.63375E-04	C	-.36047E-01	R	.30424E-04	DELVY	.00000
AZB	-.15732	DELXV	.00000	DELYV	.00000	DELIV	.00000	X	65+5.+
Y	-.11870E-01	Z	-4756.2	AMB	-.12989	XT	13120.	YT	.00000
DTHTA	-.36047E-01	CPHI	1.0000	SPHI	-.11718E-03	CPSI	1.0000	SPSI	.28507E-05
CPSIS	1.0000	GZB	32.158	GYB	-.37692E-02	GXB	.31607		

AUTOPILOT1

DCPHIC	.00000	DELXS	6433.2	PEC	.00000	DELMIS	.00000	TXEC	.68181E-02
DELZS	1552.9	OMEGA	.31279E-14	DYEF	.00000	DPEF	.00000	DTHTAS	.36047E-01
RTM	661A.0	KT	20.000	PEFL	.12651	NULL	1	DELR	-.69619E-04
OMEGZ	.00000	PSRG	.00000	PED	.00000	PEF	.00000	PITERS	.00000
PHIC	.95970E-04	PSIS	-.21232E-05	PXEC	.24739E-03	THBS	.26797	PSBS	-.85919E-05
DEL1	-.12151E-05	RLAMY	.00000	RLAMP	.00000	THTAS	.13217	THRBS	.18106E-02
YEF	.00000	PEP	.00000	YEC	.00000	PED	.00000	YEF	.00000
YBRG	.00000	YEG	.00000	DELYS	-.74270E-01	YAWERR	-.11223E-04	YAWERS	.00000
LAMYR	.00000	LAPPR	.00000	GSA	-.36047E-01	GAPS	162.49	DPSIS	-.21807E-04
IACC	1	PSRBS	-.21787E-05	REN	.00000				

LOGIC1

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T
GATE 6	T	GATE 7	T						

AERODYNAMICS1

CLO	.90082E-01	ALB	.31851E-04	CNR	-150.12	CMB	-150.16	CY	-.25964E-04
CAZ	.34C38	CLP	-21.093	CN	.46941E-03	CYCB	.42107E-04	CMCB	-.15691E-02
AKR	-.34778E-02	CLB	-.51798E-03	CMB	.12894	CNB	-.10882E-03	THASD	.00000
DTHASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.80573E-04	BETA	-.21628E-05

RAP1

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DEBUG PRINT1

DELXB	6581.7	DELYB	-.87910E-01	DELZB	691.55	DELXS	6433.2	DELYB	-.74270E-01
DELZS	1552.9	KLTTA	1	PITERR	-.23686	YAWERR	-.11223E-04	PITERS	.00000
YAWERS	.00000	DRLAMY	.00000	PB	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIC	.59268E-04	RPHIC	.29362E-05	DELVR	-.12151E-05	DPHIC	-.63273E-04	G	32.159
VSRC	109.+C	ISKR	0	IACT	0	ISLIDE	0	IRAP	0
KASE	2	NAVY	0	F1	.00000	DRLAMP	.00000	NUM	0
IPRINT	1	NPRS	20	NDT	128	NDTA	256	NULSKR	2
PEFL	.12651	PHIC	.95970E-04	RHB	.90631E-03	SB	1.0000	DELRBL	-.12151E-05
RPD	.00000	RET	.00000	REB	.11099E-05	RPSI	.00000	RTHTA	.00000
SMEGV	.00000	SMEGZ	.00000	NX	33				

ROLL HOLD

ACCELSTIRR

LATERAL ENABLE

GUIDANCE ENABLE

PROJECTILE1

TIME	8.0000	RSA	.75122E-06	DELVB	.00000	U	869.81	V	.14867E-02
W	.64792E-01	THTA	-.46519E-01	PHD	-.11165E-03	DELZ	731.31	TOTACC	.31390E-01
DZ	40.513	DY	.68341E-03	DPHI	-.84285E-07	DTHTA	-.37049E-01	DX	868.87
DPSI	.48936E-05	DR	.46584E-03	DQ	.86543E-02	DP	.11867E-05	DW	-.13255
DL	-10.408	DV	-.49669E-02	VRW	869.81	MACH	.79208	GAP	761.12
PSI	-.96637E-06	P	-.48484E-07	Q	-.37049E-01	R	.75723E-06	DELVY	.00000
AZS	-.14086	DELZV	.00000	DELVV	.00000	DELZV	.00000	X	7420.0
Y	-.11200E-01	Z	-6731.3	AMB	-.11558	XT	13120.	YT	.00000
DTHTA	-.37049E-01	CPHI	1.0000	SPHI	-.11135E-03	CPSI	1.0000	SPSI	-.96630E-06
CPSIS	1.0000	GZB	32.128	GYB	-.25851E-05	GXB	1.4955		

AUTOPILOT1

DDPHIC	.00000	DELXS	5727.8	PEC	-.17453	DELZS	.00000	TXEC	.79181E-03
DELZS	465.91	OMEGA	.39095E-16	DYEF	-.21403E-03	DYEF	-6.1087	DTHTAS	-.13748
RTH	5746.7	KT	10.000	PEFL	.12651	NULL	2	DELR	.29650E-07
OMEGZ	-.61322E-04	PSRG	.00000	PED	-.17453	PEF	.00000	PITERR	-.26180E-01
PHIG	-.41942E-07	PSIS	.14912E-08	PXEF	.14908E-09	THBS	.90047E-07	PSSS	.15765E-11
DEL1	.51748E-09	RLAMY	.42342E-07	PLAMP	.00000	THTAS	.79203E-04	THRBS	-.79158E-04
YEF	.00000	PEF	.00000	YEC	-.14132E-04	PED	.17453	YEF	.00000
YBRG	.00000	YEG	-.14904E-08	DELYS	-.35240E-01	YAWERR	-.61322E-05	YAWERS	-.61322E-05
LAMYR	-.61322E-04	LAMPR	-.17453	OSA	-.37049E-01	GAPS	158.51	DPSIS	-.62079E-04
IACC	2	PSRBS	-.14900E-08	REN	.00000				

LOGIC1

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T
GATE 6	T	GATE 7	T						

AERODYNAMICS1

CLC	.89881E-01	ALB	.29820E-07	CNR	-149.90	CMC	-149.94	CY	.20461E-04
CAZ	.33715	CLP	-80.869	CN	.88867E-03	CYCG	-.33123E-04	CMCG	-.14346E-02
AKB	.26687E-02	CLB	.21471E-06	CMB	.13077	CNB	-.26722E-05	TMASD	.00000
DTMASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.74030E-04	BETA	.17092E-05

RAP1

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6459								

DEBUG 1

DELZS	5727.8	DELYB	-.35231E-01	DELZR	-.35240E-01	DELYB	5727.8	DELYS	-.35240E-01
ZELZS	465.91	KLTTA	1	PITERR	-.81162E-01	YAWERR	-.61322E-05	PITERS	-.26180E-01
YAWERB	-.61322E-05	DRLAMY	-.84285E-06	P3	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIG	-.22912E-07	RPHIG	-.15224E-08	DELVR	.81748E-09	DPHIO	-.84285E-07	G	32.159
VSKC	109.01	ISKR	0	IACT	0	IGUIDE	0	IRAP	0
KAGF	2	NAVY	0	P1	.00000	DRLAMP	.00000	NLM	0
IPRINT	1	NPPS	20	NDT	128	NDTA	256	NOLSKR	2
PEFL	.12651	PHIG	-.41942E-07	PHB	.20649E-09	S2	1.0000	DELRSL	.51748E-09
RED	.00000	RET	.00000	REG	-.59787E-09	RPSI	.00000	RTHTA	.00000
OMEGY	-.17453	OMEGZ	-.61322E-04	NX	33				

PROJECTILE:

TIME	9.0000	RSA	.47106E-07	DELVB	-.49043E-01	U	852.32	V	-.75373E-03
W	76.962	THTA	-.14785E-01	PHD	-.11156E-09	DELZ	662.66	TOTACC	14.167
DZ	89.555	DY	-.97898E-03	DPHI	.10715E-05	DTHTA	.24754	DX	851.09
DPSI	-.27842E-04	DR	-.50492E-03	DQ	4.0239	DP	-.39335E-04	DW	228.98
DU	830.888	DV	-.28841E-02	VRW	855.79	MACH	.77912	GAP	757.72
PSI	-.10337E-04	P	-.14874E-05	G	.24754	R	-.22780E-06	DELVY	-.14673E-05
AZB	883.547	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	8278.8
Y	-.11888E-01	Z	4662.4	AMB	24.101	XT	13120.	YT	.00000
DTHTA	.24754	CPHI	1.0000	SPHI	-.11158E-03	CPSI	1.0000	SPSI	-.10337E-04
CPSIS	1.0000	GZB	32.154	GYB	-.35833E-02	GXB	.47548		

AUTOPILOT:

DCPHIC	.00000	DELXB	4886.4	PEC	-.90282E-01	DELMIB	.00000	TXEC	-.5636+E-02
DELZB	2.8767	OMEGA	.46912E-16	DYEF	.38856E-05	DPEF	.88978E-01	DTHTAB	-.25342
RTM	4886.4	KT	101000	PEFL	.97010E-01	NULL	2	DELR	-.12297E-05
OMEGZ	-.46271E-07	PSRG	.00000	PED	-.58872E-02	PEF	-.29503E-01	PITERB	-.58872E-03
PHIG	.19894E-05	PSIB	-.79340E-06	PXED	.95647E-03	THBB	-.25477	PBBB	-.32762E-05
DEL1	-.14888E-05	RLAMY	.91792E-06	RLAMB	.00000	THTAB	-.12066	THRBB	-.67277E-02
YEF	-.95C91E-08	PEF	-.29503E-01	YED	-.46271E-07	PED	-.58872E-02	YEF	-.65051E-04
YBRG	.00000	YEG	-.13952E-05	DELYB	-.22609E-04	YAWERR	-.46271E-08	YAWERB	-.46271E-08
LAMYR	-.46971E-07	LAMBR	-.58872E-02	GBA	.24754	GAPB	153.76	DPSIB	.83529E-09
IACG	2	PSRBS	-.84473E-06	REN	.00000				

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T
GATE 6	T	GATE 7	T						

AERODYNAMICS:

CLO	.89687E-01	ALB	.71310E-06	CNR	-1.9.74	CMQ	-186.61	CY	-.18057E-04
CAZ	.35068	CLP	-20.655	CN	.41329	CYCQ	.37010E-04	CMCQ	.30838
AKR	-.28925E-02	CLR	-.80198E-05	CMR	-1.0722	CNB	.79170E-06	THASD	.00000
DTHASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.90051E-01	BETA	-.88074E-06

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DEBUG PRINT:

DELXB	4886.5	DELYB	-.38994E-02	DELZB	591.00	DELXB	9886.4	DELYB	-.22609E-04
DELZB	2.8767	KUTTA	1	PITERB	-.58872E-03	YAWERB	-.46271E-08	PITERB	-.58872E-03
YAWERB	-.46271E-08	DRLAMY	.10715E-04	PB	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIG	.11178E-05	RPHIG	.69727E-07	DELVB	-.21462E-07	DPHIO	.10715E-05	G	32.160
VSND	1094.4	ISKB	0	IACT	0	IGUIDE	0	IRAP	0
KAOF	2	NAVY	0	PI	.00000	DRLAMP	.00000	NLM	0
IPRINT	1	NPPB	20	NDT	128	NDTA	256	NULBKB	2
PEFL	.97C1CE-01	PHIG	.19894E-05	RHB	.90692E-02	B2	1.0000	DELRBL	-.21462E-07
REB	.CCCCC	RET	.00000	REG	.21997E-07	RPSI	.00000	RTHTA	.00000
OMEGV	-.58872E-02	OMEGZ	.46271E-07	NX	39				

PROJECTILE:

TIME	10.000	RSA	-.40370E+06	DELVB	-.10764	U	837.86	V	-.21774E+02		
W	107.11	THTA	.12807E+01	PHD	-.11165E+03	DELZ	569.16	TOTACC	25.390		
DZ	96.374	DY	-.34603E+02	DPHI	.546998+07	DTHTA	-.12739E+01	DX	839.17		
DPSI	.10504E+05	DR	-.28872E+05	DQ	.A3617E+01	DP	-.76264E+06	DW	-3.9061		
DU	-10.418	DV	-.27503E+02	VRW	844.68	MACH	.76875	GAP	740.28		
PSI	-.15805E+04	P	.23603E+06	Q	-.12739E+01	R	-.3719AE+06	DELVY	.26386E+05		
AZB	-113.97	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	9123.4		
Y	-.14137E+01	Z	-4569.2	AMB	.42846	XT	13120.	YT	.00000		
DTHTA	-.12739E+01	CPHI	1.0000	SPHI	-.11165E+03	CPSI	1.0000	SPSI	-.15805E+04		
CPSIS	1.0000	GZB	32.157	GYB	-.35970E+02	GXB	-.41185				

ALTSPILOT:

DRPHIG	.00000	DELXS	4037.0	PEG	-.10764	DELMIS	.00000	TXED	-.77072E+02		
DFL2S	2.2268	OMEGA	.54728E-16	DYEF	.97477E+04	DPEF	-.40606E-03	DTHTAS	.72225E-02		
RTM	4037.C	KT	10.000	PEFL	.10725	NULL	2	DELR	-.61751E+08		
OMEGZ	.85007E+06	PSRG	.00000	PED	-.55164E+02	PEF	-.19267E+01	PITERB	-.55161E+03		
PHIG	-.31246E+07	PSIS	.18776E+05	PXED	.91279E+07	THBS	-.30697	PSBS	.38593E+05		
DFL1	.26385E+05	RLAMY	-.65945E+07	RLAMP	.00000	THTAS	-.15371	THRBS	.42997E+03		
YEF	.26003E+05	PEF	-.19267E+01	YED	.A5007E+06	PED	-.55164E+02	YEF	.26003E+05		
YARG	.00000	YEG	.26525E+05	DELYS	.34497E+03	YAWERR	.85452E+07	YAWERB	.85452E+07		
LAMYR	.85007E+06	LAMPR	-.55164E+02	GSA	-.12739E+01	GAPS	150.22	DPSIS	.12538E+05		
IACC	2	PSRBS	.52040E+07	REN	.00000						

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	T	GATE 7	T								

AERODYNAMICS:

CLD	.89931E+01	ALB	-.11108E+06	CNR	-149.61	CMC	-171.14	CY	-.14036E+04		
CAZ	.33977	CLP	-20.484	CN	.75869	CYCG	.23337E+06	CMCG	.56114E+02		
AXB	-.17A19E+04	CLB	-.42213E+07	CMB	.80086E+01	CNB	.12784E+08	THASD	.00000		
DTHASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.12715	BETA	-.25778E+05		

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6667										

DEFLG PRINT:

DFLXB	3989.C	DELYB	.79248E+02	DELZB	620.30	DELXB	4037.0	DELYS	.34497E+03		
DFL2S	2.2268	KLTTA	1	PITERR	-.55161E+03	YAWERR	.85452E+07	PITERB	-.55161E+03		
YAWERB	.85452E+07	DRLAMY	.34699E+06	P3	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIG	.36317E+07	RPHIG	-.54051E+08	DELVR	-.10778E+09	DPHIO	.34699E+07	G	32.160		
VERR	109.88	ISKP	0	IACT	0	IGUIDE	0	IRAP	0		
KAGE	2	NAVY	0	F1	.00000	DRLAMP	.00000	NUN	0		
IPRINT	1	NPPS	20	NDT	128	NDTA	256	NULSKR	2		
PEFL	.10725	PHIG	-.31246E+07	RHB	.20750E+02	B2	1.0000	DELRSL	-.10778E+09		
REF	.00000	RET	.00000	REG	.13937E+09	RPSI	.00000	RTHTA	.00000		
OMEGY	-.55164E+02	OMEGZ	.85007E+06	NX	33						

PROJECTILE:

TIME	11.000	RSA	.30561E+05	DELVW	-.10667	D	827.48	V	-.16C113E+02
W	105.47	THTA	.24194E+02	PHD	-.11165E+03	DELZ	468.84	TOTACC	24.819
DZ	103.47	DY	-.52646E+02	DPHI	-.76568E+09	DTHTA	-.11211E+01	DX	827.73
DPSI	.44047E+05	DR	.29508E+05	DG	-.91930E+08	DP	.15395E+07	DW	-1.9357
DU	-9.9660	DV	-.49075E+02	VRW	834.17	MACH	.75892	GAP	724.14
PSI	-.13329E+04	P	.14665E+06	Q	-.11211E+01	R	.31530E+05	DELVV	.74272E+05
AZB	.111.4C	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	9956.9
Y	-.1857CE+01	Z	.4665.8	AMB	-.86059E+01	XT	13120.	YT	.00000
DTHTA	-.11211E+01	CPHI	1.0000	SPHI	-.11165F+03	CPSI	1.0000	SPSI	-.13328E+04
CPSIS	1.0000	GZB	32.160	GYB	-.95917E+09	GXB	-.77810E+01		

AUTOPILOT:

DDPHIO	.00000	DELXS	3198.3	PEQ	-.10667	DELMIS	.00000	TXEQ	-.74815E+05
DELZS	1.8381	OMEGA	.62544E-16	DYEF	.65899E-06	DPEF	-.13877E-03	DTHTAS	.54634E-02
RTM	319X.3	KT	10.000	PEFL	.10641	NULL	2	DELP	.10761E-07
OMEGZ	.23258E-05	PSRG	.00000	PEQ	-.57473E-09	PEF	-.20108E-01	PITERO	-.57473E-03
PHIG	-.29885E-07	PSIS	.21194E-05	PXEQ	.10765E-04	THEG	-.89791	PRES	.41723E-05
DEL1	.74274E-05	RLAMV	-.29119E-07	RLAMP	.00000	THTAS	.14897	THRSH	.26263E-03
YEF	.74812E-05	PEF	-.20108E-01	YEQ	.23258E-05	PEQ	-.89791E-02	YEP	.74812E-05
YBRG	.00000	YEG	.74812E-05	DELYS	.74384E-03	YAWERR	.23258E-06	YAWERO	.23258E-06
LAMVR	.23258E-05	LAMPR	-.57473E-02	GSA	-.11211E-01	GAPS	146.94	DPSIP	-.77029E-04
IACC	2	PSRBS	-.33222E-07	REN	.00000				

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T
GATE 6	T	GATE 7	T												

AERODYNAMICS:

CLD	.89384E-01	ALB	-.68747E-07	CNR	-149.49	CMQ	-170.64	CY	-.39023E-04
CAZ	.33817	CLP	-20.322	CN	.75814	CYCG	-.36957E-06	CMCG	-.75054E-03
AKB	.27604E-04	CLR	.71641E-07	CNB	.43509E-01	CNB	-.10726E-04	TWASH	.00000
DTWASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.12678	BETA	-.72063E-05

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DEBUG PRINT:

DELXB	9162.6	DELYB	.78222E+02	DELZB	476.80	DELXS	3198.3	DELYS	.74384E-03
DELZS	1.8381	KLTTA	1	PITERR	-.87473E-09	YAWERR	.23258E-06	PITERS	-.57473E-03
YAWERR	.23258E-06	DRLAMV	-.76568E-08	PS	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIG	-.74800E-09	RPHIG	-.23310E-08	DELVR	.18781E-09	DPHIO	-.76568E-09	G	32.160
VSKC	1099.2	ISKR	0	IACT	0	IGUIDE	0	IRAP	0
KAGE	2	NAVY	0	PI	.00000	DRLAMP	.00000	NUM	0
IPRINT	1	NPPS	80	NDT	128	NDTA	256	NULSKR	2
PEFL	.10641	PHIG	-.29885E-07	RHO	.20813E-03	S2	1.0000	DELRSL	.18781E-09
PEQ	.00000	REY	.00000	REQ	-.18604F-09	RPSI	.00000	RTHTA	.00000
OMEGY	-.57473E-02	OMEGZ	.23258E-05	NX	33				

PROJECTILE1

TIME	12.000	RSA	.10428E-04	DELVP	-.10596	U	817.80	V	-.12861E-01
W	103.82	THTA	-.88930E-02	PHD	-.11164E-03	DELZ	361.18	TOTACC	24.203
DZ	111.09	DY	-.59735E-02	DPHI	.32487E-08	DTHTA	-.11560E-01	DX	816.84
DPSI	.11837E-04	DR	.75474E-05	DQ	-.27109E-02	DP	-.14434E-06	DW	-1.4977
DU	-9.3203	DV	-.94951E-02	VRW	824.36	MACH	.74971	GAP	709.51
PSI	-.57812E-05	P	.69735E-07	Q	-.11560E-01	R	.10546E-04	DELVY	.16086E-04
AZH	-108.64	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	10778.
Y	-.24305E-01	Z	-4361.2	AMB	-.59882E-01	XT	13120.	YT	.00000
DTHTA	-.11560E-01	CPHI	1.0000	RPHI	-.11164E-03	CPSI	1.0000	SPSI	-.57512E-05
CPSIS	1.0000	GZB	32.159	GYB	-.35888E-02	GXB	.28600		

ALTAPILOT1

DPHIC	.00000	DELXB	2369.7	PEQ	-.10595	DELMIB	.00000	TXEQ	-.71900E-02
DELZB	1.4238	OMEGA	.70361E-16	DYEF	.12699E-04	DPEF	-.18585E-02	DTHTAB	.55518E-02
RTM	2369.7	KT	10.000	PEFL	.10567	NJLL	2	DELR	.41688E-09
OMEGZ	.50427E-05	PSRG	.00000	PED	-.60086E-09	PEF	-.20844E-01	PITERB	-.60086E-03
PHIG	-.62382E-08	PSIS	-.59008E-06	PXED	-.16943E-07	THBS	-.28648	PSBS	-.16842E-05
DEL1	.16086E-04	RLAMY	-.94869E-08	RLAMP	.00000	THTAG	-.14352	THRBS	.28029E-03
YEF	.16379E-04	PEF	-.20844E-01	YED	.50427E-05	PED	-.60086E-02	YEP	.16379E-04
YRRG	.00000	YEQ	.16128E-04	DELYG	.11949E-02	YAWERR	.50427E-06	YAWERB	.5C427E-06
LAMYR	.50427E-05	LAMPR	-.60086E-02	CBA	-.11560E-01	CAPS	143.98	CPSIB	-.53851E-05
IACC	2	PSRBS	-.25162E-06	REN	.00000				

LOGIC1

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T
GATE 6	T	GATE 7	T						

AERODYNAMICS1

CLD	.89246E-01	ALB	-.31735E-07	CNR	-149.38	CMQ	-170.10	CY.	-.84522E-04
CAZ	.33691	CLP	-20.170	CN	.75456	CYCQ	-.10758E-05	CMCQ	-.81[illegible]E-03
AKR	.78733E-04	CLR	.27228E-03	CMB	.44367E-01	CNB	-.35544E-04	TWRQD	.00000
DTHASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.12628	BETA	-.15601E-04

RAP1

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6867								

DERLG PRINT1

DELXR	2345.1	DELVB	-.20430E-03	DELZB	340.34	DELXB	2369.7	DELYB	.11949E-02
DELZS	1.4238	KUTTA	1	PITERR	-.60086E-09	YAWERR	.50427E-06	PITERB	-.6C086E-03
YAWERB	.50427E-06	DRLAMY	.32487E-07	F3	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIG	.26646E-08	RPHIG	-.71222E-09	DELVR	.72760E-11	DPHIO	.32487E-08	G	32.161
VSKD	109.6	ISKR	0	IACT	0	IGUIDE	0	IRAP	0
KASE	2	NAVY	0	F1	.00000	DRLAMP	.00000	NUM	0
IPRINT	1	NPPS	20	NOT	128	NOTA	256	NULSKR	2
PEFL	.10567	PHIG	-.62382E-08	RHO	.90881E-02	S2	1.0000	DELRBL	.72760E-11
PEP	.00000	RET	.00000	REQ	-.13448E-10	RPSI	.00000	RTHTA	.00000
OMEGY	-.60086E-02	OMEGZ	.50427E-05	NX	33				

PROJECTILE!

TIME	13.000	RBA	.32283E-04	DELVB	-.10527	U	808.80	V	-.28044E-01		
W	102.30	THTA	-.20897E-01	RHO	-.11164E-03	DELZ	245.64	TOTACC	23.652		
DZ	119.18	DY	-.46341E-02	DPHI	.10098E-07	DTHTA	-.12134E-01	DX	808.49		
DPSI	.33422E-04	DR	.31232E-04	DQ	-.67847E-09	DP	-.39117E-06	DW	-1.3124		
DU	-8.6855	DV	-.24102E-01	VRW	815.25	MACH	.74111	GAM	696.33		
PSI	.14824E-04	P	-.10978E-06	Q	-.12134E-01	R	.32568E-04	DELVY	.35538E-04		
AZB	106.17	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	11589.		
Y	-.29852E-01	Z	4245.6	AMB	-.84934E-01	XT	13120.	YT	.00000		
DTHTA	-.12134E-01	CPHT	1.0000	SPHI	-.11164E-03	CPSI	1.0000	SPSI	.14824E-04		
CPSIB	1.000C	GZB	32.154	GYB	-.35955E-09	GXB	.67201				

ALTAPILOT!

DRPHIC	.00000	DELXS	1550.4	PEQ	-.10527	DELMIS	.00000	TXEQ	-.68922E-02		
DELZS	.95718	OMEGA	.78177E-14	DYEF	.33542E-04	DPEF	-.67044E-03	DTHTAS	.59608E-02		
RTW	1550.4	XT	10.000	PEPL	.10497	NULL	2	DELR	-.24179E-07		
OMEGZ	.11422E-04	PSRG	.00000	PED	-.61736E-09	PEF	-.21541E-01	PITERS	-.61736E-03		
PHIG	.59331E-07	PSIS	-.11950E-04	PXEQ	-.84874E-04	THBS	.27458	PSBS	-.25850E-04		
DPL1	.35537E-04	RLAMY	.49233E-07	RLAMP	.00000	THTAS	-.13759	THRBS	.29832E-03		
YEF	.36622E-04	PEF	-.21841E-01	YEQ	.11422E-04	PED	-.61736E-02	YEP	.36622E-04		
YBRG	.0000C	YEG	.35647E-04	DELYS	.17709E-02	YAWERR	.11422E-05	YAWERS	.11422E-05		
LAMYR	.11422E-04	LAMPR	-.61736E-02	QSA	-.12134E-01	CAPS	141.30	DPSIS	-.20861E-04		
IACC	2	PSRBS	-.97820E-06	REN	.00000						

LOGIC!

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	T	GATE 7	T								

AERODYNAMICS!

CLB	.89117E-01	ALB	.71135E-07	CNR	-149.28	CMQ	-169.70	CY	-.18601E-03		
CAZ	.33574	CLP	-20.028	CN	.75135	CYCB	-.40048E-05	CMCB	-.11826E-02		
AXB	.28761E-03	CLB	-.13478E-08	CMB	.48105E-01	CNB	-.10866E-03	THABC	.00000		
DYNASC	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.12582	BETA	-.34399E-04		

RARI

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6667										

DEBUG PRINT!

DELXB	1535.7	DELYB	-.18787E-01	DELZB	213.80	DELXB	1550.4	DELYS	.17709E-02		
DELZS	.95718	KUTTA	1	PITERR	-.61736E-03	YAWERR	.11422E-05	PITERS	-.61736E-03		
YAWERS	.11422E-05	DRLAMY	.10098E-06	PB	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIG	.83791E-08	RPHIG	.40761E-08	DELVR	-.42201E-04	DPHIO	.10098E-07	G	32.161		
VSKC	1100.0	ISKR	0	IACT	0	IGUIDE	0	IRAP	0		
KAGE	2	NAVY	0	PI	.00000	DRLAMP	.00000	NLM	0		
IPRINT	1	NPPS	20	NDT	12R	NDTA	256	NULSKR	2		
PEPL	.10497	PHIG	.59331E-07	RHB	.90954E-09	SZ	1.0000	DELRBL	-.42201E-04		
REQ	.00000	PET	.00000	REQ	.43140E-04	RPBI	.00000	RTHTA	.00000		
OMEGY	-.61736E-02	OMEGZ	.11422E-04	NX	33						

PROJECTILE:

TIME	14.000	RBA	.16319E-03	DELVP	-.10479	U	800.47	V	-.82276E-01
W	100.91	THTA	-.33506E-01	PHD	-.11161E-03	DELZ	171.80	TOTACC	23.150
DZ	127.67	DY	.22353E-02	DPHI	-.85475E-07	DTHTA	-.12709E-01	DX	796.64
DPSI	.16588E-03	DR	.33011E-03	DQ	.84798E-02	DP	-.23145E-05	DH	-1.1805
DU	-7.9983	DV	-.11860	VRW	806.80	MACH	.73312	GAP	684.53
PSI	.91807E-04	P	-.10975E-05	Q	-.12709E-01	R	.16446E-03	DELVY	.10653E-03
AZB	-103.91	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	12390.
Y	-.31856E-01	Z	-4121.8	AMB	-.33667E-01	XT	13120.	YT	.00000
DTHTA	-.12709E-01	CPHI	1.0000	SPHI	-.11161E-03	CPSI	1.0000	SPSI	.91807E-04
CPSIS	1.0000	GZB	32.143	GYB	-.36861E-02	GXB	1.0774		

AUTOPILOT:

DPHIO	.00000	DELXS	739.94	PEQ	-.10473	DELMIS	.00000	TXEO	-.65770E-02
DELZS	.46471	OMEGA	.85994E-16	DYEF	.17801E-03	DPEF	.11756E-02	DTHTAS	.64289E-02
RTM	739.94	KT	10.000	PEPL	.10441	NULL	2	DELR	-.15133E-06
OMEGZ	.37295E-04	PSRG	.00000	PED	-.42803E-02	PEF	-.22099E-01	PITERS	-.62803E-03
PHIG	.35473E-06	PSIS	-.66064E-04	PXED	-.30210E-05	THRS	-.26183	PSIS	-.14942E-03
DEL1	.10653E-03	RLAMV	.28926E-06	RLAMP	.00000	THTAS	-.13123	THRSS	.31278E-03
YEF	.11273E-03	PEF	-.22099E-01	YED	.37295E-04	PED	-.62803E-02	YEP	.11273E-03
YBRG	.00000	YEG	.10709E-03	DELYS	.27596E-02	YAWERR	.37295E-05	YAWERS	.37295E-05
LAMYR	.37295E-04	LAMPR	-.62803E-02	GSA	-.12709E-01	GAPS	138.91	DPSIG	-.12890E-03
IACC	2	PSRSS	-.56439E-05	REN	.00000				

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	Y	GATE 4	T	GATE 5	T
GATE 6	T	GATE 7	T						

AERODYNAMICS:

CLD	.88997E-01	ALB	.48567E-06	CNR	-149.21	CNQ	-169.31	CY	-.54483E-03
CAZ	.33472	CLP	-19.896	CN	.74809	CYCG	-.34489E-04	CMCG	-.47684E-03
AKB	.24351E-02	CLB	-.95090E-06	CMB	.47859E-01	CNB	-.34580E-03	THRSD	.00000
DTHASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.12541	BETA	-.10198E-03

RAD:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DEBUG PRINT:

DELXB	733.92	DELVB	-.46124E-01	DELZB	97.283	DELXS	739.94	DELYB	.27596E-02
DELZS	.46471	KUTTA	1	PITERR	-.42803E-02	YAWERR	.37295E-05	PITERB	-.62803E-03
YAWERB	.37295E-05	DRLAMV	.65475E-06	PB	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIG	.56181E-07	RPHIG	.23884E-07	DELVB	-.26412E-08	DPHIO	.65475E-07	G	32.161
VSKD	110044	ISKR	0	IACT	0	IGUIDE	0	IRAP	0
KARP	2	NAVY	0	P1	.00000	DRLAMP	.00000	NLM	0
IPRINT	1	APPS	20	NOT	128	NOTA	256	NULSKR	2
PEPL	.10441	PHIG	.35473E-06	RHB	.81032E-02	S2	1.0000	DELRAL	-.26412E-08
PED	.00000	PET	.00000	REG	.86340E-08	RPSI	.00000	RTHTA	.00000
AMERR	-.62803E-02	OMEGZ	.37295E-04	NX	33				

IMPACT:

TIME	14.926

```
PROJECTILE:
TIME   =  14.926       RBA    =  .62387E-01   DELVP  =  .32379E-01   U      =  798.97       Y      = -2.3950
W      =  71.483       THTA   = -.81127E-01   RHO    = -.81480E-04   DELZ   = -.34106       TOTACC =  35.891
DZ     =  135.99       DY     =  .98820E-02   DPHI   =  .14160E-03   DTHTA  = -.71473       DX     =  788.05
DPSI   =  .62625E-01   DR     =  3.5731       DQ     = -23.418       DP     = -.30593E-01   DW     = -573.03
DU     =  42.391       DV     = -52.485       VRW    =  799.70       MACH   =  .72634       QAP    = -674.99
PSI    =  .30121E-02   P      = -.73687E-03   Q      = -.71474       R      =  .62567E-01   DELVY  =  .19351E-01
AZS    = -180.76       DELXV  = -3.1875       DELYV  =  .18348E-01   DELZV  =  .20397       X      =  13123.
Y      = -.18258E-01   Z      = -3999.7       AMB    = -136.92       XT     =  13120.      YT     =  .00000
DTHTA  = -.71473       CPHI   =  1.0000       SPHI   = -.81480E-04   CPSI   =  1.0000       SPSI   =  .30121E-02
CPSIS  =  1.0000       QZB    =  32.056       QYB    = -.10462E-01   QXB    =  8.6063

AUTOPILOT:
DDPHIO =  .00000       DELXB  = -3.1865       PEQ    =  .31127E-01   DELPIS =  .20479       TXED   = -.53605E-02
DELZS  =  .21960       OMEGA  =  .93230E-16   DYEF   = -.18816       DPEF   =  1.6087       DTHTAS =  .94665
RTM    =  .21458       KT     =  20.000       PEPL   = -.34359E-01   NULL   =            1  DELR   = -.10457E-02
OMEGZ  =  .00000       PSRG   =  .00000       PED    =  .00000       PEF    = -.16087       PITERS =  .00000
PHIG   =  .17175E-02   PSIS   = -.19037E-02   PXED   = -.73222E-04   THPS   = -.16426       PSBS   = -.46857E-02
DFL1   =  .19333E-01   RLAMY  =  .30158E-03   RLAMP  =  .00000       THTAS  = -.94665E-01   THRBS  =  .12541E-01
YFP    =  .18818E-01   PEP    = -.16087       YZO    =  .00000       PEO    =  .00000       YEP    =  .18816E-01
YBRG   =  .00000       YEQ    =  .19012E-01   DELYS  =  .21820E-01   YAWERR =  .68313E-02   YAWERS =  .00000
LAMYR  =  .00000       LAMPR  =  .00000       GBA    = -.71472       GAPS   =  136.97       DPSIS  =  .19037E-01
IACC   =            1  PSRBS  = -.43981E-03   REN    =  .00000

LOGIC:
GATE 1 =            T  GATE 2 =            F  GATE 3 =            T  GATE 4 =            T  GATE 5 =            T
GATE 6 =            T  GATE 7 =            T

AERODYNAMICS:
CLC    =  .88892E-01   ALP    =  .32258E+03   CNR    = -180.46       CMC    = -183.39       CY     =  .84759E-01
CAZ    =  .37030       CLP    = -19.785       CN     =  1.1736       CYCG   = -.29675       CMCG   = -1.9666
AKR    =  20.660       CLQ    = -.64717E-02   CMB    =  2.8993       CNB    = -.20830       THASD  =  .00000
DTHASD =  .00000       PSISD  =  .00000       DPSISD =  .00000       ALPHA  =  .89787E-01   BETA   = -.29949E-02

RAP:
STT    =  .00000       CTT    =  1.0000       SPT    =  .00000       CPT    =  1.0000       TH     =  .00000
XLTA   =  1.6667

DEBUG PRINT:
DFLXS  = -3.1929       DELYB  =  .27886E-01   DELZR  = -.82581E-01   DELXB  = -3.1865       DELYS  =  .21820E-01
DFLZS  =  .21960       KUTTA  =            1  PITERR = -3.0728       YAWERR =  .68313E-02   PITERS =  .00000
YAWERB =  .00000       DRLAMY =  .14160E-01   P3     =  .00000       DRPSI  =  .00000       DRTHTA =  .00000
DRPHIG =  .13608E-02   RPHIG  =  .28541E-04   DELVR  = -.18250E-04   DPHIO  =  .14160E-02   G      =  32.162
VRVD   =  1101.0       ISKR   =            0  IACT   =            0  IGUIDE =            0  IRAP   =            0
KA3F   =            1  NAVY   =            0  F1     =  .00000       DRLAMP =  .00000       NUM    =            0
IPRINT =            1  NPPS   =           20  NDT    =          128  NDTA   =          256  NULBKR =            2
PFFL   = -.34359E-01   PHIG   =  .17178E-02   RHO    =  .21110E-02   S2     =  1.0000       DELREL = -.18250E-04
RFC    =  .00000       RET    =  .00000       REQ    =  .22552E-04   RPSI   =  .00000       RTHTA  =  .00000
OMEGY  =  .00000       OMEGZ  =  .00000       NX     =           33

IMPACT:
PCAT   =  14.922       PCAX   =  13120.       PCAY   = -.18317E-01   PCAZ   = -4000.2       PCA    =  .21458

END-OF-FILE ON UNIT:
UNIT   =          105
STOP
TOTAL JOB TIME=00113156
```

Appendix B.

CSSL PROGRAM – DYNAMIC GYRO MODEL

```
8B CSSL, GYRO          VERSION HRBM
EWIND START
LLBBT (FILE,08),(FSIZE,0),SAVE
LLBBT (FILE,8V),(FSIZE,C),SAVE
LLBBT (FILE,X4),(FORMAT,B),(RSIZE,128),(FSIZE,280),SAVE
LLBBT (FILE,X5),(FORMAT,B),(RSIZE,128),(FSIZE,350),SAVE
LLBBT (FILE,X6),(FORMAT,B),(RSIZE,128),(FSIZE,350),SAVE
SSIGN (FI1,X4)
SSIGN (FI2,X5)
SSIGN (FI3,X4)
SSIGN (FI4,STAR0)
SSL
  PROGRAM     GYRO
  INITIAL
  H=.0921875
  A=.0027083
  B=.0032083
  RR=.00017192
  RB=.00017192
  THTAS=PSIS=0.
  TFIN=10.
  END
  DYNAMIC
  IF(T-TFIN)L1,L1,L2
  L1..CONTINUE
  DERIVATIVE GYRO
  RMYL=STEP(0.,T)
  RMY=.015625*RMYL
  RMPU=STEP(0.,T)
  RMP=.015625*RMPU
  DPSISD=-THTASD*(H/A)-(RR/A)*PSISD+(RMY/A)
  PSISD=INTEG(DPSISD,0.)
  PSIS=INTEG(PSISD,0.)
  DTHTASD=PSISD*(H/B)-(RB/B)*THTASD+(RMP/B)
  THTASD=INTEG(DTHTASD,0.)
  THTAS=INTEG(THTASD,0.)
  PLT T,T
  PLT DPSISD,DTHTASD,PSISD,THTASD,PSIS,THTAS,T
  CINTERVAL CINT=1.0
  NSTEPS NET=236
  END DERIVATIVE
  END DYNAMIC
  TERMINAL
  L2..CONTINUE
  END TERMINAL
  END PROGRAM
```

2-DOF GYRO MODEL
DYNAMIC (REALISTIC)

UNITS

A - lb ft ^{2}

B - lb ft ^{2}

RR, RB - lb ft

H - ft lb - sec

RMY, RMP - ft lb

TIME - sec

ψ, θ - rad

$\dot{\psi}$, $\dot{\theta}$ - rad /sec

$\ddot{\psi}$, $\ddot{\theta}$ - rads /sec ^{2}

```
      CONNECT (PZ6E,RTSL)
      END
      SUBROUTINE RTSL
           COMMON/ZC004/Z0004(58)
           COMMON/ZCCC4/RMYL,RMY,RMPU,RMP,H,A,RR,PSIS,B,RB,THTAS
           EQUIVALENCE (Z0004(4),DPSISD),(Z0004(3),Z0000),(Z0004(18),PSISD),(
          1Z0004(17),Z0001),(Z0004(32),DTHTASD),(Z0004(31),Z0002),(Z0004(46),
          2THTASD),(Z0004(45),Z0003)
           EXTERNAL GYRB
99997      Z9995=0.
           NST=256
           CINT=1.0
           T=0.0
           IALGBR=5
           JALGBR=5
           HMINT=0.000001
           NIST=1
           ITER=2
           Z0004(14)=0.
           Z0004(28)=0.
           Z0004(42)=0.
           Z0004(56)=0.
           H=.0921875
           A=.0027083
           B=.0032083
           RR=.00017192
           RB=.00017192
           THTAS=PSIS=0.
           TFIN=10.
           CALL Z9998(4,Z0004,GYRB,NST,CINT,T,0)
99999      CONTINUE
           IF(T-TFIN)90000,90000,90001
90000      CONTINUE
           PRINT 90003,T
90003      FORMAT(6(8X,E12.5))
90002      CONTINUE
           PRINT 90005,DPSISD,DTHTASD,PSISD,THTASD,PSIS,THTAS
90005      FORMAT(6(8X,E12.5))
90004      CONTINUE
           CALL Z9999(4,Z0004,GYRB,NST,CINT,T,IALGBR,JALGBR,HMINT,NIST,ITER,I
          1ERR)
           Z9995=1.
           GO TO 99999
99998      CONTINUE
90001      CONTINUE
           STOP
           END
           SUBROUTINE GYRB(T)
           COMMON/ZCCC4/Z0004(58)
           EQUIVALENCE (Z0004(4),DPSISD),(Z0004(3),Z0000),(Z0004(18),PSISD),(
          1Z0004(17),Z0001),(Z0004(32),DTHTASD),(Z0004(31),Z0002),(Z0004(46),
          2THTASD),(Z0004(45),Z0003)
           COMMON/Z0004/RMYL,RMY,RMPU,RMP,H,A,RR,PSIS,B,RB,THTAS
           RMYL=STEP(0.,T)
           RMY=.015625*RMYL
           RMPL=STEP(0.,T)
           RMP=.015625*RMPU
           PSISD=Z0000
           PSIS=Z0001
           THTASD=Z0002
           THTAS=Z0003
```

```
      DPSISD=-THTASD*(H/A)-(RB/A)*PSISD+(RMY/A)
      DTHTASD=PSISD*(H/B)-(RB/B)*THTASD+(RMP/B)
      RETURN
      END
TOP* 0
EOF 9TA8C
TAL JOB TIME=0C:C2:1C
```

```
      ***FIRST PASS DONE***
 INVOKING PROGRAM  MACRO
 INVOKING INITIAL  MACRO
 INVOKING DYNAMIC  MACRO
 INVOKING OUT      MACRO
 INVOKING OUT      MACRO
 INVOKING TERMINAL MACRO
      ***SECOND PASS DONE***
      ***THIRD PASS DONE   0 ERRORS***
      ***FOURTH PASS DONE   0 ERRORS***
      ***FIFTH PASS DONE***
      ***SIXTH PASS DONE***
```

```
OR STAGE,TWO          VERSION MR8M
EWIND STA80
RFC STA80,3
SSIGN (MISI,STA80)
ORTRAN SI,GO,NO,EC
LOAD GO,(TEMP,*OO),(LIB,USER,SYSTEM)
ADING WAS COMPLETED
RV
```

TIME	θ	ψ	θ	ψ	θ
.00000E 00					
.57693E 01	.49702E 01	.00000E 00	.00000E 00	.00000E 00	.00000E 00
.10000E 01					
.15998E 01	.38403E 01	-.35861E-01	-.94367E-02	-.16948E 00	.17084E 00
.20000E 01					
.62454E 01	.28391E 01	-.70711E-01	-.13856E-01	-.33878E 00	.34164E 00
.30000E 01					
.62428E 01	.18858E 01	-.10369E 00	-.19716E-01	-.50792E 00	.51240E 00
.40000E 01					
.61019E 01	.99605E 00	-.13484E 00	-.25200E-02	-.67691E 00	.68306E 00
.50000E 01					
.58414E 01	.18270E 00	-.16314E 00	-.31189E-02	-.84579E 00	.85369E 00
.60000E 01					
.54802E 01	-.54474E 00	-.18843E 00	.88460E-02	-.10146E 01	.10242E 01
.70000E 01					
.50374E 01	-.11796E 01	-.21080E 00	.21896E-01	-.11828E 01	.11941E 01
.80000E 01					
.48319E 01	-.17181E 01	-.22922E 00	.36781E-01	-.13510E 01	.13640E 01
.90000E 01					
.39819E 01	-.21689E 01	-.24459E 00	.52948E-01	-.15191E 01	.15338E 01
.10000E 02					
.34044E 01	-.25032E 01	-.25648E 00	.69986E-01	-.16872E 01	.17035E 01

```
TOP= 0
IN
TAL JOB TIME=00:00:37
BEGIN IDLE
```

Appendix C.

6-DOF DIGITAL MISSILE TRAJECTORY SIMULATION WITH DYNAMIC GYROSCOPE MODEL

```
JOB ADAF,DIGITAL MISSILE TRAJECTORY SIMULATION WITH A DYNAMIC GYROSCOPE MODEL
ALLOT (FILE,X6),(FORMAT,C),(FSIZE,1950),SAVE
UPDATE
```

```
1               C ***           AERODYNAMICS AS AT 12/20/72 AND MEASURED SEEKER PERFOR-
2               C *** MANCE DATA AT 12/72.
3                     EXTERNAL DERIVATIVES
4                1    CALL INITIAL (IS,DERIVATIVES)
5                2    CALL RUNGK
6                     CALL FINISH
7                     GO TO 2
8                     END
```

```
      SUBROUTINE INITIAL(ENDRUN,DERIVS)
      DOUBLE PRECISION DT,FSTSAM,SPER,TME,TIMEO,TIME1,TIME2,TIME3,
     1TIME4,TST,DTA,TIME
      REAL KPC,KM,KC,KT,KT10,KT20
      REAL KT30
      REAL KB,KOL,KP
      REAL KG,KRGL,KG,LAMPR,LAMYR,LAMBI
      REAL LP,KD,KS,K4,K5,KR                                          WILL
      REAL MACH,MASS,IX,IYZ,IT,IA
      REAL       XBA(33),   XBB(33)
      COMMON/INTEG/KUTTA,NX,DTRK,U,V,W,P,Q,R,PHI,THTA,PSI,X,Y,Z,RTHTA,
     1RPSI,THTAS,THASD,PSIS,PSISD,OMEGA,TXFD,PXFD,PEF,YEF,DEL1,DELVP,
     2DEL3,DDEL1,DDELVP,DDEL3,RLAMY,RLAMP,RPHIO,DPHIO,DU,DV,DW,DP,DQ,DR,
     3DPHI,DTHTA,DPSI,DX,DY,DZ,DRTHTA,DRPSI,DTHTAS,DTHASD,DPSIS,DPSISD,
     4DOMEGA,DTXFD,DPXFD,DPEF,DYEF,DDELP1,DDELPP,DDELP3,DDDEL1,DDDELP,
     5DDDEL3,DRLAMY,DRLAMP,DRPHIO,DDPHIO
      COMMON/ETB/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/BTS/BS11,BS12,BS13,BS21,BS22,BS23,BS31,BS32,BS33
      COMMON/TDC/CPSI,SPSI,SPHI,CPHI
      COMMON/ IN/ GAMP,GAMY,DELXTB,DELYTB,DELZTB
      COMMON/BTV/DELXV,DELYV,DELZV
      COMMON/DEL/DELX,DELY,DELZ
      COMMON/STUFF/ DELXS,DELYS,DELZS
      COMMON/INPSKR/PITERR,YAWERR
      COMMON/MACL/MACH,VSND,UR,VR,WR,VRS,VRW,VW
      COMMON/F/WXS,WYS,WZS
      COMMON/COEF/CAZ,CY,CN,CLP,CMCG,CYCG,CLD,CMC,CNR,ALPHA,BETA,CMAD,
     1CLRAC
      COMMON/TOCEG/AXB,AYB,AZB,CLB,CNB,ALB,AMB,ANB,CMB
      COMMON/DD/DELYT,DELVR,DELR,DELROL
      COMMON/JUNK/TIME,TIME3,RHO,S,D,SCUW,CAP,IRAP,RAPTM1,RAPTM2,IACT,
     1SLOPE1,BT1,RAPTM3,SLOPE2,BT2,CTT,CMT,SPT,XLTA,STT,GAPS,GAPSD,
     2GAPSCM,TH
      COMMON/FF/FFCLB,FFCMB,FFCNB,FFAXB,FFAYB,FFAZB,FFALB,FFAMB,FFANB
      COMMON/GG/GXB,GYB,GZB
      COMMON/JUNK1/THOLD,IROLL,G,MASS,IX,IYZ,XINTIA,NAVY
      COMMON/MO/GEOALT,TB,TGRAD,RHOSL,ARG1,HTMSL,RSTAR,
     1RMEE,ARG2,G0,TMOL
      COMMON/TT/FSTSAM,TIME4,DT,DTA,TST,TME,SPER,TSAM,CC,JMAX,IPRINT,T2
      COMMON/JUNK2/SRKOE,IFUP1,IACQ,RCET,YAWERS,PITERS,PHPOV,OA,RNGLIM,
     1PITYAWSC,R2D,NULSKR,BRS,RFLECT,NULL,KAGE
      COMMON/BOW/RBL,KT,KT10,KT20,LAMPR,LAMYR,RTM,RTMIN,RSQE,ED1,FLG4,
     1RSA,ED4,OBA
      COMMON/PERV/OMEGY,OMEGZ
      COMMON/OUTAP/YEG,REG,PEG
      COMMON/ARROW/PHIO,PLO1,PLO2,PLO3,REF,RFL,YEC,PEC,THRBS,PSRBS,
     1THBS,PSBS,GRLV,PFFL,KPD,KC,KM,KG,LAMBI,PSLFS
      COMMON/SS/S1,S2,S3,S4,S5,S6
      COMMON/GP/RB,RR,W,A,B,KT30
      COMMON/STUFF1/DELXB,DELYB,DELZB
C
C     DICTIONARY
C
C     AERO
C
C     ALPHA
C
C     CAS
C
C
C     AUTOPLT
C
```

```
C
C
C      DEFAULT VALUES
C
       REAL REAL(206)/
      1+2.896600000E+01,+5.186880000E+02,+3.217400000E+01,          001--003
      2-3.566160000E-03,+2.085553150E+07,+2.376900000E-03,          004--006
      3+9.971962570E+04,+5.312000000E+00,+4.488650000E+00,          007--009
      4+2.010000000E-01,+5.723000000E+00,+5.083000000E-01,          010--012
      5+5.000000000E+00,+3.141592654E+00,+0.000000000E+00,          013--015
      6+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          016--018
      7+4.000000000E+00,+8.000000000E-01,+0.000000000E+00,          019--021
      8+1.500000000E+01,+8.000000000E-02,+6.000000000E-01,          022--024
      9+1.492500000E+02,+4.000000000E+00,+6.250000000E+00,          025--027
      A+2.500000000E+02,+2.500000000E+01,+2.000000000E+00,          028--030
      B+1.000000000E+02,+1.000000000E+20,+0.000000000E+00,          031--033
      C+0.000000000E+00,+5.000000000E-01,+1.500000000E+01,          034--036
      D+1.000000000E+00,+1.000000000E+00,+1.000000000E+00,          037--039
      E+1.000000000E+00,+1.000000000E+00,+1.000000000E+00,          040--042
      F+1.000000000E+00,+1.000000000E+00,+1.000000000E+00,          043--046
      G+1.000000000E+00,+8.000000000E+00,+1.500000000E+01,          046--048
      H+1.800000000E+01,+7.500000000E+00,+5.000000000E+00,          049--051
      I+5.000000000E-02,+2.352800000E-05,+1.622600000E-05,          052--054
      J+2.000000000E-01,+1.500000000E+00,+1.250000000E+01,          055--057
      K+1.250000000E+01,+1.500000000E+01,+2.000000000E+01,          058--060
      L+3.000000000E+02,+1.000000000E+01,+0.000000000E+00,          061--063
      M+1.000000000E-01,+6.000000000E+00,+3.140000000E+02,          064--066
      N+2.000000000E+03,+1.245000000E+03,+0.000000000E+00,          067--069
      O+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          070--072
      P+0.000000000E+00,+0.000000000E+00,+2.830000000E+01,          073--075
      Q+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          076--078
      R-4.000000000E+03,+0.000000000E+00,+0.000000000E+00,          079--081
      S+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          082--084
      T+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          085--087
      U+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          088--090
      V+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          091--093
      W+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          094--096
      X+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          097--099
      Y+0.000000000E+00,+2.112244897E+02,+5.250000000E+02,          100--102
      Z+2.726600000E-03,+1.000000000E+00,+0.000000000E+00,          103--105
      1+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          106--108
      2+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          109--111
      3+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          112--114
      4+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          115--117
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          118--120
      5+0.000000000E+00,+1.250000000E+01,+0.000000000E+00,          121--122
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          123--125
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          126--128
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          129--131
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          132--134
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          135--137
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          138--140
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          141--143
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          144--146
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          147--149
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          150--152
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          153--155
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          156--158
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          159--161
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          162--164
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          165--167
      5+0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          168--170
```

```
     5*0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          171--173
     5*0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          174--176
     5*2.608000000E+04,+0.000000000E+00,-4.000000000E+03,          178--180
     5*0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          180--182
     5*0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          183--185
     5*0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          186--188
     5*0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          189--191
     5*0.000000000E+00,+0.000000000E+00,+0.000000000E+00,          192--194
     5*0.000000000E+00,+8.000000000E+03,+6.000000000E+00,          196--198
     5*4.300000000E+00,+6.500000000E+00,+1.020000000E+01,          199--201
     5*1.440000000E+01,-4.000000000E+03,+1.000000000E+03,          202--204
     5*0.000000000E+00,+0.000000000E+00/                           205--206
      DOUBLE PRECISION DOUBLE(001)/
     1*0.000000000D+00/
      INTEGER FIXED(030)/
     1*0000000014,+0000000000,+0000000002,+0000000020,+0000000128,  001--005
     1*0000000256,+0000000001,+0000000002,+0000000000,+0000000000,  006--010
     3*0000000000,+0000000000,+0000000000,+0000000000,+0000000000,  011--015
     3*0000000001,+0000000001,+0000000001,+0000000001,+0000000000,  016--020
     3*0000000006,+0000000006,+0000000006,+0000000000,+0000000000,  021--025
     3*0000000000,+0000000000,+0000000000,+0000000000,+0000000000/  026--030
      LOGICAL GATE(007)/SET/.TRUE./,RST/.FALSE./
      LOGICAL LOGICAL(008)/
     1.TRUE .,.FALSE.,.FALSE.,.FALSE.,.FALSE.,.FALSE.,.FALSE.,.FALSE./
      NAMELIST TIME,X,Y,Z,U,V,W,P,Q,R,THTA,PSI,PHI,RTHTA,RPSI,RLAMY,
     XRLAMP,RPHIG,RDET,LAMBI,BF,KQ,TIMEO,TIME1,TIME2,TIME3,TIME4,ZMIN,
     BXT,YT,ZT,VXT,VYT,VZT,
     CPMFOV,YMFOV,THTAC,DT,DTA,CG,PASS,IX,IYZ,S,TME,BRS,DELROL,KB,KG,
     DKG,KROL,BD,BF,BQ,AF,BA,CS,KP,GC,KOL,GAMLB,PCL,YCL,CI,IT,IA,WF,
     ECLC,RKOLIN,DELMX,DELMY,VRATE,K4,K5,FBON,KS,RVBIAS,BR5,PHIMAX,IROLL
     F,RTOL,S1,S2,S3,S4,S5,ISKR,IROLLDC,IACT,IACG,IPRINT,JMAX,IRAM,
     GTHETAT,PSIT,SLOPE1,SLOPE2,BT1,BT2,XLTA,RAPTM1,RAPTM2,RAPTM3
     H,TB,TO,TO1,TO2,TO3,TO4,TO5,TO6,TO7,T1,T2,NULL,IFUFO,IGUIDE,T1P1,
     JT1P5,KPC,KM,KC,THTOL,DTRM,S6,S7,S8,S9,S10,S11,S12,KT,KT10,KT20
     K,SFC,SF1,SF2,SF3,SF4,SF5,SF6,SF7,SF8,SF9,SF10,SF11,SF12,SF13,SF14,
     LSF15,RTMIN,KASE,FFCLB,FFCMB,FFCNB,FFAXB,FFAYB,FFAZB,FFALB,FFAMB,
     MFFANB,FULL,THOLD,NAVY,KT30,KC
      REAL MDAC(16)/16*0./,POLES(011)/
     1*2.000000000E+01/
      LOGICAL FLG0/.TRUE./,FLG1/.TRUE./,FLG2/.TRUE./,FLG3/.TRUE./,FULL/.
     1FALSE./,FLG4/.TRUE./,IMPACT,ERROR,FLG5
      DATA KG,KC,KM,KP,KPD,XR/3.5,.05,2.,10.,.015,75./
      DATA TB,TC/.6,10./,KT,KT10,KT20/20.,10.,20./
      DATA S1,S2,S3,S4,S5,S6,S7,S8,S9,S10,S11,S12/-1.,1.,3*-1.,7*1./
      DATA SLOPE1,SLOPE2/36.7346938,-11.5384615/,XLTA/1.666667/
      DATA RAPTM1,RAPTM2,RAPTM3/1.6,6.5,13./
      DATA R2D/5.729577951E+01/,D2R/.01745329/
      DATA RB,RM,H,A,B/2*.00017192,.0921875,.0000818,.00009972/
      CALL ABORTSET(99995,1)                                      HH1074
      CALL EOFSET(99988,LUNIT)
    1 CONTINUE
X     CALL MYELIB
X     CALL MODE('R')
X     CALL MODE('C')
      DO 1234 I=0,15000
X     CALL WDACS(0,16,MDAC)
 1234 CONTINUE
C
C  PASS ADDRESSES AND INITIALIZE LIBRARY RUNGE-KUTTA INTEGRATOR
C
       CALL RUNGKI(DU,L,DT,TIME,X*A,X*B,NX,DERIVS)
C
```

```
170             C     INPUT VALUES
171             C
172                   GATE(001) * RST) GATE(002) * RST) GATE(003) * RST) GATE(004) * RST********
173                   GATE(005) * RST) GATE(006) * RST) GATE(007) * RST
174                   TIME      * DBUBLE(001)
175                   KX        * FIXED(001)) NUM       * FIXED(002)                          ********
176                   IPRINT    * FIXED(003)) NPPS      * FIXED(004)                          ********
177                   NDT       * FIXED(005)) NDTA      * FIXED(006)                          ********
178                   KAGE      * FIXED(007)) NULSKR    * FIXED(008)                          ********
179                   KAVY      * FIXED(009)) ISUICE    * FIXED(010)                          ********
180                   IFLFG     * FIXED(011)) IRGLL     * FIXED(012)                          ********
181                   ISKR      * FIXED(013)) IRAP      * FIXED(014)                          ********
182                   IACT      * FIXED(015)) IRGLLDC   * FIXED(016)                          ********
183                   IACC      * FIXED(017)) NULL      * FIXED(018)                          ********
184                   KAGE      * FIXED(019)) IDUM      * FIXED(020)                          ****
185                   IDUM      * FIXED(021)) IDUM      * FIXED(022)                          ********
186                   IDUM      * FIXED(023)) IDUM      * FIXED(024)                          ********
187                   IDUM      * FIXED(025)) IDUM      * FIXED(026)                          ********
188                   IDUM      * FIXED(027)) IDUM      * FIXED(028)                          ********
189                   IDUM      * FIXED(029)) IDUM      * FIXED(030)                          ********
190                   FLGS      * LOGICAL(001)) IMPACT    * LOGICAL(002)
191                   ERROR     * LOGICAL(003)
192                   WTMOL     * REAL(001)) TP         * REAL(002)
193                   GG        * REAL(003)) TORAD      * REAL(004)
194                   RO        * REAL(005)) RHOSL      * REAL(006)
195                   RSTAR     * REAL(007)) CG         * REAL(008)
196                   MASS      * REAL(009)) IX         * REAL(010)
197                   IYZ       * REAL(011)) D          * REAL(012)
198                   REFLECT   * REAL(013)) PI         * REAL(014)
199                   WNOO      * REAL(015)) R2         * REAL(016)
200                   FSYSAM    * DBLE(REAL(017))) ARS      * REAL(018)
201                   DELROL    * REAL(019)) LAMBI      * REAL(020)
202                   KB        * REAL(021)) KG         * REAL(022)
203                   KG        * REAL(023)) KROL       * REAL(024)
204                   BC        * REAL(025)) RVBIAS     * REAL(026)
205                   BF        * REAL(027)) BG         * REAL(028)
206                   AF        * REAL(029)) BRS        * REAL(030)
207                   PHIMAX    * REAL(031)) RTOL       * REAL(032)
208                   BA        * REAL(033)) CS         * REAL(034)
209                   KP        * REAL(035)) GC         * REAL(036)
210                   KOL       * REAL(037)) FFCLB      * REAL(038)
211                   FFCMB     * REAL(039)) FFCNB      * REAL(040)
212                   FFAXB     * REAL(041)) FFAYB      * REAL(042)
213                   FFAZB     * REAL(043)) FFALB      * REAL(044)
214                   FFAMB     * REAL(045)) FFANB      * REAL(046)
215                   GAMLB     * REAL(047)) PCL        * REAL(048)
216                   YCL       * REAL(049)) THTAC      * REAL(050)
217                   GF        * REAL(051)) CLD        * REAL(052)
218                   IA        * REAL(053)) IT         * REAL(054)
219                   KD        * REAL(055)) RNOLIN     * REAL(056)
220                   FHFSV     * REAL(057)) YWFAV      * REAL(058)
221                   DELMX     * REAL(059)) DELMY      * REAL(060)
222                   VRATE     * REAL(061)) KA         * REAL(062)
223                   K5        * REAL(063)) FBGN       * REAL(064)
224                   K8        * REAL(065)) OMEGA      * REAL(066)
225                   PCA       * REAL(067)) U          * REAL(068)
226                   V         * REAL(069)) W          * REAL(070)
227                   P         * REAL(071)) Q          * REAL(072)
228                   R         * REAL(073)) PRI        * REAL(074)
229                   THTA      * REAL(075)) PHI        * REAL(076)
230                   X         * REAL(077)) Y          * REAL(078)
231                   Z         * REAL(079)) PSIG       * REAL(080)
```

```
      THTAS  = REAL(081); DP     = REAL(082)
      CG     = REAL(083); DR     = REAL(084)
      CL     = REAL(085); DV     = REAL(086)
      CM     = REAL(087); DELXB  = REAL(088)
      DELYB  = REAL(089); DELZB  = REAL(090)
      DELXS  = REAL(091); DELYS  = REAL(092)
      DELZS  = REAL(093); PITERR = REAL(094)
      YAWERR = REAL(095); PITERO = REAL(096)
      YAWERO = REAL(097); OMEGY  = REAL(098)
      OMEGZ  = REAL(099); PSRQ   = REAL(100)
      BT1    = REAL(101); BT2    = REAL(102)
      THTOL  = REAL(103); KC     = REAL(104)
      SF0    = REAL(105); SF1    = REAL(106)
      SF2    = REAL(107); SF3    = REAL(108)
      SF4    = REAL(109); SF5    = REAL(110)
      SF6    = REAL(111); SF7    = REAL(112)
      SF8    = REAL(113); SF9    = REAL(114)
      SF10   = REAL(115); SF11   = REAL(116)
      SF12   = REAL(117); SF13   = REAL(118)
      SF14   = REAL(119); SF15   = REAL(120)
      TIC    = REAL(121); TIC1   = REAL(122)
      PSRQ   = REAL(123); YERQ   = REAL(124)
      QSA    = REAL(125); RSA    = REAL(126)
      PEQ    = REAL(127); YEQ    = REAL(128)
      REG    = REAL(129); RET    = REAL(130)
      REK    = REAL(131); RED    = REAL(132)
      T2     = REAL(133); DELXV  = REAL(134)
      DELYV  = REAL(135); DELZV  = REAL(136)
      DEL1   = REAL(137); DEL2   = REAL(138)
      DEL3   = REAL(139); DEL4   = REAL(140)
      DELVP  = REAL(141); DELMIS = REAL(142)
      TM     = REAL(143); THBS   = REAL(144)
      PSBS   = REAL(145); THRBS  = REAL(146)
      PSRBS  = REAL(147); THTAG  = REAL(148)
      REF    = REAL(149); PEF    = REAL(150)
      YEF    = REAL(151); TXED   = REAL(152)
      PXED   = REAL(153); F1     = REAL(154)
      F2     = REAL(155); F3     = REAL(156)
      PSISC  = REAL(157); THASD  = REAL(158)
      DRTHTA = REAL(159); DRPSI  = REAL(160)
      DDEL1  = REAL(161); DDEL3  = REAL(162)
      DDELP1 = REAL(163); DDELP3 = REAL(164)
      DDELVP = REAL(165); DDELPP = REAL(166)
      DDDEL1 = REAL(167); DDDEL3 = REAL(168)
      DDDELP = REAL(169); DRLAMP = REAL(170)
      DRLAMY = REAL(171); DRPHIO = REAL(172)
      RLAMY  = REAL(173); RLAMP  = REAL(174)
      RPHIO  = REAL(175); RPSI   = REAL(176)
      RTHTA  = REAL(177); XT     = REAL(178)
      YT     = REAL(179); ZT     = REAL(180)
      DPSIS  = REAL(181); DTHTAS = REAL(182)
      THETAT = REAL(183); PSIT   = REAL(184)
      PED    = REAL(185); YED    = REAL(186)
      DPEF   = REAL(187); DYEF   = REAL(188)
      PEFL   = REAL(189); PHIO   = REAL(190)
      DPHIO  = REAL(191); TPTACC = REAL(192)
      VM     = REAL(193); DPHIO  = REAL(194)
      DDPHIO = REAL(195); THOLD  = REAL(196)
      RCET   = REAL(197); TIME0  = REAL(198)
      TIME1  = REAL(199); TIME2  = REAL(200)
      TIME3  = REAL(201); TIME4  = REAL(202)
      ZMIN   = REAL(203); RTMIN  = REAL(204)
```

```
294                   DLM       * REAL(205)) DLM       * REAL(206)
  1*                  DTHASC    * REAL(205)) DPSISD    * REAL(206)
295             C
296             C     CALCULATED VALUES
297             C
298                   ARG1=1.+(GG*TMRL)/(RSTAR*TGRAD)
299                   XINTIA = (IYZ-IX)/IYZ
300                   S=.25*PI*D*D
301                   WANG=PI*R2
302                   SNWANG=SIN(WANG)
303                   CS=ANG=COS(WANG)
304                   SPER=1.DD/DBLE(FLOAT(NPPS))
305                   TPE=SPER
306                   DT=1.CC/DBLE(FLOAT(NCT))
307                   DTRK=SNGL(DT)
308                   DTA=1.DC/DBLE(FLOAT(NDTA))
309                   DELRGL=REAL(C19)/R2D
310                   DELRGL=DELRGL/R2D
311                   LAMBI=LAMBI/R2C
312                   PHIMAX=PHIMAX/R2C
313                   GAMLB=GAMLB/R2D
314                   YCL=YCL/R2D
315                   PHFOV=PHFOV/R2C
316                   VRATE=VRATE/R2D
317                   RVBIAS=RVBIAS/R2C
318                   GC=GC/R2D
319                   PCL=PCL/R2D
320                   THTAC=THTAC/R2C
321                   CI=(IT-IA)/IT
322                   RI=IA/IT
323                   RNGLIN=RNGLIN/R2C
324                   YHFOV=YHFOV/R2D
325                   K4=K4/R2D
326                   THTA=THTA/R2C
327                   CPSIS=COS(PSIS)
328             C**** JMAX=PRINT CONTROL. PRINTING OCCURS EVERY JMAX INTERVALS.
329                   JMAX=1.DD/DT+.000001
330                   INPUT(105)
331                   ZHOLC=Z
332                   THTAHD=THTA
333                   TC1=TC+.4*T02=TC1+.4
334                   TC3=TC2+.2
335                   TC4=TC3+.2
336                   TC5=TC4+.2
337                   TC6=TC5+.2
338                   TC7=TC6+.2
339                   T1=TC+2.
340                   IF(T2.LT..01)T2=T1+.
341                   CTT=COS(THETAT)
342                   STT=SIN(THETAT)
343                   CPT=COS(PSIT)
344                   SPT=SIN(PSIT)
345                   IF(IROLLOC.EG.2)IACT=2
346             C**** RANGE TARGET FROM MISSILE=RTM IN FEET.
347                   RTM=SQRT((XT-X)**2+(YT-Y)**2+(ZT-Z)**2)
348             C****
349             C     WHITE SANDS ALTITUDE=4000. FT.
350             C**** IMPORTANT--DEFINE TIMES FOR EACH TRAJECTORY.
351             C****
352             C**** START ROLL GYRO(LINE358) AT TIME1
353             C*****START PITCH AND YAW GYROS(LINE 347)/ROLL CONTROL(LINE 399) AT TIME3
354             C**** ENABLE TRACK AT TIME4     IF TARGET IS WITHIN FOV AND ROET
```

```
C**** BALLISTIC FLYOUT
      IF(RDET.LT.5.)TIME=.9999.
      ITEMP=TIME+1.000001
C*****FIRST SCHEDULED PRINT TIME
      PRINTM=ITEMP
      DELX=XT-X
      DELY=YT-Y
      DELZ=ZT-Z
      DELXT=DELX
      DELYT=DELY
      DELZT=DELZ
      CFC=0.
      CAC=0.
C*****
      EDC=T1
      EC1=Y1+0.25
      EC2=T2
      EC3=EC1+.2
      EC4=EC3+3.8
      EC5=TIME3
      DELMX=DELMX/R2D                    !DELMY=DFLMY/R2D
9CC00 FORMAT(//2X,KA=,/,5(2X,2A6,' = ',G11.5))
9CC01 FORMAT(/,2X,'NULL ROLL RATE SENSOR')
9CC02 FORMAT(/,2X,'ROLL HOLD')
9CC03 FORMAT(/,2X,'LATERAL ENABLE')
9CC04 FORMAT(/,2X,'GUIDANCE ENABLE')
9CC05 FORMAT(/,2X,'ACQUISITION')
9CC06 FORMAT(//2X,'UNCAGE GYRO FOR ROLL TO VERTICAL')                  FLG=
9CC07 FORMAT(1H1)
9CC10 FORMAT(/,2X,'BEGIN SEEKER CANT')
    9 CONTINUE
      KUTTA = C
      R E T U R N
C
      E N T R Y   D E R I V A T I V E S
C
      KUTTA = KUTTA + 1
C
      ALT=-Z
      G = GO*RO*RO/(RO+ALT)**2
      GE=ALT*RO+ALT/(RO+ALT)
C**   METO CALCULATES VSND
      CALL METO
   13 CONTINUE
C
C** ECS TO SCS TRANSFORMATION
      CALL TRSFEB
C
C** BCS TO SCS TRANSFORMATION,SEQUENCE IS THTAS,PSIS
      CALL TRSFBS
  100 IF(KUTTA.NE.1) GO TO 105
      IF(TIME.LT.THOLD)NX=0
      IF(TIME.GE.THOLD)NX=14
      IF(GATE(003))GO TO 1235
      IF(TIME.LT.TIME3)GO TO 1235
      GATE(C03)=SET
      IPRINT=2
1235  CONTINUE
      IF(GATE(004))GO TO 1236
      IF(TIME.LT.TIME1)GO TO 1236
      GATE(C04)=SET
      IPRINT=2
```

```
      1236  CONTINUE
            IF(GATE(OC5))GO TO 1237
            IF(TIME.LT.TIME2)GO TO 1237
            GATE(OC5)=SET
            IPRINT=2
      1237  CONTINUE
            IF(GATE(OC6))GO TO 1238
            IF(TIME.LT.TIME4)GO TO 1238
            GATE(OC6)=SET
            IPRINT=2
      1238  IF(GATE(OC7))GO TO 1239
            IF(TIME.LT.T1)GO TO 1239
            GATE(OC7)=SET
            IPRINT=2
      1239  CONTINUE
C
C     LOS ERROR IN SCS
      CALL LOSERR
C
C**   SUBROUTINE SEEK DETECTS TARGET WITHIN THE DETECTION RANGE OF SEEKER,
C     TARGET WITHIN THE FIELD OF VIEW,S=A-W,SEEKER WITHIN LINEAR RANGE
      CALL SEEK
  105 CONTINUE
C
C** MISSILE VELOCITY WRT AIR MASS
      WNDV=.00007367*Z+5.236
      WND=WND*(1.+0.6*SIN(WNDV))
      WXB = WND*SKWANG
      WYB = WND*CSWANG
      CALL MCALC
C
C** ANGLE OF ATTACK COMPONENTS
C** TERMS FOR EQUATIONS OF MOTION
C** AERO AND CONTROL FORCES AND MOMENTS
C**   SUBROUTINE FORMAN CALCULATES FORCES AND MOMENTS FOR THE DIFEQ EQUATIONS
      CALL FORMAN
C
C**SUBROUTINE DIFEQ CONSTRUCTS THE EQUATIONS OF MOTION
      CALL DIFEQ
      IF(IFLP3.EQ.C)GO TO 5150
      IF(TIME.LT.T1)GO TO 406
      IF(.NOT.FLGO)GO TO 6666
      PRINT 90CC1,IPRINT=2,FLGO=.NOT.FLGO
 6666 CONTINUE
      XX=33
C
C**   SUBROUTINE ECSKRGYRO CONSTRUCTS THE SEEKER GYRO MODEL FOR EC
      CALL ECSKRGYRO
 5203 CONTINUE
C
C**   EC AUTOPILOT
      CALL ECAP
      GO TO 226
C
C     ENGINEERING DESIGN AUTOPILOT
C
 5150 IF(TIME.LT.TIME3)GO TO 401
      IF(.NOT.FLG5)GO TO 6671                                    FLG5
      PRINT 90C1C,IPRINT=2,FLG5=.FALSE.                          FLG5
 6671 CONTINUE                                                   FLG5
      XX = 32
      IMFG2=KB=YAWZRB
```

```
C***CANTSEEKER
C**** CANTSEEKER UNTIL ACQUISITION(IACQ#2)
      OMEGY=KS*(THTAC-THTAS)
      IF(IACQ.EQ.2) OMEGY=KS*PITCH
      IF(ABS(OMEGY).GT..10472) OMEGY=SIGN(.10472,OMEGY)
      IF(ABS(OMEGZ).GT..10472) OMEGZ=SIGN(.10472,OMEGZ)
C     IDEAL GYRO
      OSA=BS21*P+BS22*Q+BS23*R
      RSA=BS31*P+BS32*Q+BS33*R
      F1=(OMEGY-QSA)/COS(PSIS)
      F3=OMEGZ-RSA
      CPSIS=COS(PSIS)
      IF(ISKR.EQ.1)F1=(OMEGY-RSA)/CPSIS
      IF(ISKR.EQ.1)F3=OMEGZ-QSA
      F4=0.
      F5=0.
      LAMPR = OMEGY
      LAMYR = OMEGZ
      IF(IACQ.NE.2)LAMPR=LAMYR=0.
C        GYRO EQUATIONS FOLLOW
      CTHTAS=F1
      CTHASC=F2
      CPSIS=F3
      CPSISD=F4
      COMEGA=F5
C
C***  ROLL RATE GYRO
  401 CONTINUE
      IF (TIME.LT.TIME1)GO TO 406
C***  ROLL GYRO EQS
      TMP3 = SIN(RTHTA)
      TMP4 = COS(RTHTA)
      DRTHTA = (P*TMP4-R*TMP3)*TAN(RPS1)*G
      CRPSI = -(P*TMP3+R*TMP4)
C***RATE CAMMING OF GIMBAL ANGLES
C     IF (TIME.LT.TIME4)GO TO 301
      IF (TIME.LT.TIME3)GO TO 301
      CTXEC=BD*(TXED-KG*THTAS)
      THRBS=BD*(KG*THTAS-TXED)
      CPXEC=BD*(PXED-KG*PSIS)
      PSRBS=BD*(KG*PSIS-PXED)
      THBS=KRGL*THRBS*THTAS
      PSBS=KRGL*PSRBS*PSIS
C***DEAD BAND ZONE FOR PSBS,THBS
      IF(ABS(THBS).LE.GAMLB) GO TO 160
      THBS = KGL*(THBS-SIGN(GAMLB,THBS))
      GO TO 161
  160 THBS=0.
  161 IF(ABS(PSBS).LE.GAMLB) GO TO 162
      PSBS = KGL*(PSBS-SIGN(GAMLB,PSBS))
      GO TO 163
  162 PSBS=0.
  163 CONTINUE
C *** GUIDANCE FILTER                                                  WILL
C***KG AND LAMBI ARE TIME CONTROLLED CONSTANTS
  164 CONTINUE
      PEC=LAMPR+LAMBI+KB*THTAB
      YEC=LAMYR
      CPEF=-BF*(PEF-KG*PED)
      CYEF=-BF*(YEF-KG*YED)
      IF(ABS(PEF).GT.GC)PEF=SIGN(GC,PEF)
      IF(ABS(YEF).GT.GC)YEF=SIGN(GC,YEF)
```

```
                PEG=THRBS+THBS+PEF
                YEG=PSRBS+PBBS+YFF
                PEG = -PEG
                IF(ABS(PEG).GT.PCL)PEG=SIGN(PCL,PEG)
                IF(ABS(YEG).GT.YCL)YEG=SIGN(YCL,YEG)
C***ROLL DECOUPLER
 301  CONTINUE
                IF (TIME.LE.TIME3)GO TO 406
                GO TO(1401,1402),IROLLDC
 1401 CONTINUE
C*****PREVIOUS ROLL DECOUPLER
                IF(IACQ.EQ.2 .AND. TIME.GT.TIME4 .AND. NULSKR.EQ.2) GO TO 300
                RLAMY=-PSIS
                RLAMP=THTAS-RTHTA
                GO TO 302
  300 CONTINUE
                ORLAMY=RLAMYR
                ORLAMP=-RLAMPR
  302 CONTINUE
                RICY=-PSIS
                RICP=THTAS-RTHTA
                REC=RICP-RLAMP
                REN=RICY-RLAMY+RPSI
  305 CONTINUE
                IF(RED.LT.-4363)RED=-.4363
                IF(RED.GT.1.7453) RED=1.7453
                RET=REN/RED
                PHIG=2.*RET
                GO TO 1404
 1402 CONTINUE
C*****LATEST ROLL DECOUPLER
                ORLAMY=BRS*(PSIS-RLAMY)
                IF(IACQ.EQ.2)ORLAMY=0.
                REN=S1*RPSI+S2*RLAMY+S3*PSIS
                REC=S4*THTAS-S5*RTHTA
                IF(ABS(RET).LT.RTOL)GO TO 304
C***CHECK FOR SATURATION
                IF(ABS(PHIMAX-ABS(RET)).LT.RTOL.AND.REC.LT.REN/RET)GO TO 306
C****
  304 RET=SIGN(999.,REN)
                IF(REC.GT.0.)RET=REN/RED
  306 CONTINUE
                IF(ABS(RET).GT.PHIMAX)RET=SIGN(PHIMAX,RET)
                PHIG=RET
 1404 CONTINUE
                DRPHIG=-BG-RPHIG-BG-(1.-BG/AF)*PHIG
                REF=(BG/AF)*PHIG+RPHIG
                REF=-KP*REF
                IF(ABS(REF).GT..17453) REF=SIGN(.17453,REF)
  303 CONTINUE
                REG=REF+RVBIAS
C
C** CONTROL SYSTEM, CANARDS FOR EACH PLANE ON COMMON SHAFT
  307 CONTINUE
                IF(IACQ.EQ.2 .AND. NULSKR.EQ.2) GO TO 226
  221 CONTINUE
                YEG=0.
                PEG=0.
  226 CONTINUE
                CALL CONTRL
C** 4TH ORDER RUNGE KUTTA INTEGRATION
  406 CONTINUE
```

```
            IF(KUTTA .NE. 1)    GO TO 50
      CALL ESVCTAPE(IE,SNGL(TIME),DTHASD,THASD,DPSISD,PSISD,THTAS,PSIS)
   29 CONTINUE
C
C     PROCESS TIC MARKS ON CHANNELS 0 AND A
C
      TICL=0.
      IF(TIME.LT.DBLE(TIC))GO TO 1777
C
C     SET EVENT LEVEL
C
      IF(KAGE.EQ.2)TICL=TICL+.1
      IF(NULL.EQ.2)TICL=TICL+.2
      TIC=TIC+TICI
      TICL=TICL+.05
C
C     SET ACQUISITION SIGN
C
      IF(IACQ.EQ.2)TICL=-TICL
 1777 CONTINUE
      PHC=ATAN2(SIN(PHI),COS(PHI))
C
C     PROCESS MDAC BUFFER
C
      MDAC(01)=TICL/SF0                   ;MDAC(09)=TICL/SF8
      MDAC(02)=(ALT-ACCG.)/SF1            ;MDAC(10)=R2D*BMEGY/SF9
      MDAC(03)=TOTACC/SF2                 ;MDAC(11)=R2D*DEFL/SF10
      MDAC(04)=R2D*THTAS/SF3              ;MDAC(12)=R2D*THBS/SF11
      MDAC(05)=R2D*PSIS/SF4               ;MDAC(13)=R2D*PEG/SF12
      MDAC(06)=R2D*DELRBL/SF5             ;MDAC(14)=R2D*THRBS/SF13
      MDAC(07)=R2D*DELVY/SF6              ;MDAC(15)=R2D*CRLAMY/SF14
      MDAC(08)=R2D*DELVP/SF7              ;MDAC(16)=R2D*THTA/SF15
C
C     LIMIT MDAC OUTPUT
C
      DO 1492 I=1,16
      IF(ABS(MDAC(I)).GT.0.9999)MDAC(I)=SIGN(.9999,MDAC(I))
 1492 CONTINUE
C
C     OUTPUT MDAC VALUES
C
X     CALL MDACS(0,16,MDAC)
X     IERR=ISVOTAPE(SNGL(TIME),R2D*TXED)
      PRNTNEXT=PRINTM-1.E-6
      IF(TIME.LT.PRNTNEXT.AND.IPRINT.EQ.1)GO TO 72
      IF(TIME.GE.PRNTNEXT)PRINTM=PRINTM+DMAX*DT
      IPRINT=1
   70 TMP1=SIN(PHI)
      TMP2=COS(PHI)
      PHC=ATAN2(TMP1,TMP2)
C----------------------------------------------------------------------C
C                                                                      C
C                        L I N E   P R I N T E R   I / O               C
C                                                                      C
C----------------------------------------------------------------------C
      IF(DATE(OC1))GO TO 1661
      PRINT 90007
      PRINT 90000,6,4HBEGI,4H  EX,4HECUT,4HION,
     14HBF  ,4H    ,BF      ,4HRTBL,4H    ,RTBL,
     14HBO  ,4H    ,BO      ,4HA   ,4H    ,A,
     14HBRS ,4H    ,BRS     ,4HKP  ,4H    ,KP,
     14HBRS ,4H    ,BRS     ,4HKQ  ,4H    ,KQ,
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```
     14HBT1  ,4H      ,BT1      ,4HBT2  ,4H      ,BT2      ,
     14HCPT  ,4H      ,CPT      ,4HSTT  ,4H      ,STT      ,
     14HCS   ,4H      ,CS       ,4HFFCM ,4HB     ,FFCMB,
     14HCTY  ,4H      ,CTY      ,4HRAPT ,4HM3    ,RAPTM3   ,
     14HD    ,4H      ,D        ,4HKG   ,4H      ,KG,
     14HDELM ,4HY     ,DELMY    ,4HED0  ,4H      ,ED0      ,
     14HED1  ,4H      ,ED1      ,4HED2  ,4H      ,ED2      ,
     14HED3  ,4H      ,ED3      ,4HED4  ,4H      ,ED4      ,
     14HED5  ,4H      ,ED5      ,4HKT10 ,4H      ,KT10     ,
     14HFFAL ,4HB     ,FFALB    ,4HYCL  ,4H      ,YCL,
     14HFFAN ,4HB     ,FFANB    ,4HGF   ,4H      ,GF,
     14HFFCL ,4HB     ,FFCLB    ,4HFFAZ ,4HB     ,FFAZB,
     14HFFCN ,4HB     ,FFCNB    ,4HFFAM ,4HB     ,FFAMB,
     14HGAML ,4HB     ,GAMLB    ,4HPHFB ,4HV     ,PHFBV,
     14HGC   ,4H      ,GC       ,4HFFAX ,4HB     ,FFAXB,
     14HIACT ,4H      ,IACT     ,4HIRBL ,4HLDC   ,IRBLLDC  ,
     14HIDLM ,4H      ,IDLM     ,
     14HIFUF ,4HB     ,IFUFB    ,4HNULL ,4H      ,NULL     ,
     14HIRBL ,4HL     ,IRBLL    ,4HKT20 ,4H      ,KT20     ,
     14HISKR ,4H      ,ISKR     ,4HS5   ,4H      ,S5       ,
     14HIT   ,4H      ,IT       ,4HFBGN ,4H      ,FBGN,
     14HIX   ,4H      ,IX       ,4HBD   ,4H      ,BD,
     14HIYZ  ,4H      ,IYZ      ,4HR2   ,4H      ,R2       ,
     14HK4   ,4H      ,K4       ,4HPCA  ,4H      ,PCA,
     14HKB   ,4H      ,KB       ,4HRVBI ,4HAS    ,RVBIAS,
     14HKC   ,4H      ,KC       ,4HTHTB ,4HL     ,THTBL    ,
     14HKGL  ,4H      ,KGL      ,4HFFAY ,4HB     ,FFAYB,
     14HKPC  ,4H      ,KPC      ,4HTIPS ,4H      ,TIPS     ,
     14HKRGL ,4H      ,KRGL     ,4HAF   ,4H      ,AF,
     14HKS   ,4H      ,KS       ,4HKM   ,4H      ,KM       ,
     14HLAMB ,4HI     ,LAMBI    ,4HJMAX ,4H      ,JMAX     ,
     14HMASS ,4H      ,MASS     ,4HCG   ,4H      ,CG,
     14HNRUN ,4H      ,NRUN     ,
     14HPCL  ,4H      ,PCL      ,4HIA   ,4H      ,IA,
     14HPHIM ,4HAX    ,PHIMAX   ,4HS8   ,4H      ,S8       ,
     14HPRIN ,4HTM    ,PRINTM   ,4HJMAX ,4H      ,JMAX     ,
     14HRAPT ,4HM2    ,RAPTM2   ,4HRAPT ,4HM1    ,RAPTM1   ,
     14HRDET ,4H      ,RDET     ,4HDTA  ,4H      ,DTA      ,
     14HRFLE ,4HCT    ,RFLECT   ,4HPI   ,4H      ,PI,
     14HRLAM ,4HP     ,RLAMP    ,4HPSIT ,4H      ,PSIT     ,
     14HRLAM ,4HY     ,RLAMY    ,4HRPSI ,4H      ,RPSI     ,
     14HRNGL ,4HIN    ,RNGLIN   ,4HVRAT ,4HF     ,VRATF,
     14HRTMI ,4HN     ,RTMIN    ,4HKM   ,4H      ,KM       ,
     14HS7   ,4H      ,S7       ,4HS6   ,4H      ,S6       ,
     14HS10  ,4H      ,S10      ,4HS9   ,4H      ,S9       ,
     14HS12  ,4H      ,S12      ,4HS11  ,4H      ,S11      ,
     14HS4   ,4H      ,S4       ,4HS3   ,4H      ,S3       ,
     14HS2   ,4H      ,S2       ,4HS1   ,4H      ,S1       ,
     14HS    ,4H      ,S        ,4HDELM ,4HX     ,DELMX    ,
     14HSF0  ,4H      ,SF0      ,4HSF1  ,4H      ,SF1      ,
     14HSF2  ,4H      ,SF2      ,4HSF3  ,4H      ,SF3      ,
     14HSF4  ,4H      ,SF4      ,4HSF5  ,4H      ,SF5      ,
     14HSF6  ,4H      ,SF6      ,4HSF7  ,4H      ,SF7      ,
     14HSF8  ,4H      ,SF8      ,4HSF9  ,4H      ,SF9      ,
     14HSF10 ,4H      ,SF10     ,4HSF11 ,4H      ,SF11     ,
     14HSF12 ,4H      ,SF12     ,4HSF13 ,4H      ,SF13     ,
     14HSF14 ,4H      ,SF14     ,4HSF15 ,4H      ,SF15,
     14HSLOP ,4HE2    ,SLOPE2   ,4HSLOP ,4HE1    ,SLOPE1   ,
     14HT01  ,4H      ,T01      ,4HT0   ,4H      ,T0       ,
     14HT03  ,4H      ,T03      ,4HT02  ,4H      ,T02      ,
     14HT05  ,4H      ,T05      ,4HT04  ,4H      ,T04      ,
     14HT07  ,4H      ,T07      ,4HT06  ,4H      ,T06      ,
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      14HT2  ,4H     ,T2       ,4HT1  ,4H     ,T1      ,
      14HTB  ,4H     ,TB       ,4HSPT ,4H     ,SPT     ,
      14HTHAL,4HD    ,THALD,
      14HTHTA,4HC    ,THTAC    ,4HKD  ,4H     ,KD,
      14HTHET,4HAT   ,THETAT   ,4HIRAP,4H     ,IRAP    ,
      14HTHBL,4HD    ,THBLD    ,
      14HTIC ,4H     ,TIC      ,4HTICI,4H     ,TICI,
      14HTIME,4H3    ,TIME3    ,4HTIME,4H2    ,TIME2   ,
      14HTIME,4H1    ,TIME1    ,4HTIME,4HC    ,TIMEC   ,
      14HTIPI,4H     ,TIPI     ,4HDT  ,4H     ,DT      ,
      14HYWFB,4HV    ,YWFBV    ,4HK5  ,4H     ,K5,
      14HZMIN,4H     ,ZMIN     ,4HTIME,4H4    ,TIME4   ,
      14HWADB,4H     ,WADB     ,4HZMIN,4H     ,ZMIN
      GATE(CC1)=SET
 1661 CONTINUE
      PRINT 90007
      PRINT 90000,4,4HPROJ,4HECTI,4HLE1 ,4H     ,
      14HTIME,4H     ,TIME     ,4HRSA ,4H     ,RSA     ,
      14HDELV,4HP    ,DELVP    ,4HU   ,4H     ,U       ,
      14HV   ,4H     ,V        ,4HW   ,4H     ,W       ,
      14HTHTA,4H     ,THTA     ,4HPHD ,4H     ,PHD     ,
      14HDELZ,4H     ,DELZ     ,4HTOTA,4HCC   ,TOTACC  ,
      14HDZ  ,4H     ,DZ       ,4HDY  ,4H     ,DY      ,
      14HCPHI,4H     ,CPHI     ,4HDTHT,4HA    ,DTHTA   ,
      14HCX  ,4H     ,DX       ,4HDPSI,4H     ,DPSI    ,
      14HDR  ,4H     ,DR       ,4HDQ  ,4H     ,DQ      ,
      14HDP  ,4H     ,DP       ,4HDW  ,4H     ,DW      ,
      14HDC  ,4H     ,DC       ,4HDV  ,4H     ,DV      ,
      14HVRW ,4H     ,VRW      ,4HMACH,4H     ,MACH    ,
      14HGAP ,4H     ,GAP      ,4HPSI ,4H     ,PSI     ,
      14HP   ,4H     ,P        ,4HQ   ,4H     ,Q       ,
      14HR   ,4H     ,R        ,4HDELV,4HY    ,DELVY   ,
      14HAZB ,4H     ,AZB      ,4HDELX,4HV    ,DELXV   ,
      14HDELY,4HV    ,DELYV    ,4HDELZ,4HV    ,DELZV   ,
      14HX   ,4H     ,X        ,4HY   ,4H     ,Y       ,
      14HZ   ,4H     ,Z        ,4HAMB ,4H     ,AMB     ,
      14HXT  ,4H     ,XT       ,4HVT  ,4H     ,VT      ,
      14HDTHT,4HA    ,DTHTA    ,
      14HCPHI,4H     ,CPHI     ,4HSPHI,4H     ,SPHI    ,
      14HCPSI,4H     ,CPSI     ,4HSPSI,4H     ,SPSI    ,
      14HCPSI,4HS    ,CPSIS    ,4HGZB ,4H     ,GZB     ,
      14HGYB ,4H     ,GYB      ,4HGXB ,4H     ,GXB
      PRINT 90000,4,4HAUTB,4HPILB,4HTI  ,4H     ,
      14HDPHI,4HIO   ,DDPHIO   ,
      14HDELX,4HS    ,DELXS    ,4HPEG ,4H     ,PEG     ,
      14HDELY,4HIS   ,DELYIS   ,4HTXED,4H     ,TXED    ,
      14HDELZ,4HS    ,DELZS    ,4HOMEG,4HA    ,OMEGA   ,
      14HDYEF,4H     ,DYEF     ,4HDPEF,4H     ,DPEF    ,
      14HDTHT,4HAS   ,DTHTAS   ,4HRTM ,4H     ,RTM     ,
      14HKT  ,4H     ,KT       ,4HPEFL,4H     ,PEFL,
      14HNULL,4H     ,NULL     ,4HDELR,4H     ,DELR    ,
      14HOMEG,4HZ    ,OMEGZ    ,4HPSRG,4H     ,PSRG    ,
      14HPED ,4H     ,PED      ,4HPEF ,4H     ,PEF     ,
      14HPITE,4HRB   ,PITERB   ,4HPHIB,4H     ,PHIB,
      14HPSIS,4H     ,PSIS     ,
      14HPXED,4H     ,PXED     ,4HTHBS,4H     ,THBS    ,
      14HPSBS,4H     ,PSBS     ,4HDEL1,4H     ,DEL1    ,
      14HRLAM,4HV    ,RLAMV    ,4HRLAM,4HP    ,RLAMP   ,
      14HTHTA,4HS    ,THTAS    ,4HTHRB,4HS    ,THRBS   ,
      14HYEF ,4H     ,YEF      ,4HPEF ,4H     ,PEF     ,
      14HYED ,4H     ,YED      ,4HPED ,4H     ,PED     ,
      14HYEF ,4H     ,YEF      ,4HYBRG,4H     ,YBRG    ,
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                14HYEG ,4H     ,YEG      ,4HDELY,4HS    ,DELYS   ,
                14HYAWE,4HRR   ,YAWERR   ,4HYAWE,4HR9   ,YAWERR  ,
                14HLAMY,4HR    ,LAMYR    ,4HLAMP,4HR    ,LAMPR   ,
                14HGSA ,4H     ,GSA      ,4HGAPS,4H     ,GAPS    ,
                14HDPSI,4HS    ,DPSIS    ,4HIACC,4H     ,IACC    ,
                14HPSR9,4HS    ,PSRRS    ,4HREV ,4H     ,REV
                 PRINT 90000,2,4HLAGI,4HC!  ,
                14HGATE,4H     1,GATE(001),4HGATE,4H     2,GATE(002),
                24HGATE,4H     3,GATE(003),4HGATE,4H     4,GATE(004),
                24HGATE,4H     5,GATE(005),4HGATE,4H     6,GATE(006),
                34HGATE,4H     7,GATE(007)
                 PRINT 90000,4,4HAERR,4HDYNA,4HMICS,4HI  ,
                14HCLD ,4H     ,CLD      ,4HALB ,4H     ,ALB     ,
                14HCNR ,4H     ,CNR      ,4HCMG ,4H     ,CMG     ,
                14HCY  ,4H     ,CY       ,4HCAZ ,4H     ,CAZ     ,
                14HCLP ,4H     ,CLP      ,4HCN  ,4H     ,CN      ,
                14HCYCG,4H     ,CYCG     ,4HCMCG,4H     ,CMCG    ,
                14HANB ,4H     ,ANR      ,4HCLB ,4H     ,CLB     ,
                14HCMB ,4H     ,CMB      ,4HCNB ,4H     ,CNB     ,
                14HTHAS,4HD    ,THASD    ,4HDTHA,4HSD   ,DTHASD  ,
                14HPSIS,4HD    ,PSISD    ,4HDPSI,4HSD   ,DPSISD  ,
                14HALPH,4HA    ,ALPHA    ,4HBETA,4H     ,BETA
                 PRINT 90000,1,4HRAPI,
                14HSTT ,4H     ,STT      ,4HCTT ,4H     ,CTT     ,
                14HSPT ,4H     ,SPT      ,4HCPT ,4H     ,CPT     ,
                14HTH  ,4H     ,TH       ,4HXLTA,4H     ,XLTA
                 PRINT 90000,3,4HDEBU,4HG PR,4HINTI,
                14HDELX,4HB    ,DELXB    ,4HDELY,4HB    ,DELYB,
                14HDELZ,4HB    ,DELZB    ,4HDELX,4HS    ,DELXS,
                14HDELY,4HS    ,DELYS    ,4HDELZ,4HS    ,DELZS,
                14HKUTT,4HA    ,KUTTA    ,
                14HPITE,4HRR   ,PITERR   ,4HYAWE,4HRR   ,YAWERR,
                14HPITE,4HR8   ,PITER8   ,4HYAWE,4HR8   ,YAWER8,
                34HDRLA,4HMP   ,DRLAMP   ,4HF3  ,4H     ,F3      ,
                34HDRPS,4HI    ,DRPSI    ,4HDRTH,4HTA   ,DRTHTA  ,
                34HDRPH,4HIG   ,DRPHIG   ,4HRPHI,4HG    ,RPHIG   ,
                14HDELV,4HR    ,DELVR    ,4HDPHI,4HO    ,DPHIO   ,
                14HG   ,4H     ,G        ,4HVSND,4H     ,VSND    ,
                14HISKR,4H     ,ISKR     ,4HIACT,4H     ,IACT    ,
                14HIGUI,4HDE   ,IGUIDE   ,4HIRAP,4H     ,IRAP    ,
                14HKAGE,4H     ,KAGE     ,4HNAVY,4H     ,NAVY    ,
                34HF1  ,4H     ,F1       ,4HDRLA,4HMP   ,DRLAMP  ,
                14HNUM ,4H     ,NUM      ,4HIPRI,4HNT   ,IPRINT  ,
                14HNPPS,4H     ,NPPS     ,4HNDT ,4H     ,NDT     ,
                14HNDTA,4H     ,NDTA     ,4HNULS,4HKR   ,NULSKR  ,
                34HPEPL,4H     ,PEPL     ,4HPHIG,4H     ,PHIG    ,
                14HRHO ,4H     ,RHO      ,
                14HS2  ,4H     ,S2       ,4HDELR,4H8L   ,DELR8L  ,
                14HRED ,4H     ,RED      ,4HRET ,4H     ,RET     ,
                14HREG ,4H     ,REG      ,4HRPSI,4H     ,RPSI    ,
                 1* 14HRTHT,4HA    ,RTHTA    ,
                14H8MEG,4HY    ,8MEGY    ,4H8MEG,4HZ    ,8MEGZ   ,
                14HNX  ,4H     ,NX
          72    IF(IMPACT)PRINT 90000,2,4HIMPA,4HCT!  ,
                14HPCAT,4H     ,PCAT     ,4HPCAX,4H     ,PCAX    ,
                14HPCAY,4H     ,PCAY     ,4HPCAZ,4H     ,PCAZ    ,
                14HPCA ,4H     ,PCA
                 IF(IMPACT .OR. ERROR)                R E T U R N          END RUN
          50    C O N T I N U E
                C
                C     DISPLACEMENT ERRORS FROM AIM POINT
                C
```

```
C      DISPLACEMENT ERRORS FROM SPOT
       DELX=XT-X
       DELY=YT-Y
       DELZ=ZT-Z
       IF (TIME.LT.TIME3)GO TO 51
C
       IF (ABS(DEL1 ).GT.DELMY)DEL1 =SIGN(DELMY,DEL1)
       IF (ABS(DELVP).GT.DELMX)DELVP=SIGN(DELMX,DELVP)
       IF (ABS(DEL3 ).GT.DELMY)DEL3 =SIGN(DELMY,DEL3)
       IF (ABS(DDELVP).GT.VRATE)DDELVP=SIGN(VRATE,DDELVP)
       IF (ABS(DDEL1 ).GT.VRATE)DDEL1 =SIGN(VRATE,DDEL1 )
       IF (ABS(DDEL3 ).GT.VRATE)DDEL3 =SIGN(VRATE,DDEL3 )
       IF(IACT.GT.0)GO TO 51
       DEL1 = YEG*REG
       DELVP = PEG
       DEL3 = -YEG*REG
       IF(IACT.EQ.2)DEL1=REG*YEG
       IF(IACT.EQ.2)DEL3=REG*YEG
    51 CONTINUE
       RETURN
C
       ENTRY FINISH
C
C
       IF (IACC.EQ.1)GO TO 40
       XT = XT+DTRK*VXT
       YT = YT+DTRK*VYT
    40 CONTINUE
       VMS=U*U+V*V+W*W
       VM=SQRT(VMS)
       TOTACC=(SQRT(AYB*AYB+AZB*AZB))/MASS
C*****TRAJECTORY TERMINATION
       IF(TIME.GT.5..AND.Z.GT.ZMIN)GO TO 45
       IF(Z.LT.ZMIN)GO TO 157
    45 CONTINUE
       DELXT = XT-X
       DELYT = YT-Y
       DELZT = ZT-Z
       DELXTB=EB11*DELXT+EB12*DELYT+EB13*DELZT
       DELYTB=EB21*DELXT+EB22*DELYT+EB23*DELZT
       DELZTB=EB31*DELXT+EB32*DELYT+EB33*DELZT
C** LOS IN ECS
       VERLAM=ATAN2(-DELZ,SQRT(DELX*DELX+DELY*DELY))
       HORLAM=ATAN2(DELY,DELX)
C** TOTAL MISSILE NON-FIELD ACCELERATION
C
       GAMP=-ATAN2(W,U)
       RTUWS=SQRT(U*U+W*W)
       GAMY=ATAN2(V,RTUWS)
C** BCS TO VCS TRANSFORMATION
       CALL TRSFBV
       DELMIS=SQRT(DELYV**2+DELZV**2)
       GO TO 73
   157 CONTINUE
C**** RANGE TARGET FROM MISSILE-RTM IN FEET.
       RTM=SQRT((XT-X)**2+(YT-Y)**2+(ZT-Z)**2)
C**** POINT OF CLOSEST APPROACH COMPUTATION-PCA IN FEET.
       IF(RTM.GT.PCA)GO TO 55
       PCAT=SNGL(TIME);PCAX=X;PCAY=Y;PCAZ=Z;PCA=RTM
    55 CONTINUE
       GO TO 9
    73 IMPACT=.TRUE.
```

```
                      IPRINT=2
                      PRINT 90000,2,4HIMPA,4HCTI ,4HTIME,4H    ,TIMF
                      GO TO 9
              9999    GATE\JC21*SET
                      ERROR=.TRUE.
                      GO TO 70
              9998    PRINT 90000,5,4HEND=,4HOF=F,4HILE ,4HON U,4HNIT:,
                     14HLUNI,4HT   ,LUNIT
                      DO 3121 I=1,16
              3121    MDAC(I)=0.
                      DO 3122 I=1,1500
              X       CALL WDACS(0,16,MDAC)
              3122    CONTINUE
                1*    CALL BEOF(IE)
                2*    CALL WEOF=00
                3*    CALL WEOF=0F
              X       CALL MODE('RI')
              X       CALL MODE('RI')
              X       CALL WEOF
              X       CALL PLOT(1,' TIME',2,' TXED  ')
              X       CALL FGORLS('0V      ')
                      STOP
                      END
```

```
      SUBROUTINE SEEKER(SRNGE,REFLEC,ERR,ERS)
      DIMENSION TRNGE(18),TRFLEC(2),THS(18,2),TLBS(19),TERS(19,6)
      DIMENSION TRAD(6)
      DATA TRNGE/100.,200.,300.,400.,500.,600.,800.,1000.,2000.,3000.,
     14000.,5000.,6000.,8000.,10000.,12000.,14000.,16000./
      DATA TRFLEC /1.25,5./
      DATA TLBS /-1.5,-1.333,-1.167,-1.,-.833,-.667,-.5,-.333,-.167,0.,
     1.167,.333,.5,.667,.833,1.,1.167,1.333,1.5/
      DATA TRAD /4.3E-14,4.6E-13,4.5E-12,4.1E-11,4.1E-10,2.6E-9/
      DATA THS/9.3E-11,2.6E-11,9.4E-12,5.8E-12,4.6E-12,2.9E-12,1.9E-12,
     19.0E-13,2.1E-13,9.3E-14,5.0E-14,3.0E-14,2.2E-14,1.4E-14,7.5E-15,
     25.0E-15,3.8E-15,2.6E-15,
     33.7E-9,9.0E-10,3.7E-11,2.1E-11,1.4E-11,9.2E-12,5.0E-12,3.3E-12,
     48.4E-13,3.7E-13,2.0E-13,1.4E-13,8.4E-14,4.8E-14,3.0E-14,2.0E-14,
     51.8E-14,1.05E-14/
      DATA TERS/-2.,-2.,-1.95,-1.86,-1.8,-1.72,-1.5,-1.25,-.85,0.,.55,
     1.75,1.05,1.2,1.3,1.4,1.5,1.5,1.6,
     2-4.,-4.,-3.95,-3.85,-3.6,-3.35,-2.8,-2.1,-.85,.6,2.15,3.1,3.45,
     33.7,3.75,3.9,3.95,4.,4.,
     4-4.7,-4.7,-4.65,-4.5,-4.5,-4.2,-3.2,-2.6,-1.15,.7,2.3,3.2,3.5,3.7,
     53.75,3.8,3.9,3.9,3.9,
     6-3.5,-3.4,-3.25,-3.1,-2.9,-2.8,-2.5,-2.05,-1.15,0.,1.3,1.7,1.85,
     72.1,2.4,2.5,2.6,2.6,2.6,
     8-3.55,-3.55,-3.5,-3.4,-3.2,-3.0,-2.85,-2.5,-1.8,-.9,-.4,.05,.25,
     9.5,.7,.9,1.,1.05,1.1,
     A-2.4,-2.4,-2.35,-2.3,-2.2,-2.,-1.85,-1.,-1.1,-.95,-.8,-.5,-.35,
     B-.2,-.1,-.05,.025,.05,.05/
      DIMENSION AHS(4), AEND(4)
      DATA  IS,IR, JH/3*0/
      I = IS
      CALL FIND(I,TRNGE,18,SRNGE)
      IF(I.EQ.IS)  GO TO 10
      IS=I
      CALL  INTERP (AHS,THS,I,TRNGE,18,1,TRFLEC)
   10 HS=FUNCTION(AHS,SRNGE,REFLEC)
      RRR=ERR*57.296
      I=IS;  J=JH
      CALL FIND(I,TLBS,19,RRR)
      CALL FIND(J,TRAD,6,HS)
      IF(I.NE.IS)  GO TO 20
      IF(J.EQ.JH)  GO TO 30
   20 IS=I;  JH=J
      CALL  INTERP (AEND,TERS,I,TLBS,19,J,TRAD)
   30 END=FUNCTION(AEND,RRR,HS)
      ERS = END/4./57.296
      RETURN
      END
```

```
      SUBROUTINE AERO (T1,T2,FMACH,ALPHA,BETA,DELPIT,DELYAW,DELROL,
     1   CN,CMCG,CY,CLNCG,CA,CLP,CLD,CMQ,CMAD,CLNR,CLNAD)
C     MP
C
C     INPUTS
C     T1        = TIME - SEC.
C     T2        = TIME TO START CONTROL PHASE - SEC.
C     FMACH     = FREE STREAM MACH NUMBER
C     ALPHA     = ANGLE OF ATTACK (PITCH PLANE) - DEG.
C     BETA      = ANGLE OF ATTACK (YAW PLANE) - DEG.
C     DELPIT    = CONTROL DEFLECTION ANGLE (PITCH PLANE) - DEG.
C     DELYAW    = CONTROL DEFLECTION ANGLE (YAW PLANE) - DEG.
C     DELROL    = CONTROL DEFLECTION (ROLL) - DEG)
C
C     OUTPUT
C     CN        = NORMAL FORCE COEFF.
C     CMCG      = PITCHING MOMENT COEFF.
C     CY        = YAW FORCE COEFF.
C     CLNCG     = YAW MOMENT COFFF.
C     CA        = AXIAL FORCE COEFF.
C     CLP       = ROLL DAMPING COEFF. - (1/RAD)
C     CLD       = ROLL MOMENT COEFF. - (1/DEG)
C     CMQ       = PITCH DAMPING COEFF. DUE TO THETA DOT
C     CMAD      = PITCH DAMPING COEFF. DUE TO ALPHA DOT
C     CLNR      = YAW DAMPING COEFF. DUE TO PSI DOT
C     CLNAD     = YAW DAMPING COEFF. DUE TO ALPHA DOT
C
C     TABLES
C     TCN1      = TABLE OF CN   FOR CONTROL PHASE
C     TCMCG1    = TABLE OF CMCG FOR CONTROL PHASE
C     TCA1      = TABLE OF CA   FOR CONTROL PHASE
C     TCN2      = TABLE OF CN   FOR BALLISTIC PHASE
C     TCMCG2    = TABLE OF CMCG FOR BALLISTIC PHASE
C     TCA2      = TABLE OF CA   FOR BALLISTIC PHASE
C     TDELT1    = TABLE OF DELTA FOR CN,CMCG
C     TMACH1    = TABLE OF FMACH FOR CONTROL PHASE
C     TMACH2    = TABLE OF FMACH FOR BALLISTIC PHASE
C     TMACH3    = TABLE OF FMACH FOR CLP,CLD
C     TMACH4    = TABLE OF FMACH FOR CMQ
C     TMACH5    = TABLE OF FMACH FOR CA (BALLISTIC PHASE)
C
      DOUBLE PRECISION T1,T2
      DIMENSION TALP(6),TDELT1(7),          TCN1(6,7,3),TCN2(6,8)
      DIMENSION TCMCG1(6,7,3),TCMCG2(6,5),TCA1(6,7,2),TCA2(15)
      DIMENSION TCLP(8),TCLD(8),TCMQ(10,5),TALP4(10)
      DIMENSION TMACH1(3),TMACH2(5),TMACH3(8),TMACH4(8),TMACH5(15)
      DIMENSION ACN(8),   ACMCG(8), ACY(8),ACLNCG(8),ACAP(8),
     1 ACAB(8),  ACA0(8),ACLP(8),    ACLD(8),  ACMQ(8),  ACLNR(8)
      DIMENSION ISAVE(13)
      DATA      ISAVE     /13*0/
      DATA TCN1  /
     X    -1.25    ,-.79    ,-.41    ,.91     ,1.98    ,3.12    ,  -20 .4
     X    -1.2     ,-.6     ,-.4     ,1.35    ,2.4     ,3.39    ,  -15 .4
     X    -1.      ,-.68    ,-.37    ,1.81    ,2.72    ,3.45    ,  -10 .4
     X    -.44     ,-.38    ,1.32    ,2.19    ,2.78    ,3.60    ,   -5 .4
     X     .0      ,.53     ,1.8     ,2.29    ,2.95    ,3.8     ,    0 .4
     X     .4      ,1.3     ,1.84    ,2.3     ,3.05    ,3.95    ,    5 .4
     X     .95     ,1.8     ,1.85    ,2.43    ,3.2     ,4.05    ,   10 .4
     X    -1.35    ,-.9     ,-.2     ,1.05    ,2.1     ,3.35    ,  -20 .8
     X    -1.25    ,-.69    ,-.4     ,1.48    ,2.56    ,3.67    ,  -15 .8
     X    -1.1     ,-.09    ,.95     ,1.9     ,2.99    ,3.89    ,  -10 .8
     X    -.06     ,.4      ,1.88    ,2.29    ,3.1     ,4.08    ,   -5 .8
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```
     X    .0     ,1.05   ,1.85   ,2.54   ,3.31   ,4.28    ,   0 .4
     X    .45    ,1.38   ,1.95   ,2.64   ,3.45   ,4.39    ,   5 .8
     X    1.     ,1.56   ,2.1    ,2.8    ,3.56   ,4.5     ,  10 .8
     X    -2.    ,-1.17  ,.02    ,1.23   ,2.5    ,4.13    , -20 1.0
     X    -1.7   ,-.64   ,.59    ,1.7    ,3.06   ,4.65    , -15 1.0
     X    -1.2   ,.0     ,1.     ,2.24   ,3.62   ,5.05    , -10 1.0
     X    -.6    ,.48    ,1.56   ,2.75   ,4.05   ,5.23    ,  -5 1.0
     X    .0     ,1.05   ,2.2    ,3.3    ,4.25   ,5.32    ,   0 1.0
     X    .43    ,1.6    ,2.6    ,3.44   ,4.28   ,5.39    ,   5 1.0
     X    1.     ,2.1    ,2.85   ,3.5    ,4.34   ,5.41    /  10 1.0
     DATA TCN2 /
     X    .0     ,.93    ,1.8    ,2.29   ,2.94   ,3.8     ,   0 .4
     X    .0     ,1.05   ,1.85   ,2.54   ,3.31   ,4.28    ,   0 .8
     X    .0     ,1.05   ,2.2    ,3.3    ,4.25   ,5.32    ,   0 1.0
     X    .0     ,.85    ,1.8    ,2.85   ,4.2    ,5.6     ,   0 1.3
     X    .0     ,.59    ,1.4    ,2.5    ,3.5    ,4.9     /   0 1.8
     DATA TCMC81 /
     X    3.6    ,4.     ,3.35   ,2.35   ,1.8    ,1.3     , -20 .4
     X    3.4    ,3.12   ,1.9    ,1.1    ,.48    ,.4      , -15 .4
     X    2.84   ,1.57   ,.53    ,-.25   ,-.5    ,.2      , -10 .4
     X    1.25   ,.37    ,-.75   ,-1.32  ,-.70   ,-.3     ,  -5 .4
     X    .0     ,-1.25  ,-2.1   ,-1.62  ,-1.2   ,-.98    ,   0 .4
     X    -1.1   ,-2.35  ,-2.2   ,-1.7   ,-1.5   ,-1.35   ,   5 .4
     X    -2.7   ,-2.9   ,-2.25  ,-2.05  ,-1.94  ,-1.65   ,  10 .4
     X    3.85   ,4.     ,3.6    ,2.16   ,1.7    ,1.5     , -20 .8
     X    3.6    ,3.2    ,1.95   ,.88    ,.3     ,.41     , -15 .8
     X    3.1    ,1.65   ,.35    ,-.4    ,-.7    ,-.25    , -10 .8
     X    1.65   ,.3     ,-1.08  ,-1.5   ,-1.35  ,-.83    ,  -5 .8
     X    .0     ,-1.7   ,-2.28  ,-2.2   ,-1.98  ,-1.52   ,   0 .8
     X    -1.2   ,-2.57  ,-2.56  ,-2.5   ,-2.39  ,-1.8    ,   5 .8
     X    -3.94  ,-3.1   ,-3.    ,-2.98  ,-2.7   ,-2.16   ,  10 .8
     X    5.9    ,4.96   ,3.17   ,1.98   ,1.3    ,1.      , -20 1.0
     X    4.98   ,3.32   ,1.52   ,.53    ,-.4    ,-.79    , -15 1.0
     X    3.55   ,1.4    ,-.27   ,-1.12  ,-2.2   ,-2.1    , -10 1.0
     X    1.7    ,.02    ,-1.42  ,-3.0   ,-3.5   ,-2.72   ,  -5 1.0
     X    .0     ,-1.65  ,-3.32  ,-4.4   ,-4.1   ,-3.04   ,   0 1.0
     X    -1.23  ,-3.3   ,-4.57  ,-4.75  ,-4.3   ,-3.2    ,   5 1.0
     X    -2.95  ,-4.7   ,-5.27  ,-4.9   ,-4.45  ,-3.38   /  10 1.0
     DATA TCMC82 /
     X    .0     ,-1.25  ,-2.1   ,-1.62  ,-1.2   ,-.98    ,   0 .4
     X    .0     ,-1.7   ,-2.28  ,-2.2   ,-1.98  ,-1.52   ,   0 .8
     X    .0     ,-1.65  ,-3.32  ,-4.4   ,-4.1   ,-3.04   ,   0 1.0
     X    .0     ,-.9    ,-1.8   ,-2.38  ,-2.17  ,-.65    ,   0 1.3
     X    .0     ,-.28   ,-.45   ,-.57   ,-.57   ,-.57    /   0 1.8
     DATA TCA1 /
     X    .71    ,.69    ,.55    ,.363   ,.176   ,-.03    , -20 .4
     X    .585   ,.506   ,.382   ,.24    ,.173   ,-.02    , -15 .4
     X    .435   ,.35    ,.275   ,.189   ,.102   ,.09     , -10 .4
     X    .328   ,.311   ,.26    ,.25    ,.245   ,.22     ,  -5 .4
     X    .295   ,.294   ,.313   ,.341   ,.323   ,.19     ,   0 .4
     X    .32    ,.366   ,.412   ,.476   ,.425   ,.404    ,   5 .4
     X    .42    ,.47    ,.502   ,.58    ,.529   ,.5      ,  10 .4
     X    .78    ,.767   ,.652   ,.419   ,.24    ,.061    , -20 .8
     X    .64    ,.384   ,.435   ,.298   ,.153   ,.068    , -15 .8
     X    .51    ,.419   ,.348   ,.25    ,.196   ,.153    , -10 .8
     X    .375   ,.352   ,.308   ,.301   ,.29    ,.26     ,  -5 .8
     X    .338   ,.338   ,.381   ,.390   ,.403   ,.383    ,   0 .8
     X    .373   ,.425   ,.482   ,.51    ,.545   ,.515    ,   5 .8
     X    .475   ,.53    ,.581   ,.635   ,.65    ,.66     ,  10 .8
     X    1.23   ,1.11   ,.88    ,.685   ,.47    ,.214    , -20 1.0
     X    1.06   ,.855   ,.705   ,.56    ,.363   ,.175    , -15 1.0
     X    .79    ,.673   ,.61    ,.518   ,.356   ,.226    , -10 1.0
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     X     .643      ,.605     ,.58      ,.54      ,.456     ,.382     /   .5 1.0
     X     .582      ,.61      ,.595     ,.58      ,.54      ,.50      ,   0 1.0
     X     .63       ,.685     ,.753     ,.775     ,.765     ,.74      ,   5 1.0
     X     .73       ,.83      ,.90      ,.918     ,.92      ,.89      /  10 1.0
      DATA TCA2             / .31,.31,.32,.332,.367,.428,.505,.58,
     X  .615,.639,.645,.639,.628,.60,.565/
      DATA TALP            /0.,5.,10.,15.,20.,25./
      DATA TALP2             /0.,4.,6.,8.,10.,12.,14.,16.,18.,20./
      DATA TDELT1            /-20.,-15.,-10.,-5.,0.,5.,10./
      DATA TMACH1            /.4,.8,1.0/
      DATA TMACH2            /.4,.8,1.0,1.3,1.8/
      CAT  TMACH4            /.4,.8,1.0,1.3,1.8/
      DATA TMACH3             /.4,.6,.8,1.0,1.2,1.4,1.6,1.8/
      DATA TMACH5            / .4,.5,.6,.7,.8,.85,.9,.95,1.0,1.1,1.2,
     X  1.3,1.4,1.6,1.8/
      DATA TCLP             /-.185,-17.7,-21.0,-29.,-20.,-21.,-17.,-14./
      DATA TCLD             /.085,.087,.090,.097,.086,.073,.061,.049/
      DATA TCPQ /
     X  -145.,-165.,-162.,-125.,-100.,-101.,-102.,-104.,-105.,-107.,
     X  -150.,-185.,-190.,-165.,-135.,-108.,-75.,-75.,-75.,-75.,
     X  -160.,-205.,-215.,-220.,-234.,-240.,-248.,-227.,-180.,-107.,
     X  -178.,-194.,-195.,-195.,-194.,-192.,-188.,-174.,-144.,-110.,
     X  -130.,-155.,-162.,-155.,-150.,-143.,-134.,-120.,-105.,-67./
      ABALP = ABS(ALPHA)*57.296
      ABBET = ABS(BETA )*57.296
      IF(T1.LT.T2) GO TO 2
      DELP = DELPIT*57.296
      DELY = DELYAW*57.296
      IF(ALPHA.LT.0.) DELP=-DELP
      IF(BETA.LT.0.) DELY=-DELY
       I = ISAVE(1)
       J = ISAVE(2)
       K = ISAVE(3)
       CALL FIND(I,TALP,6,ABALP)
       CALL FIND(J,TDELT1,7,DELP)
       CALL FIND(K,TMACH1,3,FMACH)
       IF(I .NE. ISAVE(1))              GO TO 50
       IF(J .NE. ISAVE(2))              GO TO 60
       IF(K .NE. ISAVE(3))              GO TO 70
       GO TO 80
   50  ISAVE(1) = I
   60  ISAVE(2) = J
   70  CONTINUE
       CALL NTERP (ACN,TCN1,I,TALP,6,J,TDELT1,7,K,TMACH1)
       CALL  NTERP (ACMCG,TCMCG1)
       CALL  NTERP (ACAP,TCA1)
   80  I = ISAVE(4)
       J = ISAVE(5)
       CALL FIND(I,TALP,6,ABBET)
       CALL FIND(J,TDELT1,7,DELY)
       IF(I .NE. ISAVE(4))              GO TO 150
       IF(J .NE. ISAVE(5))              GO TO 160
       IF(K .NE. ISAVE(3))              GO TO 170
       GO TO 180
  150  ISAVE(4) = I
  160  ISAVE(5) = J
  170  CONTINUE
       CALL NTERP (ACY,TCN1,I,TALP,6,J,TDELT1,7,K,TMACH1)
       CALL  NTERP (ACLNCG,TCMCG1)
       CALL  NTERP (ACAB,TCA1)
  180  IF(K .EQ. ISAVE(3))              GO TO 190
C
```

```
187             C  SET I & J FOR ALPHA = DELTA = 0.0 IN TALP & TDELT1
188             C
189                     I = 1
190                     J = 5
191                     CALL NTERP (ACA8,TCA1,I,TALP,6,J,TDELT1,7,K,TMACH1)
192                     ACA8(2) = ACA8(5)
193                     ISAVE(3) = K
194               190   CONTINUE
195                     CN          = FUNCTION(ACN,ABALP,DELP,FMACH)
196                     CMCG        = FUNCTION(ACMCG)
197                     CAP         = FUNCTION(ACAP)
198                     CY          = FUNCTION(ACY,ABBET,DELY,FMACH)
199                     CLNCG       = FUNCTION(ACLNCG)
200                     CAB         = FUNCTION(ACAB)
201                     CA8         = FUNCTION(ACA8,FMACH)
202                     CA = CAP + CAB - CA8
203                     GO TO 3
204             C
205               2     I = ISAVE(6)
206                     J = ISAVE(7)
207                     K = ISAVE(8)
208                     CALL FIND(I,TALP,6,ABALP)
209                     CALL FIND(J,TMACH2,5,FMACH)
210                     CALL FIND(K,TALP,6,ABBET)
211                     IF(J .NE. ISAVE(7))             GO TO 250
212                     IF(I .EQ. ISAVE(6))             GO TO 260
213               250   ISAVE(6) = I
214                     CALL NTERP (ACN,TCN2,I,TALP,6,J,TMACH2)
215                     CALL  NTERP (ACMCG,TCMCG2)
216               260   IF(J .NE. ISAVE(7))             GO TO 270
217                     IF(K .EQ. ISAVE(8))             GO TO 280
218               270   ISAVE(7) = J
219                     ISAVE(8) = K
220                     CALL NTERP (ACY,TCN2,K,TALP,6,J,TMACH2)
221                     CALL  NTERP (ACLNCG,TCMCG2)
222               280   I = ISAVE(9)
223                     CALL FIND(I,TMACH5,15,FMACH)
224                     IF(I .EQ. ISAVE(9))             GO TO 290
225                     ISAVE(9) = I
226                     CALL NTERP (ACAP,TCA2,I,TMACH5)
227               290   CONTINUE
228                     CN          = FUNCTION(ACN,ABALP,FMACH)
229                     CMCG        = FUNCTION(ACMCG)
230                     CY          = FUNCTION(ACY,ABBET,FMACH)
231                     CLNCG       = FUNCTION(ACLNCG)
232                     CA          = FUNCTION(ACAP,FMACH)
233             C
234               3     I = ISAVE(10)
235                     CALL FIND(I,TMACH3,8,FMACH)
236                     IF(I .EQ. ISAVE(10))            GO TO 350
237                     ISAVE(10) = I
238                     CALL NTERP (ACLP,TCLP,I,TMACH3)
239                     CALL  NTERP (ACLD,TCLD)
240               350   I = ISAVE(11)
241                     J = ISAVE(12)
242                     K = ISAVE(13)
243                     CALL FIND(I,TMACH4,5,FMACH)
244                     CALL FIND(J,TALP4,10,ABALP)
245                     CALL FIND(K,TALP4,10,ABBET)
246                     IF(I .NE. ISAVE(11))            GO TO 360
247                     IF(J .EQ. ISAVE(12))            GO TO 370
248               360   ISAVE(12) = J
```

```
      CALL NTERP (ACMG,TCMQ,J,TALP4,10,I,TMACH4)
  370 IF(I .NE. ISAVE(11))          GO TO 380
      IF(K .EQ. ISAVE(13))          GO TO 390
  380 ISAVE(11) = I
      ISAVE(13) = K
      CALL NTERP (ACLNR,TCMQ,K,TALP4,10,I,TMACH4)
  390 CONTINUE
      CLP       = FUNCTION(ACLP,FMACH)
      CLQ       = FUNCTION(ACLQ)
      CMG       = FUNCTION(ACMG,ABALP,FMACH)
      CLNR      = FUNCTION(ACLNR,ABBET,FMACH)
      IF(ALPHA .LT. 0.0)  CN = -CN;          CMCG=-CMCG
      IF(BETA .LT. 0.0)   CY=-CY;            CLNCG=-CLNCG
     CMAD=0.
     CLNAD=0.
     RETURN
     END
```

```
      SUBROUTINE TRSFEB
C *** THIS SUBROUTINE PERFORMS THE EARTH TO BODY COORDINATE SYS. TRANSFORMATION
C
      DIMENSION DUM(7),DUMY(57)
      COMMON/INTEG/I,J,DUM,PHI,THTA,PSI,DUMY
      COMMON/ETB/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/TDC/CPSI,SPSI,SPHI,CPHI
      CPSI=COS(PSI)
      SPSI=SIN(PSI)
      CTHTA=COS(THTA)
      STHTA=SIN(THTA)
      CPHI=COS(PHI)
      SPHI=SIN(PHI)
      EB11=CPSI*CTHTA
      EB12=SPSI
      EB13=-CPSI*STHTA
      EB21=SPHI*STHTA*CPHI*SPSI*CTHTA
      EB22=CPHI*CPSI
      EB23=SPHI*CTHTA*CPHI*SPSI*STHTA
      EB31=CPHI*STHTA*SPHI*SPSI*CTHTA
      EB32=-SPHI*CPSI
      EB33=CPHI*CTHTA-SPHI*SPSI*STHTA
      RETURN
      END
```

```
      SUBROUTINE TRSFBS
C *** THIS SUBROUTINE PERFORMS THE BODY TO SEEKER COORDINATE SYS. TRANSFORMATION
C
      DIMENSION DUM(15),DUMR(*9)
      COMMON/INTEG/I,J,DUM,THTAS,QQ,PSIS,DUMR
      COMMON/BTS/BS11,BS12,BS13,BS21,BS22,BS23,BS31,BS32,BS33
      BS12=SIN(PSIS)
      BS22=COS(PSIS)
      BS31=SIN(THTAS)
      BS33=COS(THTAS)
      BS11=BS22*BS33
      BS13=-BS22*BS31
      BS21=-BS12*BS33
      BS23=BS12*BS31
      BS32=0.
      RETURN
      END
```

```
      SUBROUTINE TRSFRV
C *** THIS SUBROUTINE PERFORMS THE BCS TO VCS TRANSFORMATION
C
      COMMON/ IN/ GAMP,GAMY,DELXTB,DELYTB,DELZTB
      COMMON/RTV/DELXV,DELYV,DELZV
      BV12=SIN(GAMY)
      BV22=COS(GAMY)
      BV31=SIN(GAMP)
      BV33=COS(GAMP)
      BV11=BV22*BV33
      BV13=-BV22*BV31
      BV21=-BV12*BV33
      BV23=BV12*BV31
      BV32=0.
      DELXV=BV11*DELXTB+BV12*DELYTB+BV13*DELZTB
      DELYV=BV21*DELXTB+BV22*DELYTB+BV23*DELZTB
      DELZV=BV31*DELXTB+BV32*DELYTB+BV33*DELZTB
      RETURN
      END
```

```
      SUBROUTINE LASERR
C***  THIS SUBROUTINE TRANSFORMS MISSLE TO TARGET DISPLACEMENTS
C***  FROM ECS TO BCS, FROM BCS TO SCS AND COMPUTES LOS ERROR IN SCS
C
      COMMON/BTS/BS11,BS12,BS13,BS21,BS22,BS23,BS31,BS32,BS33
      COMMON/ETB/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/INPSKR/PITERR,YAWERR
      COMMON/DEL/DELX,DELY,DELZ
      COMMON/STUFF/ DELXS,DELYS,DELZS
*     COMMON/STUFF1/DELXB,DELYB,DELZB
      DELXB=EB11*DELX+EB12*DELY+EB13*DELZ
      DELYB=EB21*DELX+EB22*DELY+EB23*DELZ
      DELZB=EB31*DELX+EB32*DELY+EB33*DELZ
      DELXS=BS11*DELXB+BS12*DELYB+BS13*DELZB
      DELYS=BS21*DELXB+BS22*DELYB+BS23*DELZB
      DELZS=BS31*DELXB+BS32*DELYB+BS33*DELZB
      PITERR=ATAN2(-DELZS,DELXS)
      YAWERR=ATAN2(DELYS,SQRT(DELXS*DELXS+DELZS*DELZS))
      RETURN
      END
```

```
      SUBROUTINE MCALC
C***  THIS SUBROUTINE CALCULATES THE MACH NUMBER
C
      DIMENSION RHM(63)
      REAL MACH
      COMMON/ETB/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/MACL/MACH,VSND,UR,VR,WR,VRS,VRW,VW
      COMMON/INTEG/I,J,GG,U,V,W,RHM
      COMMON/F/WXS,WYS,WZS
      UW=EB11*WXS+EB12*WYS
      VW=EB21*WXS+EB22*WYS
      WW=EB31*WXS+EB32*WYS
      UR=U-UW
      VR=V-VW
      WR=W-WW
      VRS=UR*UR+VR*VR+WR*WR
      VRW=SQRT(VRS)
      MACH=VRW/VSND
      RETURN
      END
```

```
      SUBROUTINE FORMBA
C**   SUBROUTINE FORMBA CALCULATES FORCES AND MOMENTS FOR THE DIFEQ SUBROUTINES
C
      DOUBLE PRECISION TIME,TIME3
      REAL MACH
      DIMENSION WRWB(8),WRWI(17),WIWI(40)
      COMMON/YDCEQ/AXB,AYB,AZB,CLB,CNB,ALB,AMB,ANB,CMA
      COMMON/CDEP/CAZ,CY,CN,CLP,CMCG,CYCG,CLD,CMC,CNR,ALPHA,BETA,CMAC,
     1CLNAC
      COMMON/MACL/MACH,AA,UR,VR,WR,UR3,VRW,VW
      COMMON/DD/DELVY,DELVP,DELR,DELRBL
      COMMON/JUNK/TIME,TIME3,RMB,S,D,SQUW,QAP,IRAP,RAPTM1,RAPTM2,IACT,
     1SLOPE1,BT1,RAPTM3,SLOPE2,BT2,CTT,CPT,SPT,XLTA,STT,QAPS,QAPSD,
     2QAPSCM,TM
      COMMON/INTEG/I,J,WBWB,P,Q,R,WBWI,DEL1,DELVP,DEL3,WIWI
      COMMON/FF/FFCLB,FFCMB,FFCNB,FFAXB,FFAYB,FFAZB,FFALB,FFAMB,FFANB
      ALPHA=ATAN2(WR,UR)
      SQUW=SQRT(UR*UR+WR*WR)
      BETA=ATAN2(VR,SQUW)
      QAPS=.5*RMB*VRS
      CAPS=QAPS*S
      QAPSD=QAPS*D
      IF(VRW.EQ.0.)GO TO 121
      QAPSCM=QAPSD*D/(2.*VRW)
      GO TO 122
  121 QAPSCM=0.
  122 CONTINUE
      DELVY=(DEL1+DEL3)/2.
      DELVP=(DEL1+DEL3)/2.
      IF(IACT.EQ.2)DELVY=(DEL3-DEL1)*.5
      IF(TIME.GE.TIME3)DELRBL=DELVR
      DELR=DELRBL+57.2957795
      CALL AERB(TIME,TIME3,MACH,ALPHA,BETA,DELVP,DELVY,DEL R,CN,CMCG,CY,
     1CYCG,CAZ,CLP,CLD,CMC,CMQ,CNR,CLNAC)
      CLB=QAPSD*CLD*DELR+FFCLB
      CMB = QAPSDM*CMC+Q*FFCMB
      CNB = QAPSDM*CNR*R+FFCNB
      AXB = -CAPS*CAZ+FFAXB
      AYB = -CAPS*CY+FFAYB
      AZB = -CAPS*CN+FFAZB
      ALB=QAPSDM*CLP*P+FFALB
      AMB = QAPSD*CMCG+FFAMB
      ANB=QAPSD*CYCG+FFANB
      IF(IRAP.EQ.0.OR.TIME.LT.RAPTM1)GO TO 123
      IF(TIME.LE.RAPTM2)TM=SLOPE1*TIME+BT1
      IF(TIME.GT.RAPTM2.AND.TIME.LE.RAPTM3)TM=SLOPE2*TIME+BT2
      IF(TIME.GT.RAPTM3)TM=0.
      IF(TIME.GT.RAPTM3)IRAP=0
  123 AXB=AXB+TM*CTT*CPT
      AYB=AYB+TM*CTT*SPT
      AZB=AZB+TM*STT
      AMB=AMB+TM*STT*XLTA
      ANB=ANB+TM*CTT*SPT*XLTA
      RETURN
      END
```

```
      SUBROUTINE DIFEQ
C***SUBROUTINE DIFEQ CONSTRUCTS THE EQUATIONS OF MOTION
      DOUBLE PRECISION TIME
      DIMENSION DAG(27),C8W(21)
      REAL MASS,IX,IYZ
      COMMON/ETA/EB11,EB12,EB13,EB21,EB22,EB23,EB31,EB32,EB33
      COMMON/TODEQ/AXB,AYB,AZB,CLB,CNB,ALB,AMB,ANB,CMB
      COMMON/INTEG/I,J,GG,U,V,W,P,Q,R,DBG,DU,DV,DW,DP,DQ,DR,
     1DPHI,DTHTA,DPSI,DX,DY,DZ,C8W
      COMMON/JUNK/TIME
      COMMON/JUNK1/THOLD,IROLL,G,MASS,IX,IYZ,XINTIA,NAVY
      COMMON/TDG/CPSI,SPSI,SPHI,CPHI
      COMMON/GG/GXB,GYB,GZB
C**   GRAVITY RESOLUTION TO BCS
      GXB=EB13*G
      GYB=EB23*G
      GZB=EB33*G
C**   EQUATIONS OF MOTION
      DU=AXB/MASS+R*V-Q*W+GXB
      IF(TIME.LT.THOLD.AND.NAVY.EQ.1)DU=0.
      DV=AYB/MASS+P*W-R*U+GYB
      DW=AZB/MASS+Q*U-P*V+GZB
      DP=(ALB+CLB)/IX
      DQ=(ANB+CMB)/IYZ+P*R*XINTIA
      DR=(ANB+CNB)/IYZ-P*Q*XINTIA
      DTHTA=(Q*CPHI-R*SPHI)/CPSI
      DPHI=P-DTHTA*SPSI
      DPSI=R*CPHI+Q*SPHI
      IF(IROLL.NE.0)DP=0.
      IF(IROLL.NE.0)P=0.
C**   MISSILE VELOCITY IN ECS
      DX=EB11*U+EB21*V+EB31*W
      DY=EB12*U+EB22*V+EB32*W
      DZ=EB13*U+EB23*V+EB33*W
      RETURN
      END
```

```
      SUBROUTINE METO
C**** SUBROUTINE METO CALCULATES THE VELOCITY OF SOUND
C
      DOUBLE PRECISION TIME,TIME3
      DIMENSION DUM(22),DUMY(6)
      REAL MACH
      COMMON/MO/GEOALT,T0,TGRAD,RHOSL,ARG1,ATMOL,RSTAR,
     1RHOO,ARG2,G0,TMOL
      COMMON/JUNK/TIME,TIME3,RHO,DUM
      COMMON/MACL/MACH,VSND,DUMY
      IF(GEOALT.GT.36089.2389) GO TO 12
      TMOL=T0+TGRAD*GEOALT
      RHO=RHOSL*(T0/TMOL)**ARG1
      RHOO=RHO
      VSND=SQRT(1.4*RSTAR*TMOL/WTMOL)
      GO TO 13
   12 CONTINUE
      ARG2=-G0*WTMOL*(GEOALT-36089.2389)/(RSTAR*TMOL)
      RHO=RHOO*EXP(ARG2)
   13 RETURN
      END
```

```
      SUBROUTINE SEEK
C**   THIS SUBROUTINE DETECTS TARGET WITHIN THE DETECTION RANGE OF SEEKER,
C     TARGET WITHIN THE FIELD OF VIEW,S-A-M,SEEKER WITHIN LINEAR RANGE
C
      DOUBLE PRECISION TIME,FSTSAM,TIME4,DT,DTA,TST,TME,SPER
      DIMENSION CAT(14),RAT(49)
      COMMON/STUFF/DELXS,DELYS,DELZS
      COMMON/JUNK2/SRNGE,IFUF8,IACQ,RDET,YAWER8,PITER8,PHF8V,BA,RNGLIN,
     1PITYAWSC,R2D,NULSKR,BRS,REFLECT,NULL,KAGE
      COMMON/INP8KR/PITERR,YAWERR
      COMMON/JUNK/TIME
      COMMON/INTEJ/I,J,DTRK,CAT,THTAS,THASD,PSIS,RAT
      COMMON/TT/FSTSAM,TIME4,D   TA,TST,TME,SPER,TSAM,DO,JMAX,IPRINT,T2
      SRNGE=SQRT(DELXS*DELXS+DELYS*DELYS+DELZS*DELZS)
      DATA IACQ1/0/
      IF(IFLF8VEQ.C)GO TO 560
      IF(TIME.LT.T2)GO TO 105
      IF(IACQ1.NE.0)GO TO 11
      IF(IACQ.NE.1)GO TO 10
      FSTSAM=TIME
   10 IF(IACQ.EQ.2)IACQ1=1
   11 CONTINUE
      GO TO(565,107),IACQ
  560 CONTINUE
      IF(ACQ.EQ.2)GO TO 107
      FSTSAM=TIME
      IF(TIME.GE.TIME4)GO TO 565
      IF(TIME.LT.T1-.4)GO TO 105
C**** ACQUISTION(IACQ=2) WHEN TARGET IS WITHIN PHF8V AND RDET
  565 CONTINUE
C
C**   LINEAR SEEKER,NO OUTPUT WHEN OUT OF F8V
      IF(SRNGE.GT.RDET)GO TO 101
      IF(SQRT(YAWERR*YAWERR+PITERR*PITERR).GT.PHF8V)GO TO 101
      IF(SQRT(PITERR**2+YAWERR**2).GT.0.0872664)GO TO 101
      IF(SQRT(PSIS*PSIS+THTAS*THTAS).LT.BA)GO TO 101
  567 CONTINUE
C**** PRINT EVERY JMAX INTERVALS
      JMAX=1024
      DT=DTA
      DTRK=SNGL(DT)
      IACQ=2
      IPRINT=2
      PRINT 90005
90005 FORMAT(/,2X,'ACQUISTION')
      GO TO 103
  107 CONTINUE
C**** NULL SEEKER
      PITERR=ATAN2(-DELZS,DELXS)
      YAWERR=ATAN2(DELYS,SQRT(DELXS*DELXS+DELZS*DELZS))
C
C**   LOSS OF ACQUISTION
C
      IF(SQRT(PITERR*PITERR+YAWERR*YAWERR).GT.PHF8V)GO TO 101
      PITYAWSC=SQRT(PITERR*PITERR+YAWERR*YAWERR)
      IF(PITYAWSC.LE.0.5/R2D)NULSKR=2
  103 CONTINUE
C**   SAMPLE AND HOLD IF FSTSAM=TIME IS INCLUDED AFTER STATEMENT 102
      TST=TIME-FSTSAM
      TSAM=TST+TME
      IF(TSAM-SPER)104,104,104
  104 TME=TME-SPER
```

```
      IF(SRNGE.LT.PRS)GO TO 108
      IF(SQRT(YAWERR*YAWERR+PITERR*PITERR).GT.PLERV)GO TO 108
      IF(SQRT(PSIS*PSIS+THTAS*THTAS).LT.BA)GO TO 108
      CALL SEEKER(SRNGE,RFLECT,PITERR,PITERR)
      CALL SEEKER(SRNGE,RFLECT,YAWERR,YAWERR)
      PITERR=PITERR
      YAWERR=YAWERR
      GO TO 109
  101 IACG=NULL=KAGE=1
  108 YAWERR=0.
      PITERR=0.
  109 CONTINUE
C
C**   SEEKER WITH LINEAR RANGE
      IF(ABS(YAWERR).GE.RNGLIN)YAWERR=SIGN(RNGLIN,YAWERR)
      IF(ABS(PITERR).GE.RNGLIN)PITERR=SIGN(RNGLIN,PITERR)
  105 RETURN
      END
```

```
      SUBROUTINE EDSKRGYR8
C     THIS SUBROUTINE CONSTRUCTS THE SEEKER GYRO MODEL FOR ED
C
      DOUBLE PRECISION TIME
      REAL KT,KT10,KT20,LAMPR,LAMYR
      REAL KG,KT30
      LOGICAL FLG4/.TRUE./
      COMMON/INTEG/KUTTA,NX,DTRK,U,V,W,P,Q,R,PHI,THTA,PSI,X,Y,Z,RTHTA,
     1RPSI,THTAS,THASD,PSIS,PSISD,OMEGA,TXED,PXFD,PEF,YEF,DEL1,CELVP,
     2DEL3,DDEL1,DDELVP,DDEL3,RLAMY,RLAMP,RPHIG,DPHIO,DC,DV,DW,DP,DQ,DR,
     3DPHI,DTHTA,DPSI,DX,DY,DZ,DRTHTA,DRPSI,DTHTAS,CTHASD,DPSIS,DPSISD,
     4DOMEGA,DTXED,DPXFD,DPEF,DYEF,DDELP1,DDELPP,DDELP3,DDDEL1,CDUELP,
     5DDDEL3,DRLAMY,DRLAMP,DRPHIG,DDPHIO
      COMMON/JUNK/TIME
      COMMON/TT/FSTSAM,TIME4,DT,DTA,TST,TMF,SPER,TSAM,CO,JMAX,IPRINT,T2
      COMMON/PERV/OMEGY,OMEGZ
      COMMON/BOW/RGL,KT,KT10,KT20,LAMPR,LAMYR,RTM,RTMIN,RSGE,ED1,FLG4,
     1R8A,EC4,GSA
      COMMON/BTS/BS11,BS12,BS13,BS21,BS22,BS23,BS31,BS32,BS33
      COMMON/JUNK2/SRNGE,IFUF8,IACQ,RDET,YAWER8,PITER8,PHF8V,BA,RNGLIN,
     1PITYAWSQ,R2D,NULSKR,BRS,RFLECT,NULL,KAGE
      COMMON/GP/R5,RR,H,A,B,KT3C
      DPHIO=DPHI
      RSL=125./R2D;IF(ABS(DPHIO).GT.RSL)DPHIO=SIGN(RSL,DPHIO)
      IF(TIME.LT.T2)GO TO 5005
C
C*****CHECK FOR NULL SEEKER
      IF(TIME.GT.10.AND.RTM.LT.RTMIN)GO TO 5000
      IF(NULL.EC.2)GO TO 5000
      NULL=1
      RSGE=SQRT(THTAS*THTAS+PSIS*PSIS);IF(RSGE.LE.0.5/R2D.AND.IACQ.EC.2)
     1NULL=2
C*****IF(SQRT(PITERR**2+YAWERR**2).GT.PHF8V)IACQ=NULL=1
 5000 IF(IACQ.EC.1)NULL=1
C
      IF(NULL.EC.1)LAMPR=LAMYR=0.
C
      IF(NULL.EC.1)KT=KT20
      IF(NULL.EC.2)KT=KT10
      IF(ABS(RLAMY).GT..872664)RLAMY=SIGN(.872664,RLAMY)
      KG=KT*KT30
      OMEGY=KG*YAWER8
      OMEGZ=-KG*PITER8
      IF(ABS(OMEGZ).GT..0169625) OMEGZ=SIGN(.0169625,OMEGZ)
      IF(ABS(OMEGY).GT..0169625) OMEGY=SIGN(.0169625,OMEGY)
      LAMPR=OMEGZ/KT30
      LAMYR=OMEGY/KT30
      IF(ABS(LAMYR).GT..1745329)LAMYR=SIGN(.1745329,LAMYR)
      IF(ABS(LAMPR).GT..1745329)LAMPR=SIGN(.1745329,LAMPR)
C     SEEKER GYRO FOR ED
C
 5005 CONTINUE
      IF(TIME.LT.ED1)GO TO 6670
      IF(.NOT.FLG4)GO TO 6670
      KAGE=2;FLG4=.NOT.FLG4;PRINT 90006
90006 FORMAT(/,23X,'UNCAGE GYRO FOR ROLL TO VERTICAL')
 6670 CONTINUE
      IF(TIME.GT.ED.AND.IACQ.NE.2.AND.IFUF8.NE.2)KAGE=1
      IF(IACQ.EC.2)KAGE=2
      GSA=BS21*P+BS22*C+BS23*R
      R5A=BS31*P+BS32*C+BS33*R
      GO TO(5200,5201),KAGE
```

```
58              C
59              C       CAGE
60              C
61              5200    DTHTAS=-IC*THTAS/DPSIS=-IC,*PSIS
62                      GO TO 5203
63              5201    GO TO(5202,5204),IACC
64              C
65              C       UNCAGE
66              C
67              C       FREE GYRO
68              C
 1*              5202 DTHTAS=THASD-CSA/CBS(PSIS)
 2*                   DPSIS=PSISD-RSA
 3*                   DTHASD=(-W*PSISD-RB*THASD)/B
 4*                   DPSISD=(-RR*PSISD+W*DTHASD)/A
71                    GO TO 5203
72              C
73              C       TRACK
74              C
 1*              5204 DTHTAS=THASD-CSA/CBS(PSIS)
 2*                   DPSIS=PSISD-RSA
 3*                   DTHASD=(-W*PSISD-RB*THASD+B*EGY)/B
 4*                   DPSISD=(AMEGZ-RR*PSISD+W*THASD)/A
77              5203 RETURN
78                   END
```

```
      SUBROUTINE EDAP
C**   THIS SUBROUTINE CONSTRUCTS THE AUTOPILOT MODEL FOR ED VERSION
      DOUBLE PRECISION TIME
      LOGICAL FLG1/.TRUE./,FLG2/.TRUE./,FLG3/.TRUE./
      COMMON/JUNK/TIME
      COMMON/SS/S1,S2,S3,S4,S5,S6
      REAL POLES(01)/+20./
      REAL KPD,KQ,KM,LAMBI,LAMPR,LAMYR,KG
      COMMON/OUTAP/YEG,REG,PEG
      COMMON/BOW/RSL,KT,KTIO,KT20,LAMPR,LAMYR,RTM,RTMIN,RSGE,EDI,FLG4,
     1RSA,ED4,QSA
      COMMON/JUNK2/SRNGE,IFUFB4,ACG,RDET,YAWERR,PITERR,PHFBV,BA,RNGLIN,
     1PITYAW,SC,R2D,NULSKR,BRS,REFLECT,NULL,KAGE
      COMMON/ARROW/PHIG,FLG1,FLG2,FLG3,REF,RFL,YED,PED,THRBS,PSRBS,
     1THBS,PSBS,GBLV,PEFL,KPD,KQ,KM,KG,LAMBI,POLES
      COMMON/INTEG/KUTTA,NX,DTRK,U,V,W,P,Q,R,PHI,THTA,PSI,X,Y,Z,RTHTAI
     1RPSI,THTAS,YHASD,PSIS,PSISD,OMEGA,TXED,PXED,PEF,YEF,DEL1,DELVP,
     2DEL3,DDEL1,DDELVP,DDEL3,RLAMY,RLAMP,RPHIG,DPHIO,DU,DV,DW,DP,DQ,DR,
     3DPHI,DTHTA,DPSI,DX,DY,DZ,DRTHTA,DRPSI,DTHTAS,DTHASD,DPSIS,DPSISD,
     4DOMEGA,DTXED,DPXED,DPEF,DYEF,DDELP1,DDELPP,DDELP3,DDDEL1,DDUELP,
     5DDDEL3,DRLAMY,DRLAMP,DRPHIG,DDPHIO
      COMMON/TT/PSTSAM,TIME4,DT,DTA,TST,TME,SPER,TSAM,DC,JMAX,IPRINT,T2
C     ROLL AUTOPILOT
C
      IF(TIME.GE.ED4)GO TO 5025
      PHIG=DPHIO*S1*75.*PSIS*S2
      GO TO 5030
 5015 IF(IFUFB.EQ.2)GO TO 5025
      IF(IACQ.EQ.2)GO TO 5025
      PHIG=DPHIO*S1*75.*PSIS*S2
      GO TO 5030
 5025 IF(.NOT.FLG1)GO TO 6667
      PRINT 90002,IPRINT,2,FLG1,.NOT.FLG1
90002 FORMAT(//2X,'ROLL HOLD')
 6667 CONTINUE
      DRLAMY=10.*DPHIO
      PHIG=DPHIO*S1+RLAMY*S3
C
C**   LEAD LAG ROLL AUTOPILOT REG/PHIG=KPD*(S+5)/S+12.5)
 5030 CONTINUE
      CALL FLTR(PHIG,RPHIG,DRPHIG,REG,12.5,5.,KPD)
      RFL=7./R2D/IF(ABS(REG).GT.RFL)REG=SIGN(RFL,REG)
C
C**   PITCH YAW AUTOPILOT
C**   RATE DAMPING OF GIMBAL ANGLES THRBS/THTAS=KG*S/(.0067*S+1)
      CALL EDRTDAMP(THTAS,TXED,DTXED,THRBS,POLES(01),KG,KM,THCS)
      CALL EDRTDAMP(PSIS,PXED,DPXED,PSRBS,POLES(01),KG,KM,PSBS)
C     INPUT TO GUIDANCE FILTER=PED,YED
 5065 CONTINUE
      PED=LAMPR
      YED=LAMYR
C**   GUIDANCE FILTER PEF/PED=KG/(.01*S+1)
 5075 CONTINUE
      CALL FTLG(PED,PEF,DPEF,KG,10.)
      CALL FTLG(YED,YEF,DYEF,KG,10.)
      PEFL=PEF*LAMBI
      GBLV=8./R2D
      IF(ABS(PEFL).GT.GBLV)PEFL=SIGN(GBLV,PEFL)
      IF(ABS(YEF).GT.GBLV)YEF=SIGN(GBLV,YEF)
      IF(TIME.LT.T2+8R.IACQ.EQ.1)GO TO 5100
      IF(.NOT.FLG2)GO TO 6668
      PRINT 90003,IPRINT,2,FLG2,.NOT.FLG2
```

```
      9[illegible] FORMAT(/,2X,'LATERAL ENABLE')
 6668 CONTINUE
      GO TO (5080,5085),NULL
 5080 PEG=(PEFL-THRS*S4-THRS*S4)*S5
      YEG=YEF+PSBS*S6-PSRS*S4
      GO TO 5100
 5085 IF(.NOT.FLG3)GO TO 6669
      PRINT 90004;IPRINT=2;FLG3=.NOT.FLG3
90004 FORMAT(/,2X,'GLIDANCE ENABLE')
 6669 CONTINUE
      PEG=(PEFL-THRS*S4)*S5
      YEG=YEF+PSRS*S4
 5100 IF(ABS(PEG).GT..2094394R)PEG=SIGN(.2094394R,PEG)
      IF(ABS(YEG).GT..2094394R)YEG=SIGN(.2094394R,YEG)
      RETURN
      END
```

```
1                       SUBROUTINE FLTR(X,Y,Z,A,B,C,D)
2                       Z=X+B*Y
3                       A=(C*Y+Z)*D
4                       RETURN
5                       END
```

```
1                       SUBROUTINE EDRTDAMP(X,Y,Z,A,B,C,D,E)
2                       Z=B*(C*X+Y)
3                       A=B*(C*X+Y)
4                       E=D*(X+A)
5                       RETURN
6                       END
```

```
1                       SUBROUTINE FTLG(X,Y,Z,A,B)
2                       Z=B*(A*X+Y)
3                       RETURN
4                       END
```

```
      SUBROUTINE CONTRL
C***  THIS SUBROUTINE CONTAINS THE CONTROL SYSTEM,CANARDS FOR EACH PLANE ON
C     COMMON SHAFT,SECOND ORDER ACTUATOR MODEL
      DIMENSION ACT(24),ACTO(27),ACTR(4)
      COMMON/JUNK2/SRNGE,IFUFO,IACQ,RDET,YAWERO,PITERO,PHFOV,BA,RNGLIN,
     1PITYAWSQ,R2D,NULSKR,BRS,RFLECT,NULL,KAGE
      COMMON/OUTAP/YEG,REG,PEG
      COMMON/INTEG/I,J,ACT,DEL1,DELVP,DEL3,DDEL1,DDELVP,DDEL3,ACTO,
     1DDELP1,DDELPP,DDELP3,DDDEL1,DDDELP,DDDEL3,ACTR
      COMMON/JUNK/TIME,TIME3,RHO,S,D,SGUW,GAP,IRAP,RAPTM1,RAPTM2,IACT,
     1SLOPE1,BT1,RAPTM3,SLOPE2,BT2,CTT,CPT,SPT,XLTA,STT,GAPS,GAPSD,
     2GAPSDM,TH
      DDDEL1=60.*(60.*(YEG-REG-DEL1)-DDEL1)
      DDDELP=50.*(50.*(PEG-DELVP)-DDELVP)
      DDDEL3=60.*(60.*(-YEG-REG-DEL3)-DDEL3)
      IF(IACT.EQ.2)DDDEL1=60.*(60.*(REG-YEG-DEL1)-DDEL1)
      IF(IACT.EQ.2)DDDEL3=60.*(60.*(REG+YEG-DEL3)-DDEL3)
      DDELP1=DDEL1
      DDELPP=DDELVP
      DDELP3=DDEL3
      RETURN
      END
```

```
 ATTACH (FILE,X1),(FORMAT,U),(RSIZE,202),(FSIZE,240)
 ATTACH (FILE,X2),(FORMAT,U),(RSIZE,202),(FSIZE,100)
 ASSIGN (MSI,BT,X6)
 FORTRAN SI,GO,KS,BC
 BLOAD (TEMP,500),(LIB,USER,SYSTEM)
:ROOT (FILE,BT,GO,EOD)
:(FILE,D1,*SYSLIB,EOD)
  U SREF  UL     7DPT
  U SREF  UL     7DPDT
LOADING WAS COMPLETED

WARNING: UNSATISFIED REFS
 REWIND 9TAPE
 RUN
```

BEGIN EXECUTION!

RF	6.2500	RTBL	.10000E-19	SG	#80.00	RA	.00000	BR5	2.0000
KP	10.000	BRS	.00000	KG	.50000E-01	BT1	211.22	BT2	525.00
CPT	1.0000	STY	.00000	CS	.00000	FFCMB	1.0000	CTT	1.0000
RAPTM3	13.000	D	.50830	KQ	1.5000	DELMY	.34907	ED0	3.0000
FC1	3.2500	ED2	8.0000	ED3	3.4500	ED4	7.2500	ED5	3.0000
KT10	10.000	FFALB	1.0000	YCL	.26180	FFANB	1.0000	GF	5.0000
FFCLB	1.0000	FFAZB	1.0000	FFCNB	1.0000	FFAMB	1.0000	GAMLB	.13963
PHFOV	.21817	GC	.26180	FFAXB	1.0000	IACT	0	IROLLOC	1
IOLM	0	IFUFB	1	NULL	1	IROLL	0	KT20	20.000
ISKR	0	S5	-1.0000	IY	.16226E-04	FBGN	.10000	IX	.20100
BC	149.25	IYZ	5.7230	R2	.00000	K4	.17453	PCA	2000.0
KB	.00000	RVBIAS	.00000	KC	1.0000	THTOL	.87266E-02	KGL	1.0000
FFAYB	1.0000	KPC	.15000E+01	TIP5	.00000	KROL	.60000	AP	25.000
KS	6.0000	KM	2.0000	LAMBI	.12651	JMAX	128	MASS	4.4587
CG	5.3120	NRUN	0	PCL	.26180	IA	.23528E-04	PHIMAX	1.7453
S8	1.0000	PRINTM	1.0000	JMAX	128	RAPTM2	6.5000	RAPTM1	.00000
RCET	7000.0	DTA	.97656E-03	REFLECT	5.0000	PI	3.1416	RLAMP	.00000
PSIT	.00000	RLAMY	.00000	RPSI	.00000	RNGLIN	.26180E-01	YRATE	5.2360
RTPIN	1000.0	KF	2.0000	S7	1.0000	S6	1.0000	S10	1.0000
R9	1.0000	S12	1.0000	S11	1.0000	S4	-1.0000	S3	-1.0000
S2	1.0000	S1	-1.0000	S	.20292	DELMX	.26180	SF0	1.0000
SF1	100.00	SF2	100.00	SF3	90.000	SF4	20.000	SF5	15.000
SF6	15.000	SF7	15.000	SF8	1.0000	SF9	50.000	SF10	20.000
SF11	20.000	SF12	50.000	SF13	125.00	SF14	15.000	SF15	12.000
SLOPE2	-11.938	SLOPE1	36.735	T01	1.4000	T0	1.0000	T03	2.0000
T02	1.8000	TC5	2.4000	T04	2.2000	T07	2.8000	T06	2.6000
T2	8.0000	T1	3.0000	T6	.60000	SPT	.00000	THOLD	.00000
THTAC	-.13090	KD	.20000	THETAT	.00000	IRAP	0	THOLD	.00000
TIC	.12500	TIC1	.12500	TIME3	3.0000	TIME2	.65000	TIME1	.60000
TIMFO	.30000	TIP1	.00000	DT	.78125E-02	YHFOV	.21817	K5	.00000
ZMIN	-4000.0	TIME4	8.6000	KNDR	.00000	ZMIN	-4000.0		

PROJECTILE:

TIPE	=	.00000	RSA	=	.00000	DELVP	=	.00000	U	=	1034.0	V	=	.00000	
W	=	.00000	THTA	=	.22689	PHD	=	.00000	DELZ	=	.00000	TOTACC	=	.00000	
DZ	=	-232.60	DY	=	.00000	DPHI	=	.00000	DTHTA	=	.00000	DX	=	1007.8	
DPSI	=	.00000	DR	=	.00000	DQ	=	.00000	DP	=	3.8354	DW	=	31.337	
DU	=	-35.994	DV	=	.00000	VRW	=	1034.0	MACH	=	.93918	GAP	=	1128.8	
PSI	=	.00000	P	=	.00000	Q	=	.00000	R	=	.00000	DELVY	=	.00000	
AZE	=	.00000	DELVV	=	.00000	DELYY	=	.00000	DELZV	=	.00000	X	=	.00000	
Y	=	.00000	Z	=	-4000.0	AMB	=	.00000	XT	=	13120.	YT	=	.00000	
DTHTA	=	.00000	CPHI	=	1.0000	SPHI	=	.00000	CPSI	=	1.0000	SPSI	=	.00000	
CPSIS	=	1.0000	GZB	=	31.337	GYB	=	.00000	GXB	=	-7.2348				

ALTSPILOT:

DDPHIO	=	.00000	DELXS	=	12784.	PEQ	=	.00000	DELMIS	=	.00000	TXEQ	=	.00000	
DELZS	=	2951.4	OMEGA	=	314.00	DYEF	=	.00000	DPEF	=	.00000	DTHTAS	=	.00000	
RTF	=	1312C.	XT	=	20.000	PEFL	=	.00000	NULL	=	1	DELR	=	.69813E-01	
OMEGZ	=	.00000	PSRG	=	.00000	PED	=	.00000	PEF	=	.00000	PITERS	=	.00000	
PHIG	=	.00000	PSIS	=	.00000	PXEQ	=	.00000	THSS	=	.00000	PSSS	=	.00000	
DEL1	=	.00000	RLAMY	=	.00000	RLAMP	=	.00000	THTAS	=	.00000	YHRSS	=	.00000	
YEF	=	.00000	PEF	=	.00000	YEQ	=	.00000	PED	=	.00000	YEF	=	.00000	
YSRG	=	.00000	YEG	=	.00000	DELYS	=	.00000	YAWERR	=	.00000	YAWERS	=	.00000	
LAMYR	=	.00000	LAMPR	=	.00000	QSA	=	.00000	QAPS	=	228.99	DPSIS	=	.00000	
IACC	=	1	PSRSS	=	.00000	REN	=	.00000							

LOGIC:

GATE 1	=	T	GATE 2	=	F	GATE 3	=	F	GATE 4	=	F	GATE 5	=	F	
GATE 6	=	F	GATE 7	=	F										

AERODYNAMICS:

FLC	=	.94870E-01	ALB	=	.00000	CNR	=	-156.96	CMQ	=	-156.96	CY	=	.00000	
CAZ	=	.56374	CLP	=	-26.566	CN	=	.00000	CYCQ	=	.00000	CMCQ	=	.00000	
ANB	=	.00000	CLB	=	.77091	CMB	=	.00000	CNB	=	.00000	THASD	=	.00000	
DTHASD	=	.00000	PSISD	=	.00000	DPSISD	=	.00000	ALPHA	=	.00000	BETA	=	.00000	

RAD:

STT	=	.00000	CTT	=	1.0000	SPT	=	.00000	CPT	=	1.0000	TH	=	.00000	
XLTA	=	1.6667													

OFFLG PRINT:

DELXS	=	12784.	DELYS	=	.00000	DELZS	=	2951.4	DELXS	=	12784.	DELYS	=	.00000	
DELZS	=	2951.4	KLTTA	=	1	PITERR	=	-.22689	YAWERR	=	.00000	PITERS	=	.00000	
YAWERS	=	.00000	DRLAMY	=	.00000	F3	=	.00000	DRPSI	=	.00000	DRTHTA	=	.00000	
DRPHIO	=	.00000	RPHIG	=	.00000	DELVR	=	.00000	DPHIO	=	.00000	G	=	32.161	
VSRC	=	11C1.0	ISKR	=	0	IACT	=	0	IGUIDE	=	0	IRAP	=	0	
KAGE	=	1	KAVY	=	0	F1	=	.00000	DRLAMP	=	.00000	NUM	=	C	
IPRINT	=	1	KPPS	=	20	NDT	=	1	NDTA	=	256	NULSKR	=	2	
PEFL	=	.00000	PHIG	=	.00000	RHO	=	.21109E-02	S2	=	1.0000	DELRSL	=	.12185E-02	
RED	=	.00000	RET	=	.00000	REG	=	.00000	RPSI	=	.00000	RTHTA	=	.00000	
AMPGY	=	.00000	OMEGZ	=	.00000	NX	=	14							

PROJECTILE:

TYPE	.60156	RBA	.00000	DELV	.00000	U	1013.3	V	[illegible]
W	-.69896	THTA	.20775	PHD	.36714	DELZ	132.98	TOTACC	.43831
DZ	-209.73	DY	-.74777E-03	DPHI	.90425	DTHTA	-.18184E-01	DX	991.37
DPSI	.78131E-04	DR	-.85931E-01	DQ	.27547	DP	.39867	DW	12.844
DL	32.813	DV	4.1270	VRW	1013.3	MACH	.92080	GAP	1079.6
PSI	-.8A193E-05	P	.90425	Q	-.16944E-01	R	.65999E-02	DELVY	.00000
AZP	1.4179	DELAV	.00000	DELVV	.00000	DELZV	.00000	X	60.114
Y	-.13185E-03	Z	-4139.0	AMB	1.4695	XT	13120.	YT	.00000
DTHTA	-.18184E-01	CPHI	.93038	SPHI	.35895	CPSI	1.0000	SPSI	-.84193E-05
CPSIS	1.0000	GZB	29.373	GYB	11.294	GXB	-6.6334		

AUTOPILOT:

DCPHIC	.00000	DELXS	12222.	PEC	.00000	DELMIS	.00000	TXEC	.00000
DELZS	2531.4	OMEGA	314.00	DYEF	.00000	DPEF	.00000	DTHTAS	.00000
RTM	12520.	KT	20.000	PPFL	.00000	NULL	1	DELR	.69813E-01
OMEGZ	.00000	PSRG	.00000	PED	.00000	PEF	.00000	PITERS	.00000
PHIG	.00000	PSIS	.00000	PXED	.00000	THBS	.00000	PSBS	.00000
DEL1	.00000	RLAMY	.00000	RLAMP	.00000	THTAS	.00000	THRBS	.00000
YEF	.00000	PEF	.00000	YED	.00000	PED	.00000	YEF	.00000
YBRG	.00000	YEG	.00000	DELYS	973.63	YAWERR	.77846E-01	YAWERS	.00000
LAMYR	.00000	LAMPR	.00000	GSA	.00000	GAPS	219.04	DPSIS	.00000
IACC	1	PSRBS	.00000	REN	.00000				

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	F	GATE 4	T	GATE 5	F
GATE 6	F	GATE 7	F

AERODYNAMICS:

CLO	.94228E-01	ALS	-.65129	CNR	-156.19	CMQ	-156.45	CY	-.30928E-02
CAZ	.53620	CLP	-25.032	CN	-.82996E-02	CYCQ	.49184E-02	CMCQ	.13199E-01
ANB	-.84780	CLR	.73102	CMB	.70232E-01	CNB	-.28786E-01	THASD	.00000
DTHASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	-.68978E-03	BETA	-.25704E-03

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

PROG PRINT:

DELXB	12222.	DELYB	973.63	DELZB	2531.4	DELXB	12222.	DELYB	973.63
DELZB	2531.4	KUTTA	1	PITERR	-.20423	YAWERR	.77846E-01	PITERB	.00000
YAWERR	.00000	DRLAMY	.00000	P3	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIG	.00000	RPHIG	.00000	DELVR	.00000	DPHIC	.00000	G	32.161
VSRC	11000.5	IBXR	0	IACT	0	IGUIDE	0	IRAP	0
KAGE	1	KAVY	0	P1	.00000	DRLAMP	.00000	NUM	0
IPRINT	1	KPPS	20	NDT	128	NDTA	256	NULSKP	2
PEFL	.00000	PHIG	.00000	RHB	.21029E-02	S2	1.0000	DELRBL	.12185E-02
REC	.00000	RET	.00000	REG	.00000	RPSI	.00000	RTHTA	.00000
AMEGY	.00000	OMEGZ	.00000	NX	14				

PROJECTILE:

TIME	.85625	RBA	.00000	DELVP	.00000	U	1011.8	V	-.988372E-01		
W	.22079	THTA	.20701	PHD	.41715	DELZ	144.38	TOTACC	.13970		
DZ	-207.87	DY	-.886491E-03	DPHI	.92603	DTHTA	-.12038E-01	DX	989.98		
DPSI	.14270E-03	DR	.42198E-01	DQ	-.68173E-01	DP	.32663	DW	17.482		
DU	-32.556	DV	7.8334	VRW	1011.5	MACH	.91921	GAP	1075.3		
PSI	-.17735E-05	P	.92402	Q	-.10948E-01	R	.50078E-02	DELVY	.00000		
AZB	-.57304	DELXV	.00000	DELVV	.00000	DZLZV	.00000	X	655.32		
V	-.17748E-03	Z	-4144.4	AMB	-.46338	XT	13120.	YT	.00000		
DTHTA	-.12038E-01	CPHI	.91425	SPHI	.40518	CPSI	1.0000	SPSI	-.17735E-05		
CPSIS	1.0000	GZB	28.776	GYB	12.758	GXB	-6.6103				

AUTOPILOT:

DDPHIC	.00000	DELXS	121691	PEC	.00000	DELMIS	.00000	TXED	.00000		
DELZS	2471.4	OMEGA	314.00	DYEF	.00000	DPEF	.00000	DTHTAS	.00000		
RTM	12486.	KT	20.000	PEFL	.00000	NULL	1	DELR	-.69813E-01		
OMEGZ	.00000	PSRG	.00000	PED	.00000	PEF	.00000	PITERS	.00000		
PHIC	.00000	PSIS	.00000	PXED	.00000	THBS	.00000	PSBS	.00000		
DEL1	.00000	RLAMV	.00000	RLAMP	.00000	THTAS	.00000	THRBS	.00000		
YEF	.00000	PEF	.00000	YED	.00000	PED	.00000	TEF	.00000		
YBRG	.00000	YEG	.00000	DELYS	1095.3	YAWERR	.87975E-01	YAWERS	.00000		
LAMVR	.00000	LAMPR	.00000	QSA	.00000	GAPS	218.19	DPSIS	.00000		
IACC	1	PSRBS	.00000	REN	.00000						

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	F	GATE 4	T	GATE 5	T		
GATE 6	F	GATE 7	F								

AERODYNAMICS:

CLD	.94172E-01	ALB	-.66350	CNR	-156.08	CMQ	-156.09	CY	-.11757E-02		
CAZ	.53382	CLP	-25.768	CN	.26263E-02	CYCQ	-.18701E-02	CMCQ	-.41776E-02		
AKR	.20741	CLR	.72916	CMB	.47819E-01	CNB	-.21772E-01	THASD	.00000		
DTHASC	.00000	PSISC	.00000	DPSISD	.00000	ALPHA	.21827E-03	BETA	.97711E-04		

RAP:

RTT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6667										

DEBUG PRINT:

DELXB	12169.	DELYB	1095.3	DELZB	2471.4	DELXS	12169.	DELYS	1095.3		
DELZS	2471.4	KUTTA	1	PITERR	-.20037	YAWERR	.87975E-01	PITERS	.00000		
YAWERR	.00000	DRLAMV	.00000	FS	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIC	.00000	RPHIC	.00000	DELVR	.00000	CPHIC	.00000	G	32.161		
VSAT	1100.8	IBKR	0	IACT	0	IGUIDE	0	IRAP	0		
KAGE	1	NAVY	0	F1	.00000	DRLAMP	.00000	NUM	0		
IPRINT	1	NPPS	20	NDT	198	NDTA	256	NULSKR	2		
PEFL	.00000	PHIC	.00000	RHO	.21018E-02	G2	1.0000	DELRSL	.12185E-02		
RFC	.00000	RET	.00000	REG	.00000	RPSI	.00000	RTHTA	.00000		
ANFOV	.00000	OMEGZ	.00000	NX	14						

PROJECTILE:

TYPE	1.0000	RSX	.00000	DELVP	.00000	U	1000.8	Y	29.57		
M	.32080	THTA	.13646	PHD	.74807	DELZ	213.48	TOTACC	.24847		
DZ	-194.89	DY	-.14745E-02	DPHI	.98850	DTHTA	-.17827E-01	DX	981.48		
DPSI	.18288E-03	DR	.10995	DQ	-.94910E-01	DP	.96090E-01	DW	9.6959		
DL	-30.919	DV	9.3372	VRW	1000.4	MACH	.90952	GAP	1050.0		
PSI	.82042E-06	P	.98850	Q	-.12943E-01	R	.12260E-01	DELVY	.00000		
AZB	-.87192	DELXV	.00000	DELVV	.00000	DELZV	.00000	X	994.13		
Y	-.5C416E-03	Z	-4213.5	AMB	-.66551	XT	13120.	YT	.00000		
DTHTA	-.17827E-01	CPHI	.79330	SPHI	.68021	CPSI	1.0000	SPSI	.820+2E-06		
CPSIS	1.0000	GXB	23.121	GYB	21.454	GXB	-6.2778				

ALTSPILOT:

DCPHIO	.00000	DELXS	11851.	PEO	.00000	DELMIS	.00000	TXEO	.00000		
DELZS	1888.5	OMEGA	314.00	DVEF	.00000	DPEF	.00000	DTHTAS	.00000		
RTM	12128.	KT	20.000	PEPL	.00000	NULL	1	DELR	.69813E-01		
OMEGZ	.00000	PSRG	.00000	PEO	.00000	PEF	.00000	PITERS	.00000		
PHIG	.00000	PSIS	.00000	PXEO	.00000	THBS	.00000	PSIS	.00000		
DEL1	.00000	RLAMY	.00000	RLAMP	.00000	THTAS	.00000	THRBS	.00000		
YEF	.00000	PEF	.00000	YEO	.00000	PEO	.00000	YEF	.00000		
YBRG	.00000	YEG	.00000	DELYS	1752.	YAWERR	.14501	YAWERS	.00000		
LAMYR	.00000	LAMPR	.00000	QSA	.00000	GAPS	213.07	DPSIS	.00000		
IACG	1	PSRBS	.00000	REN	.00000						

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	F	GATE 4	T	GATE 5	T		
GATE 6	F	GATE 7	F								

AERODYNAMICS:

CLC	.93833E-01	ALB	-.69015	CNR	-155.65	CMB	-155.66	CY	-.35421E+02		
CAY	.51928	CLP	-25.381	CN	.38579E-02	CYCG	-.56425E-02	CMCG	-.61650E-02		
AXB	.61110	CLB	.70948	CMB	.85414E-01	CNB	-.92+92E-01	THASD	.00000		
DTHASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.32060E-03	BETA	.29439E-03		

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6567										

DEBUG PRINT:

DELXB	11851.	DELYB	1752.5	DELZB	1888.5	DELXB	11851.	DELYS	1752.5		
DELZS	1888.5	KUTTA	1	PITERR	-.15808	YAWERR	.14501	PITERB	.00000		
YAWERR	.00000	ORLAMY	.00000	FB	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIB	.00000	RPHIB	.00000	DELVR	.00000	DPHIO	.00000	G	32.161		
ISAC	11CC.2	ISKR	0	IACT	0	ICUICZ	0	IRAP	0		
KAGE	1	NAVY	0	FI	.00000	DRLAMP	.00000	NUM	C		
IPRINT	1	NPPS	20	NDT	1?R	NDTA	256	NULSKR	2		
PEFL	.00000	PHIO	.00000	RHO	.2097BE-02	S2	1.0000	DELRBL	.12185E-02		
REB	.00000	RET	.00000	REG	.00000	RPSI	.00000	RTHTA	.00000		
AMEGY	.00000	OMEGZ	.00000	NX	14						

PROJECTILE1

TYPE	2.0000	RSA	.00000	DELVP	.00000	U	971.87	V	.22287		
W	-.40001E-01	THTA	.16421	PHD	1.7570	DELZ	389.91	TOTACC	.12449		
DZ	-158.65	CY	-.32186E-02	PHI	1.0169	DTHTA	-.25166E-01	CX	958.84		
DPSI	.23012E-03	DR	.55665E-0		.24787E-01	DP	.56183E-02	CM	-1.3301		
DU	-26.645	CV	7.0242	RM	971.87	MACH	.88395	GAP	985.29		
PSI	-.14109E-05	P	1.0169		.88855E-02	R	.24688E-01	DELVY	.00000		
AZR	.99015E-01	DELXV	.00000	DELVV	.00000	DELZV	.00000	X	1984.0		
Y	-.25355E-02	Z	-4389.9	AMB	.80480E-01	XT	13120.	YT	.00000		
DTHTA	-.25166E-01	CPHI	-.18515	SPHI	.98271	CPSI	1.0000	SPSI	-.14109E-05		
CPSIB	1.0000	GZB	-6.8703	GYB	31.174	GXB	-5.2572				

AUTOPILOT1

DPHIC	.00000	DELXS	10942.	PED	.00000	DELMIS	.00000	TXED	.00000		
DELZS	-408.88	OMEGA	314.00	DYEF	.00000	DPEF	.00000	DTHTAS	.00000		
RTM	11163.	KT	20.000	PEFL	.00000	NULL	1	DELR	.69813E-01		
OMEGZ	.00000	PSRS	.00000	PED	.00000	PEF	.00000	PITERS	.00000		
PHIC	.00000	PSIS	.00000	PXED	.00000	THBS	.00000	PSBS	.00000		
DEL1	.00000	RLAMY	.00000	RLAMP	.00000	THTAS	.00000	THRBS	.00000		
YEF	.00000	PEF	.00000	YED	.00000	PED	.00000	YEP	.00000		
YBRG	.00000	YEG	.00000	DELYS	2170.1	YAWERR	.19565	YAWERS	.00000		
LAMYR	.00000	LAMPR	.00000	QSA	.00000	QAPS	199.94	DPSIS	.00000		
IACG	1	PSRBS	.00000	REN	.00000						

LOGIC1

GATE 1	T	GATE 2	F	GATE 3	F	GATE 4	T	GATE 5	T						
GATE 6	F	GATE 7	F												

AERODYNAMICS1

FLC	.92938E-01	XLB	-.85887	CNR	.154.33	CMB	-154.22	CY	.27518E-02		
CAT	.48028	CLP	-24.338	CN	-.49523E-03	CYCG	-.44004E-02	CMCG	.79190E-03		
AKP	.44720	CLB	.85960	CMB	-.20024E-01	CNB	-.10126	THASD	.00000		
DTHASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	-.41159E-04	BETA	.22871E-03		

RAD1

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TM	.00000		
XLTA	1.4667										

DEBUG PRINT1

DELXB	10942.	DELYB	2170.1	DELZB	-408.88	DELXS	10942.	DELYS	2170.1		
DELZS	-408.88	KLTTA	1	PITERR	.37350E-01	YAWERR	.19565	PITERS	.00000		
YAWERR	.00000	DRLAMY	.00000	P3	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIG	.00000	RPHIG	.00000	DELVR	.00000	DPHIO	.00000	G	32.161		
VSKD	1094.3	IGXR	0	IACT	0	IGUIDE	0	IRAP	0		
KAGF	1	NAVY	0	P1	.00000	DRLAMP	.00000	NUM	0		
IPRINT	1	NPPS	20	NDT	128	NDTA	256	NULSKR	2		
PEFL	.00000	PHIG	.00000	RHO	.20863E-02	SS	1.0000	DELRSL	.12185E-02		
REP	.00000	RET	.00000	REG	.00000	RPSI	.00000	RTHTA	.00000		
OMEGY	.00000	OMEGZ	.00000	NX	14						

ALLL ROLL RATE SENSOR

PROJECTILE:

TIME	= 3.0000	RSA	= .10344E+01	DELVP	= .00000	U	= 947.09	V	= .11456E+03		
W	= -.19455E+01	THTA	= .13087	PHD	= 2.7758	DELZ	= 530.70	TBTACC	= .10403E+01		
DZ	= -123.57	DY	= -.48750E-02	DPHI	= 1.0164	DTHTA	= -.29447E-01	DX	= 938.99		
DPSI	= .20222E-03	DR	= -.33790E-01	DQ	= -.22232E-02	DP	= -3.0612	DW	= -3.6535		
DL	= -21.611	DV	= 1.5877	YRW	= 947.09	MACH	= .8618*	GAP	= 931.71		
PSI	= -.11365E-04	P	= 1.0164	Q	= .27572E-01	R	= .10344E-01	DELVY	= .00000		
AZB	= .46721E-01	DELAY	= .00000	DELYY	= .00000	DELZY	= .00000	X	= 8912.7		
Y	= -.62355E-02	Z	= -4530.7	AMB	= .3807AE-01	XT	= 13120.	YT	= .00000		
DTHTA	= -.29447E-01	CPHI	= -.93384	SPHI	= .35769	CPSI	= 1.0000	SPSI	= -.11365E-04		
DPSIS	= 1.0000	GZB	= -29.776	GYB	= 11.405	GXB	= -4.1967				

AUTOPILOT:

DCPHIO	= .00000	DELXS	= 10051.	PEO	= .00000	DELMIS	= .00000	TXED	= .00000		
DELZS	= -1735.3	OMEGA	= .00000	DYEF	= .00000	DPEF	= .00000	DTHTAC	= .00000		
RTM	= 10221.	KT	= 20.000	PEFL	= .12651	NULL	= 1	DELR	= .00000		
OMEGZ	= .00000	PSRG	= .00000	PED	= .00000	PEF	= .00000	PITERO	= .00000		
PHIG	= 1.0164	PSIS	= .00000	PXED	= .00000	THBB	= .00000	PBBO	= .00000		
DEL1	= .00000	RLAMV	= .00000	RLAMP	= .00000	THTAS	= .00000	THRDS	= .00000		
YEF	= .00000	PEF	= .00000	YED	= .00000	PED	= .00000	YEF	= .00000		
YBRO	= .00000	YEO	= .00000	DELYS	= 664.53	YAWERR	= .65061E+01	YAWERO	= .00000		
LAMYR	= .00000	LAMPR	= .00000	QSA	= .27572E+01	GAPS	= 189.07	DPSIS	= .00000		
TACC	= 1	PSRES	= .00000	REN	= .00000						

LOGIC:

GATE 1	= T	GATE 2	= F	GATE 3	= T	GATE 4	= T	GATE 5	= T		
GATE 6	= F	GATE 7	= T								

AERODYNAMICS:

CLD	= .9216AE-01	ALB	= .61531	CNR	= -159.09	CMQ	= -153.10	CY	= -.14510E-04		
CA?	= .41344	CLP	= -23.473	CN	= -.24712E-03	CYCG	= -.23051E-04	CMCG	= .39623E-03		
AKB	= .22152E+02	CLB	= .00000	CMB	= -.10844	CNB	= -.4C8.0E-01	THABD	= .00000		
DTHABD	= .00000	PSISD	= .00000	DPSISD	= .00000	ALPHA	= -.20541E-04	BETA	= .12094E-05		

RAP:

STT	= .00000	CTT	= 1.0000	SPT	= .00000	CPT	= 1.0000	TK	= .00000		
XLTA	= 1.6667										

DEBUG PRINT:

DELXB	= 10051.	DELYB	= 664.53	DELZB	= -1735.3	DELXS	= 10051.	DELYS	= 664.53		
DELZS	= -1735.3	KUTTA	= 1	PITERR	= .17096	YAWERR	= .65061E+01	PITERO	= .00000		
YAWERO	= .00000	OMLAMY	= .00000	FS	= .00000	DRPSI	= .00000	DRTHTA	= .00000		
DRPHIO	= .59994	RPHIG	= .13287E-08	DELVR	= .00000	DPHIO	= 1.0164	G	= 32.160		
VSKC	= 1098.9	ISKR	= 0	IXCT	= 0	IGUIDE	= 0	IRAP	= 0		
KAGE	= 1	NAVY	= 0	F1	= .00000	DRLAMP	= .00000	NUM	= 0		
IPRINT	= 1	NPPS	= 20	NDT	= 128	NDTA	= 256	NULSKR	= 2		
PEFL	= .12651	PHIG	= 1.0164	RHO	= .20774E-02	S2	= 1.0000	DELROL	= .00000		
REO	= .00000	RET	= .00000	REG	= .15097E+01	RPSI	= .00000	RTHTA	= .00000		
OMEGY	= .00000	OMEGZ	= .00000	NX	= 33						

UNCAGE GYRO FOR ROLL TO VERTICAL

PROJECTILE:

TYPE	4.0000	RSA	.33396E+01	DELVF	.00000	U	926.87	V	-.28131E+01		
W	.38640E+01	THTA	.96730E+01	PHD	2.6132	DELZ	636.95	TOTACC	.24350E+01		
DZ	-89.563	DY	-.42008E+02	DPHI	.73937	DTHTA	-.33811E+01	DX	922.54		
DPSI	.12182E+04	DR	.69240E+03	DQ	.44627E+01	DP	-1.9467	DW	-.41291		
DU	-18.846	DV	.33294	VRW	926.87	MACH	.84378	GAP	889.50		
PSI	-.78606E+05	P	-.73937	Q	.29204E+01	R	.17036E+01	DELVY	.00000		
AZB	-.90531E+01	DELAV	.00000	DELVV	.00000	DELZV	.00000	X	3843.3		
Y	-.10762E+01	Z	-4637.0	AMB	.74019E+01	XT	13120.	YT	.00000		
DTHTA	-.33811E+01	CPHI	-.86380	SPHI	.5041R	CPSI	1.0000	SPSI	-.78606E+05		
CPSIB	1.0000	GZB	-27.643	GYB	16.138	GXB	-3.1060				

AUTOPILOT:

DCPRIC	.00000	DELXB	9129.6	PEO	.00000	DELMIB	.00000	TXED	-.10481E-02		
DEL2B	-1523.9	BMEGA	.00000	DYEF	.00000	DPEF	.00000	DTHTAB	-.19664E-01		
RTM	9298.5	KT	20.000	PEFL	.12651	NULL	1	DELR	-.98984E-01		
BMEG2	.00000	PSRO	.00000	PEO	.00000	PEF	.00000	PITERB	.00000		
PHIO	.22919	PSIB	-.12914E+01	PXEO	.56944E-03	THBB	-.46611E+01	PSBB	-.28878E+01		
DEL1	-.16927E-02	RLAMY	.00000	RLAMP	.00000	THTAB	-.22134E+01	THRBB	-.11718E-02		
YEP	.00000	PEP	.00000	YEO	.00000	PEO	.00000	YEF	.00000		
YBRO	.00000	YEO	.00000	DELYB	889.24	YAWERR	.95778E+01	YAWERB	.00000		
LAMYR	.00000	LAMPR	.00000	QSA	.19669E-01	GAPB	180.80	DPSIB	-.33396E+01		
IACO	1	PSRBS	-.15250E-02	REN	.00000						

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	F	GATE 7	T								

AERODYNAMICS:

CLO	.91532E-01	ALB	.42317	CNR	-152.20	CMQ	-152.21	CY	-.33917E-03		
CAZ	.39139	CLP	-22.750	CN	.50156E-03	CYCO	.54546E-03	CMCO	-.80669E-03		
AKB	-.50045E-01	CLB	-.81443	CMB	-.11143	CNB	-.65233E-01	THASO	.00000		
DTHASC	.00000	PSISO	.00000	DPSISO	.00000	ALPHA	.41689E-04	BETA	-.28192E-04		

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6667										

DEBUG PRINT:

DELXB	9171.8	DELYB	771.17	DEL2B	-1321.3	DELXB	9129.6	DELYB	889.24		
DEL2B	-1523.9	KUTTA	1	PITERR	.16540	YAWERR	.95778E+01	PITERO	.00000		
YAWERB	.00000	DRLAMY	.00000	FS	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIO	.37923E-01	RPHIO	.15309E-01	DELVR	-.16927E-02	DPHIO	.73937	G	32.160		
VSKO	1098.5	IGKR	0	IACT	0	IGUIDE	0	ITAP	0		
KAGE	2	NAVY	0	FI	.00000	DRLAMP	.00000	NUM	0		
IPRINT	1	NPPS	20	NDT	IPS	NDTA	256	NULSKR	2		
PEFL	.12651	PHIO	.22919	PHO	.20708E-02	BB	1.0000	DELRSL	-.16927E-02		
REO	.00000	RZT	.00000	REO	.17188E-02	RPSI	.00000	RTHTA	.00000		
AMEGY	.00000	BMEGZ	.00000	NX	93						

PROJECTILE1

TYPE	5.0000	RSA	-.58117E-01	DELVP	.00000	U	909.23	V	.13678E-01
W	.39976E-01	THTA	.61939E-01	PHD	.23289	DELZ	709.55	TOTACC	.21595E-01
DZ	-56.242	DY	.33309E-03	DPHI	-1.0979	DTHTA	-.36423E-01	DX	907.56
DPSI	-.50776E-04	DR	-.38482E-01	DQ	.11251E-02	DP	4.1207	DW	-1.0090
DU	-16.358	DV	.24139	VRW	909.23	MACH	.82795	QAP	854.18
PSI	-.41257E-05	P	-1.0972	Q	-.35451E-01	R	.83550E-02	DELVY	.00000
AZB	-.91682E-01	DELXV	.00000	DELYV	.00000	DELZV	.00000	X	4758.1
Y	-.13141E-01	Z	-4709.5	AMB	-.75136E-01	XT	13120.	YT	.00000
DTHTA	-.36423E-01	CPHI	.97301	SPHI	.23075	CPSI	1.0000	SPSI	-.41257E-05
CPSIB	1.0000	QZB	31.232	QYB	7.4065	QXB	-1.9907		

ALTPILOT1

DDPHIO	.00000	DELXS	8212.8	PEO	.00000	DELMIB	.00000	TXEO	.27817E-02
DELZS	1678.4	SPEGA	.00000	DYEF	.00000	DPEF	.00000	DTHTAB	.50730E-01
RTM	8392.0	XT	20.000	PEFL	.12651	NULL	1	DELR	.28776E-01
SMEGZ	.00000	PSRG	.00000	PEO	.00000	PEF	.00000	PITERO	.00000
PHIO	-.51484E-01	PSIB	-.13942E-01	PXEO	-.86988E-03	THBB	.12387	PSBB	-.20574E-01
DEL1	.50223E-03	RLAMY	.00000	RLAMP	.00000	THTAB	.58784E-01	THRBB	.31490E-02
YEF	.00000	PEP	.00000	YEO	.00000	PEO	.00000	YEF	.00000
YBRG	.00000	YEG	.00000	DELVB	397.43	YAWERR	.47376E-01	YAWERO	.00000
LAMYR	.00000	LAMPR	.00000	QSA	-.50729E-01	QAPB	173.33	DPSIB	.56117E-01
IACQ	1	PSRBS	.34584E-02	REN	.00000				

LOGIC1

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T
GATE 6	F	GATE 7	T						

AERODYNAMICS1

CLO	.90978E-01	ALB	.59760	CNR	-151.41	CMQ	-151.48	CY	-.18094E-03
CAZ	.97210	CLP	-22.118	CN	.52894E-03	CYCQ	-.29170E-03	CMCQ	-.85280E-03
ANB	.25700E-01	CLB	.23063	CMB	.13219	CNB	-.31182E-01	THASB	.00000
DTHASD	.00000	PSISD	.00000	DPSISD	.00000	ALPHA	.43965E-04	BETA	.15043E-04

RAP1

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667														

DEBUG PRINT1

DELXB	8302.0	DELYB	282.89	DELZB	1192.7	DELXS	8212.8	DELYS	397.43
DELZS	1678.4	KUTTA	1	PITERR	-.20158	YAWERR	.47376E-01	PITERO	.00000
YAWERR	.00000	DRLAMY	.00000	PS	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIO	-.21192E-01	RPHIO	-.24293E-02	DELVR	.50223E-03	DPHIO	-1.0972	G	32.160
VSKC	1099.2	IGKR	0	IACT	0	IGUIDE	0	IRAP	0
KAGE	2	KAVY	0	F1	.00000	DRLAMP	.00000	NUM	0
IPRINT	1	NPPS	20	NDT	128	NDTA	256	NULSKR	2
PEFL	.12651	PHIO	-.51484E-01	RHB	.20661E-02	S2	1.0000	DELRBL	.50223E-03
RFO	.00000	RET	.00000	RZB	-.49944E-03	RPSI	.00000	RTHTA	.00000
SMEGY	.00000	SMEGZ	.00000	NX	33				

PROJECTILE:

TYPE	6.0000	RSA	.18890E-03	DELVP	.00000	U	894.08	V	-.1771E-02		
W	.1C920	THTA	.86416E-01	PHD	-.14625E-02	DEL2	749.12	TOTACC	.54807E-01		
DZ	-23.504	DY	.80333E-03	DPHI	.33042E-02	DTHTA	-.38132E-01	DX	893.75		
CPSI	-.82613E-04	DR	-.36851E-03	DQ	-.12269E-01	DP	.11417E-01	DW	-.22059		
DU	-14.095	DV	.75358E-01	VRW	894.05	MACH	.81421	GAP	824.83		
PSI	.27012E-05	P	.33486E-02	Q	-.36143E-01	R	-.13547E-03	DELVY	.00000		
AZB	-.24597	DELXV	.00000	DELVV	.00000	DELZV	.00000	X	8658.4		
Y	-.12544E-01	Z	-4749.1	AMB	-.20200	XT	13120.	YT	.00000		
DTHTA	-.36143E-01	CPHI	1.0000	SPHI	-.14625E-02	CPSI	1.0000	SPSI	-.27012E-05		
CPSIS	1.0000	GZB	32.148	GYB	-.47015E-01	GXB	-.84936				

AUTOPILOT:

COMMIC	.00000	DELXB	7314.4	PEC	.00000	DELMIB	.00000	TXEC	-.47075E-02
DELZB	1654.2	OMEGA	.00000	DYEP	.00000	DPEP	.00000	DTHTAB	.36144E-01
RTM	7499.2	XT	20.000	PEFL	.12651	NULL	1	DELR	-.52493E-03
AMEGZ	.00000	PSRC	.00000	PED	.00000	PEF	.00000	PITERB	.00000
PHIC	-.58508E-02	PSIB	.12266E-03	PXEC	.64498E-05	THBB	.19543	PSBB	-.23865E-03
DEL1	.91618E-05	RLAMY	.00000	RLAMP	.00000	THTAB	.95934E-01	THRBB	.17833E-02
YEP	.00000	PEP	.00000	YEC	.00000	PED	.00000	YEP	.00000
YBRC	.00000	YEC	.00000	DELYB	-2.2862	YAWERR	-.30513E-03	YAWERB	.00000
LAMYR	.00000	LAMPR	.00000	QBA	-.36144E-01	GAPB	167.38	DPSIB	-.18590E-03
IACC	1	PSRBB	-.63350E-05	REN	.00000				

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	F	GATE 7	T								

AERODYNAMICS:

CLC	.9C497E-01	XLB	-.17467E-02	CNR	-150.71	CMQ	-150.77	CY	-.23784E-04
CAZ	.35533	CLP	-21.568	CN	.14696E-02	CYCQ	.38448E-04	CMCQ	-.23744E-02
AKB	-.32711E-02	CLB	-.40416E-02	CMB	.13179	CKB	-.93792E-03	TWASD	.00000
DTWASD	.00000	PSISC	.00000	DPSISD	.00000	ALPHA	.12214E-03	BETA	-.19813E-05

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TM	.00000
XLTA	1.6667								

DEBUG PRINT:

DELXB	7439.3	DELYB	-1.3910	DELZB	945.93	DELXB	7314.4	DELYB	-2.2882
DELZB	1654.2	KUTTA	1	PITERR	-.22241	YAWERR	-.30813E-03	PITERB	.00000
YAWERR	.00000	DRCAMY	.00000	3	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIB	.29148E-02	RPHIB	-.70125E-03	DELVR	.91618E-05	DPHIO	.33487E-02	G	32.159
VSKC	1098.1	ISKR	0	IACT	0	ICUISE	0	IRAP	0
KAGE	2	NAVY	0	F1	.00000	DRLAMP	.00000	NUM	0
IPRINT	1	NPPB	20	NDT	128	NDTA	256	NULSKR	2
PEFL	.12651	PHIC	-.58508E-02	RWB	.20638E-02	S2	1.0000	DELRSL	.91618E-05
REC	.00000	RET	.00000	REC	-.88716E-08	RPSI	.00000	RTHTA	.00000
AMEGY	.00000	OMEGZ	.00000	NX	33				

PROJECTILE:

TIME	6.6016	RSA	.982A1E-04	DELVP	.00000	U	885.95	V	-.127022-02
W	.59683E-01	THTA	.45466E-02	PHO	-.19077E-03	DELZ	757.29	TOTACC	.29674E-01
DZ	-4.0568	DY	.88412E-03	DPPT	.4057AE-03	DTHTA	-.35802E-01	DX	885.94
DPSI	.89822E-04	DR	-.424A0E-03	DQ	.34067E-02	DP	-.61901E-02	DW	.41067
DU	-12.826	DV	-.50688E-01	VRR	885.55	MACH	.80685	GAP	809.74
PSI	.2C8C2E-05	P	.40871E-03	Q	-.35802E-01	R	.80992E-04	DELVY	.00000
AZB	-.13318	DELAV	.00000	DELVY	.00000	DELEV	.00000	X	6193.8
Y	-.12136E-01	Z	-4757.1	AMB	-.1095D	XY	13120.	YY	.00000
DTHTA	-.358C2E-01	CPHI	1.0000	SPHI	-.19077E-03	CPSI	1.0000	SPSI	.20802E-05
CPSIS	1.0000	GZB	32.159	GYB	-.6134AE-02	GXB	-.14943		

AUTAPILOT:

DDPHIC	.00000	DELXS	6782.3	PEG	.00000	DELMIS	.00000	TXED	.579+7E-02
DELZS	1596.9	SPEGA	.00000	DYEF	.00000	DPEF	.00000	DTHTAS	.35802E-01
RTM	6967.8	KT	20.000	PEFL	.12681	NULL	1	DELR	-.13764E-03
SMEGZ	.00000	PSRG	.00000	PED	.00000	PEF	.00000	PITERR	.00000
PHIC	-.13853E-04	PSIS	.55952E-05	PXED	.57785E-06	THSS	.23901	PSSS	-.73930E-06
DEL1	-.24023E-05	RLAMY	.00000	RLAMP	.00000	THTAS	.11770	THRSS	.18045E-02
YEF	.00000	PEY	.00000	YED	.00000	PED	.00000	YEF	.00000
YRRG	.00000	YEG	.00000	DELYS	-.19081	YAWERR	-.27385E-04	YAWERR	.00000
LAMYR	.00000	LAMPR	.00000	QSA	-.35802E-01	GAPS	164.32	DPSIS	-.98281E-04
IACC	1	PSRSS	-.59618E-05	REN	.00000				

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T
GATE 6	T	GATE 7	T						

AERODYNAMICS:

CLC	.9C240E-01	ALB	-.20680E-03	CNR	-150.38	CMQ	-150.38	CY	-.17193E-04
CAZ	.34636	CLP	-21.270	CN	.810512-03	CYCG	.27869E-04	CMCG	-.1311CE-02
AKB	-.23277E-02	CLB	-.10370E-02	CMD	.12899	CNB	-.18366E-03	THASD	.00000
DTHASD	.CCCCC	PSISC	.00000	DPSISD	.00000	ALPKA	.67366E-04	BETA	-.14337E-05

RAP:

STT	.CCCCC	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DEBUG PRINT:

DELXB	6922.9	DELYB	-.15280	DELZB	789.43	DELXB	6782.3	DELYB	-.19081
DELZS	1596.9	KUTTA	1	PITRRR	-.2312A	YAWERR	-.27385E-04	PITERB	.00000
YAWERR	.CCCCC	DRLAMY	.00000	F3	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIC	.26813E-03	RPHIC	-.22558E-04	DELVR	-.24029E-05	DPHIO	.40578E-03	G	32.159
VSKC	1094.0	ISKR	0	IACT	0	IGUIDE	0	IRAP	0
KAGE	2	NAVY	0	P1	.00000	DRLAMP	.00000	NUM	0
IPRINT	1	KPPS	20	NDT	198	NDTA	256	NULSKR	2
PEFL	.12681	PHIG	-.13853E-04	RWB	.20633E-02	S2	1.0000	DELRBL	-.24023E-05
REC	.CCCCC	RET	.00000	REG	.23300E-05	RPSI	.00000	RTHTA	.00000
AMEGY	.CCCCC	SMEGZ	.00000	NW	93				

PROJECTILE1

TYPE	=	7.0000	RBA	=	.21807E-04	DELVP	=	.00000	U	=	881.00	V	=	-.19088E-02	
W	=	.70985E-01	THTA	=	-.98282E-02	PHD	=	-.1171AE-03	DELZ	=	756.21	T8TACC	=	.35103E-01	
DZ	=	8.7256	CY	=	.61439E-03	DPHY	=	-.63273E-04	DTHTA	=	-.36047E-01	DX	=	880.96	
DPSI	=	.34648E-04	CR	=	-.62890E-03	DQ	=	-.11007E-03	DP	=	-.24185E-02	DW	=	.36574	
DU	=	-12.020	CY	=	-.29638E-01	YRW	=	881.00	MACH	=	.80234	GAP	=	8C0.74	
PSI	=	.28507E-05	P	=	-.63378E-04	Q	=	-.36047E-01	R	=	.30424E-04	DELVY	=	.00000	
AZB	=	-.15752	DELAV	=	.00000	DELVV	=	.00000	DELZV	=	.00000	X	=	6545.4	
Y	=	-.11870E-01	Z	=	-4756.2	AMB	=	-.12959	XT	=	13120.	YT	=	.00000	
DTHTA	=	-.3AC47E-01	CPHI	=	1.0000	SPHI	=	-.1171AE-03	CPSI	=	1.0000	SPSI	=	.28507E-05	
CPSIB	=	1.0000	GZB	=	32.158	GYB	=	-.37692E-02	GXB	=	.31607				

ALTSPIL07I

DDPHIG	=	.00000	DELXB	=	6433.2	PED	=	.00000	DELMIB	=	.00000	TXED	=	-.65181E-02	
DELZB	=	1552.9	SPEGA	=	.00000	DYEP	=	.00000	DPEP	=	.00000	DTHTAB	=	.36047E-01	
RTH	=	6618.0	KT	=	20.000	PEPL	=	.12651	NULL	=	1	DELR	=	-.69619E-04	
SMEGZ	=	.00000	PSRG	=	.00000	PED	=	.00000	PEP	=	.00000	PITERB	=	.00000	
PHIG	=	.95970E-04	PSIB	=	-.21232E-05	PXED	=	.24734E-08	THBB	=	.26797	PBB	=	-.85919E-05	
DEL1	=	-.12151E-05	RLAMV	=	.00000	RLAMP	=	.00000	THTAB	=	.13217	THRBB	=	.18106E-02	
YEP	=	.00000	PEP	=	.00000	YED	=	.00000	PED	=	.00000	YEP	=	.00000	
YPRG	=	.00000	YEG	=	.00000	DELVB	=	-.74270E-01	YAWERR	=	-.11223E-04	YAWERB	=	.00000	
LAMVR	=	.00000	LAMPR	=	.00000	QBA	=	-.36047E-01	GAPB	=	162.49	DPSIB	=	-.21807E-04	
IACC	=	1	PSRBB	=	-.21727E-05	REN	=	.00000							

LOGIC1

GATE 1	=	T	GATE 2	=	F	GATE 3	=	T	GATE 4	=	T	GATE 5	=	T	
GATE 6	=	T	GATE 7	=	T										

AERODYNAMICS1

CLC	=	.9C082E-01	ALB	=	.31851E-04	CNR	=	-150.17	CMQ	=	-150.16	CY	=	-.85964E-04	
CA7	=	.34085	CLP	=	-21.093	CN	=	.96941E-03	CYCQ	=	.42107E-04	CMCQ	=	-.15691E-02	
AKB	=	-.34778E-02	CLB	=	-.31798E-03	CMB	=	.1289A	CNB	=	-.10888E-03	TMASD	=	.00000	
DTHASD	=	.00000	PBISD	=	.00000	DPSISD	=	.00000	ALPHA	=	.80573E-04	BETA	=	-.21628E-05	

RAP1

STT	=	.00000	CTT	=	1.0000	SPT	=	.00000	CPT	=	1.0000	TH	=	.00000	
XLTA	=	1.6667													

DEBUG PRINT1

DELXB	=	6681.7	DELYB	=	-.87930E-01	DPLZB	=	691.69	DELXB	=	6433.2	DELVB	=	-.74870E-01	
DELZB	=	1552.9	KLTTA	=	1	PITERR	=	-.29684	YAWERR	=	-.11223E-04	PITERB	=	.00000	
YAWERR	=	.00000	DRLAMV	=	.00000	FB	=	.00000	DRPSI	=	.00000	DRTHTA	=	.00000	
DRPHIG	=	.59268E-04	RPHIG	=	.29362E-05	DELVR	=	-.12151E-05	CPHIG	=	-.63273E-04	G	=	32.159	
VSKC	=	1094.0	IGKR	=	0	IACT	=	0	IGUIDE	=	0	IRAP	=	0	
KAGE	=	2	NAVY	=	0	F1	=	.00000	DRLAMP	=	.00000	NUM	=	0	
IPRINT	=	1	APPS	=	20	NOT	=	198	NOTA	=	256	NULSKR	=	2	
PEPL	=	.12651	PHIG	=	.95970E-04	RHB	=	.20633E-08	B2	=	1.0000	DELRBL	=	-.12151E-05	
REC	=	.00000	RET	=	.00000	REG	=	.11049E-05	RPSI	=	.00000	RTHTA	=	.00000	
SMEGV	=	.00000	SMEGZ	=	.00000	NX	=	33							

BALL WALD

ACCLISTIB1

LATERAL ENABLE

GLIDANCE ENABLE

PROJECTILE:

TYPE	8.0000	RSA	.78722E+06	DELVP	.00000	U	869.81	V	.14867E+02		
W	.64392E+01	THTA	-.46519E+01	PHD	-.11165E+03	DELZ	731.31	TOTACC	.31390E+01		
DZ	40.513	DY	.85341E+03	DPHI	-.84285E+07	DTHTA	-.37049E+01	DX	868.87		
DPSI	.48936E+05	DR	.46584E+03	DQ	.26543E+02	DP	.11867E+05	DW	-.13255		
DU	-10.403	DV	-.49669E+02	VRW	869.81	MACH	.79208	QAP	781.12		
PSI	-.96630E+06	P	-.48484E+07	Q	-.37049E+01	R	.75722E+06	DELVY	.00000		
AZB	-.14086	DELXV	.00000	DELVY	.00000	DELZV	.00000	X	7.8201		
Y	-.11200E+01	Z	-4731.3	AMB	-.1158A	XT	13120.	YT	.00000		
DTHTA	-.37049E+01	CPHI	1.0000	SPHI	-.11165E+03	CPSI	1.0000	SPSI	-.96630E+06		
CPSIS	1.0000	GZB	32.125	GYB	-.25851E+02	GXB	1.4955				

ALTAPILOT:

DCPHIC	.00000	DELXS	5727.8	PEC	-.12653	DELHIB	.00000	TXED	.79101E+05		
DELZS	465.91	OMEGA	.00000	DYEF	-.21463E+08	DPEF	-6.1087	DTHTAB	.37049E+01		
RTM	5746.7	XT	10.000	PEFL	.12651	NULL	2	DELR	.29650E+07		
OMEGZ	.16562E+01	PSRG	.00000	PED	-.17453	PEF	.00000	PITERB	-.26180E+01		
PHIG	-.41942E+07	PSIS	.14912E+08	PXED	.14908E+09	THBS	.90047E+07	PSDB	.15765E+11		
DEL1	.51748E+09	RLAMY	.42342E+07	RLAMP	.00000	THTAB	.79203E+04	THRBS	-.79158E+04		
YEF	.00000	PEF	.00000	YED	-.61322E+04	PED	-.17453	YEF	.00000		
YBRG	.00000	YEG	-.14904E+08	DELYB	-.35240E+01	YAWERR	-.61322E+05	YAWERB	-.61322E+05		
LAMYR	-.61322E+04	LAMPR	-.17483	QBA	-.37049E+01	CAPB	158.51	DPSIB	-.75722E+06		
IACC	2	PSRBS	-.14904E+08	RBN	.00000						

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	T	GATE 7	T								

AERODYNAMICS:

CLC	.35831E+01	ALB	.23300E+07	CNR	-149.90	CMQ	-149.94	CY	.20461E+04		
CAZ	.33715	CLP	-20.869	CN	.88867E+03	CYCG	-.33123E+04	CMCG	-.14346E+02		
ANB	.26687E+02	CLB	.21471E+06	CMB	.13077	CNB	-.26722E+05	THASD	.00000		
DTHASC	-.56677E+01	PSISC	.00000	DPSISD	196.75	ALPHA	.74030E+04	BETA	.17092E+05		

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DEBUG PRINT:

DELXB	5727.8	DELYB	-.35231E+01	DELZB	465.46	DELXB	5727.8	DELYB	-.35240E+01		
DELZS	465.91	KUTTA	1	PITERR	-.81168E+01	YAWERR	-.61322E+05	PITERB	-.26180E+01		
YAWERR	-.61322E+05	DRLAMY	-.84289E+06	F3	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIG	-.22912E+07	RPHIG	-.15224E+08	DPLVR	.51748E+09	DPHIO	-.84285E+07	G	32.159		
VSKC	1099.1	ISKR	0	IACT	0	IGUIDE	0	IRAP	0		
KAGE	2	NAVY	0	F1	.00000	DRLAMP	.00000	NUM	0		
IPRINT	1	NPPB	20	NDT	198	NDTA	256	NULSKR	3		
PEFL	.12651	PHIG	-.41948E+07	RHB	.20649E+02	B2	1.0000	DELRBL	.51748E+09		
RED	.00000	RET	.00000	REG	-.45787E+09	RPSI	.00000	RTHTA	.00000		
OMEGY	-.56518E+05	OMEGZ	.16562E+01	NX	33						

PROJECTILE1

TYPE	9.0000	RBA	-.27185E-02	DELVW	-.90191E-01	U	851.93	V	-.34555		
W	80.935	THTA	-.93364E-02	PHD	-.10647E-03	DELZ	661.49	TOTACC	16.112		
DZ	88.886	CT	-.87517E-01	DPHI	-.44192E-04	DTHTA	.27192	DX	851.19		
CPSI	-.27586E-02	DR	-.15260E-01	DQ	P.9654	DP	.76340E-03	DW	247.71		
DL	-33.631	DV	2.4141	VRW	855.79	MACH	.77912	GAP	757.74		
PSI	.29276E-03	P	.35415E-04	Q	.27192	R	-.27296E-02	DELVY	.34885E-03		
AZR	-72.318	DELAV	.00000	DELYY	.00000	DELZV	.00000	X	8277.3		
Y	-.10529	Z	-4661.5	AMB	18.152	XT	13120.	YT	.00000		
DTHTA	.27192	CPHI	1.0000	SPHI	-.10647E-03	CPSI	1.0000	SPSI	.29276E-03		
CPSIS	1.0000	GZB	32.158	GYB	-.35117E-02	GXB	.30025				

ALTSPILOT1

CCPHIO	.00000	DELXS	4887.7	PEQ	-.90128E-01	DELMIS	.00000	TXED	-.58948E-02		
DELZS	2.7168	BMEGA	.00000	DYEF	-.11457E-01	DPEF	.89655E-01	DTHTAS	-.30422		
RTM	4887.7	XT	10.000	PEFL	.98092E-01	NULL	2	DELR	.24913E-04		
AMEGZ	.51231E-03	PSRO	.00000	PED	-.55585E-02	PEF	-.28420E-01	PITERS	-.55585E-03		
PHIO	.75186E-05	PSIS	-.25665E-03	PXED	-.17314E-04	THBS	-.26766	PSBS	-.33396E-03		
DEL1	.34927E-03	RLAMY	.51711E-04	RLAMP	.00000	THTAS	-.12586	THRBS	-.79674E-02		
YEF	.24790E-03	PEF	-.28420E-01	YED	-.25653E-03	PED	-.55585E-02	YEF	.24790E-03		
YBRO	.00000	YEO	.33785E-03	DELYS	-.12538	YAWERR	-.25653E-04	YAWERS	-.25653E-04		
LAMYR	-.25653E-03	LAMPR	-.55585E-02	QSA	.27192	QAPS	153.76	DPSIS	-.13065E-01		
IACC	2	PSRBS	.89672E-04	RZN	.00000						

LOGIC1

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	T	GATE 7	T								

AERODYNAMICS1

CLC	.89687E-01	ALB	-.18979E-04	CNR	-149.95	CMQ	-167.22	CY	-.26140E-02		
CAZ	.34810	CLP	-20.659	CN	.47093	CYCQ	.12382E-02	CMCQ	.23226		
AKB	-.94777E-01	CLB	.17041E-03	CMB	-.11817	CNB	.94996E-02	THASD	-.32294E-01		
DTHASD	14.405	PSISD	-.15770E-01	DPSISD	29.248	ALPHA	.54714E-01	BETA	-.40378E-03		

RAP1

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DEBUG PRINT1

DELXB	4848.7	DELYB	-1.3798	DELZB	616.28	DELXB	4887.7	DELYB	-.12538		
DELZB	2.7168	KUTTA	1	PITERR	-.55585E-03	YAWERR	-.25653E-04	PITERB	-.55585E-03		
YAWERB	-.25653E-04	DRLAMY	-.44192E-03	FB	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIO	-.51232E-04	RPHIO	.47001E-05	DELVR	.42433E-06	DPHIO	-.44192E-04	G	32.160		
VSKJ	1C9844	IBKR	0	IACT	0	IGUIDE	0	IRAP	0		
KAGE	2	NAVY	0	F1	.00000	DRLAMP	.00000	NUM	C		
IPRINT	1	NPPS	20	NDT	128	NDTA	256	NULBKR	2		
PEFL	.98092E-01	PHIO	.75186E-05	RHO	.20697E-02	S2	1.0000	DELRBL	.42433E-06		
RFO	.00000	RET	.00000	REG	-.61598E-06	RPSI	.00000	RTHTA	.00000		
AMEGY	-.23643E-04	BMEGZ	.51231E-03	NX	33						

PROJECTILE:

TIME	10.000	RSA	-.62431E-05	DELVP	-.10856	U	837.61	V	-.44309E-01		
W	107.83	THTA	.14760E-01	PHD	-.11162E-03	DELZ	567.82	TOTACC	25.569		
DZ	95.459	DY	-.78667E-01	DPHI	-.17459E-06	DTHTA	-.16798E-01	DX	839.11		
DPSI	-.43321E-05	DR	-.32215E-02	DQ	.90239E-01	DP	-.13038E-06	DW	-7.4828		
DL	-10.030	DV	.13553E-01	VRW	344.52	MACH	.76860	QAP	740.01		
PSI	-.53001E-04	P	.71572E-06	Q	-.16798E-01	R	-.62070E-05	DELVY	.40917E-04		
AZB	-114.77	DELAV	.00000	DELVV	.00000	DELZV	.00000	X	9120.4		
Y	-.18588	Z	-4567.5	AMB	.45066	XT	13120.	YT	.00000		
DTHTA	-.16798E-01	CPHI	1.0000	SPHI	-.11162E-03	CPSI	1.0000	SPSI	-.53001E-04		
CPSIB	1.0000	GZB	32.186	GYB	-.36144E-02	GXB	-.47468				

AUTOPILOT:

CCPHIC	.00000	DELXS	4039.7	PEC	-.10858	DELMIS	.00000	TXED	-.77891E-01		
DELZS	2.1914	OMEGA	.00000	DYEF	.76201E-02	DPEF	-.43968E-02	DTHTAS	.31111E-01		
RTP	4039.7	KT	10.000	PEFL	.10797	NULL	2	DELR	.45440E-07		
OMEGZ	.49998E-03	PSRG	.00000	PED	-.54247E-02	PEF	-.18547E-01	PITERS	-.54247E-03		
PHIC	-.39768E-07	PSIS	.57941E-04	PXED	.38638E-05	THSS	-.30912	PSSS	.77211E-04		
DZL1	.40918E-04	RLAMY	.13482E-06	RLAMP	.00000	THTAS	-.15517	THRSS	.61125E-03		
YEF	-.47224E-04	PEF	-.18547E-01	YED	.23121E-03	PED	-.54247E-02	YEP	.47224E-04		
YBRG	.00000	YEG	.27688E-04	DELYS	.93401E-01	YAWERR	.23121E-04	YAWERS	.23121E-04		
LAMYR	.23121E-03	LAMPR	-.54247E-02	QSA	-.16798E-01	QAPS	150.16	DPSIS	-.22129E-03		
IACQ	2	PSRBS	-.19336E-04	REN	.00000						

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	T	GATE 7	T								

AERODYNAMICS:

CLC	.89529E-01	ALB	-.33673E-06	CNR	-149.63	CMQ	-170.47	CY	-.36739E-03		
CAZ	.33977	CLP	-20.482	CN	.76430	CYCG	.24182E-03	CMCG	.59042E-02		
AXB	-.18588E-01	CLB	.31082E-06	CMB	.83777E-01	CNB	.21396E-04	THASD	.14313E-01		
DTHASD	.39936	PSISC	-.22789E-03	DPSISD	21.614	ALPHA	.12804	BETA	-.52467E-04		

RAP:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6667										

DEBUG PRINT:

DELXB	3990.8	DELYB	.32748	DELZB	626.49	DELXS	4039.7	DELYS	.93401E-01		
DELZS	2.1914	KLTTA	1	PITERR	-.54247E-03	YAWERR	.23121E-04	PITERS	-.54247E-03		
YAWERS	.23121E-04	DRLAMY	-.17488E-05	F3	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIC	-.56139E-07	RPHIG	.13097E-08	DELVR	.79308E-03	DPHIO	-.17459E-06	G	32.160		
VSKD	1098.8	ISKP	0	IAC?	0	IGUIDE	0	IRAP	0		
NAGE	2	NAVV	0	F1	.00000	DRLAMP	.00000	NUM	0		
IPRINT	1	NPPS	20	NDT	128	NDTA	256	NULSKP	2		
PEFL	.10797	PHIG	-.39768E-07	RHO	.20751E-02	S2	1.0000	DELRBL	.79308E-03		
REP	.00000	RET	.00000	REQ	.74384E-09	RPSI	.00000	RTHTA	.00000		
AMEGY	.21310E-04	OMEGZ	.49998E-03	NX	33						

```
PROJECTILE:
TIPE   =  11.001        RBA    =  .24735E-04    DELVP  = -.10797       U      =  826.95        V      = -.82465E+01
W      =  106.99        THTA   =  .55301E-02    RHO    = -.11162E-03   DELZ   =  466.68        TOTACC =  25.306
DZ     =  102.42        CY     = -.66335E-01    DPHI   =  .95076E-08   DTHTA  = -.75508E-02    DX     =  827.53
DPSI   =  .25859E-04    CR     =  .20504E-02    DQ     = -.12373       DP     = -.63959E-06    DW     =  .60965
DL     = -10.420        DV     = -.84429E-02    VRW    =  833.85       MACH   =  .75868        GAP    =  723.62
PSI    =  .50637E-05    P      = -.28727E-07    Q      = -.7550RE-02   R      =  .25016E-04    DELVY  =  .11022E-03
AZB    = -113.99        DELXV  =  .00000        DELYV  =  .00000       DELZV  =  .00000        X      =  9952.5
Y      = -.25502        Z      = -4466.7        AMB    = -.73718       XT     =  13120.        YT     =  .00000
DTHTA  = -.75508E-02    CPHI   =  1.0000        SPHI   = -.11162E-03   CPSI   =  1.0000        SPSI   =  .50637E-05
CPSIS  =  1.0000        GZB    =  32.160        GYB    = -.3588AE-02   GXB    = -.17785

AUTOPILOT:
DDPHIO =  .00000        DELXS  =  3201.7        PEG    = -.10791       DELMIS =  .00000        TXED   = -.75595E-02
DELZS  =  1.6833        OMEGA  =  .00000        DYEP   = -.43659E-02   DPEF   =  .11468E-02    DTHTAS = -.93268E-02
RTM    =  3201.7        KT     =  10.000        PEFL   =  .10800       NULL   =            2   DELR   = -.21261E-07
OMEGZ  =  .48459E-03    PSRG   =  .00000        PED    = -.52577E-02   PEF    = -.18517E-01    PITERB = -.52577E-03
PHIG   =  .54221E-07    PSIG   =  .68307E-04    PXED   =  .28857E-05   THBS   = -.30275        PSDS   =  .15780E-03
DEL1   =  .11022E-03    RLAMY  =  .44714E-07    RLAMP  =  .00000       YHTAS  = -.15129        THRBS  = -.88364E-04
YEF    =  .10049E-03    PEF    = -.18617E-01    YED    = -.9602AE-04   PEO    = -.52577E-02    YEF    = -.10049E-03
YSRG   =  .00000        YEG    =  .11109E-03    DELYS  = -.30744E-01   YAWERR = -.96026E-05    YAWERO = -.96026E-05
LAMYR  = -.96026E-04    LAMPR  = -.52577E-02    QSA    = -.7550RE-02   QAPS   =  146.84        DPSIS  = -.60956E-02
IACQ   =            2   PSRBS  =  .10592E-04    REN    =  .00000

LOGIC:
GATE  1 =           T   GATE  2 =           F   GATE  3 =           T   GATE  4 =           T   GATE  5 =           T
GATE  6 =           T   GATE  7 =           T

AERODYNAMICS:
CLC    =  .59379E-01    ALB    =  .13278E+07    CNR    = -149.53       CMQ    = -169.10       CY     = -.48409E-03
CAZ    =  .33779        CLP    = -20.317        CN     =  .77386       CYCG   = -.15836E-03    CMCG   = -.98763E-02
ANB    =  .11820E-01    CLB    = -.14183E-06    CMB    =  .29047E-01   CNB    = -.85097E-04    THASD  = -.16878E-01
CTHASD =  5.5527        PSIBC  = -.60709E-02    DPSIBD = -12.714       ALPHA  =  .12867        BETA   = -.98897E-04

RAP:
STT    =  .00000        CTT    =  1.0000        SPT    =  .00000       CPT    =  1.0000        TH     =  .00000
XLTA   =  1.6667

DEBUG PRINT:
DELXB  =  3164.8        DELYC  =  .18795        DELZB  =  484.19       DELXB  =  3201.7        DELYS  = -.30744E-01
DELZS  =  1.6833        KLTTA  =            1   PITERR = -.52577E-03   YAWERR = -.96026E-05    PITERO = -.52577E-03
YAWERO = -.96026E-05    DRLAMY =  .95076E-07    F3     =  .00000       DPPSI  =  .00000        DRTHTA =  .00000
DRPHIG =  .55931E-08    RPHIG  =  .38902E-08    DELVR  = -.37107E-09   DPHIO  =  .95076E-08    G      =  32.160
VSKC   =  1099.2        ISKM   =            0   IACT   =            0  IGUIDE =            0   IRAP   =            0
KAGE   =            2   NAVY   =            0   F1     =  .00000       DRLAMP =  .00000        NUP    =            0
IPRINT =            1   NPPB   =           20   NOT    =          IPS  NDTA   =          256   NULSKR =            2
PPFL   =  .10800        PHIG   =  .54221E-07    RHS    =  .20818E-02   S2     =  1.0000        CELROL = -.37107E-09
REM    =  .00000        RET    =  .00000        REG    =  .37547E-09   RPSI   =  .00000        RTHTA  =  .00000
OMEGY  = -.88504E-05    OMEG7  =  .48459E-03    NX     =           33
```

PROJECTILE1

TYPE	12.001	RSA	.22715E-03	DELVP	-.10767	U	817.12	V	-.3891		
M	109.18	THTA	-.57049E-02	PWD	-.11163E-03	DELZ	338.90	THTACC	24.515		
AZ	109.81	DY	-.67943E-01	DPWI	-.25372E-06	DTHTA	.31784E-02	DX	8.6.5		
DPSI	.22923E-03	DR	-.21684E-02	D2	.17238E-02	DP	.73766E-05	DW	10.243		
DC	-10.948	DY	-.16005	YRW	823.86	MACH	.74929	GAP	708.70		
PSI	.96957E-04	P	.64441E-07	Q	.31783E-02	R	.22959E-03	DELVY	.16445E-03		
IYE	-110.04	DELXV	.00000	DELVV	.00000	DELZV	.00000	X	10773.		
Y	-.31597	Z	-4358.9	AMB	.21959E-01	XT	13120.	YT	.00000		
DTHTA	.31784E-02	DPWI	1.0000	SPWI	-.11163E-03	DPSI	1.0000	SPSI	.96957E-04		
DPSIS	1.0000	GZB	32.160	GYB	-.36074E-02	GXB	.18347				

ALTAPILOT1

DPWIC	.00000	DELXS	2374.8	PED	-.10768	DELMIS	.00000	TXED	-.72604E-02		
DELZS	1.2373	BMEGA	.00000	DVEP	.17699E-02	DPEP	.63639E-02	DTHTAS	.75250E-04		
RYP	2374.8	KT	10.000	PEFL	.10788	NULL	2	DELR	.83179E-06		
PMEGZ	.47389E-03	PSRG	.00000	PED	-.51417E-02	PEP	-.18632E-01	PITERG	-.52102E-03		
PWIG	-.38C1CE-06	PSIS	.83629E-05	PXED	.11803E-05	THBB	-.29197	PSBS	-.20559E-04		
DEL1	.16445E-03	RLAMY	-.13638E-06	RLAMP	.00000	THTAS	-.14549	THRBS	-.19901E-03		
YEP	.17862E-03	PEP	-.10832E-01	YED	.10158E-03	PED	-.51417E-02	YEP	.17862E-03		
YBRG	.00000	YEG	.16278E-03	DELYS	.34496E-01	YAWERR	.14526E-04	YAWERG	.14526E-04		
LAMYR	.1C158E-03	LAMPR	-.51417E-02	G9A	.31783E-02	GAPB	143.81	DPSIS	-.63819E-03		
IACC	2	PSRBS	-.16642E-04	REN	.00000						

LOGIC1

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	T	GATE 7	T								

AERODYNAMICS1

CLD	.89239E-01	ALB	-.29299E-07	CNR	-149.45	CMQ	-168.77	CY	-.97226E-03		
CAT	.33692	CLP	-20.169	CN	.76514	CYCG	.15918E-03	CMCG	.30041E-03		
AKB	-.11836E-01	CLB	.13120E-03	CMB	-.12094E-01	CNB	-.77371E-03	THABD	-.35536E-02		
DTHASC	.46826	PSISC	-.41103E-03	DPSIBD	9.193.	ALPHA	.12799	BETA	-.16860E-03		

RAP1

STT	.00000	CTT	1.0000	SRT	.00000	CRT	1.0000	TH	.00000		
XLTA	1.6667										

DEBUG PRINT1

DELXB	2349.8	DELYB	.49606E-01	DELZB	345.50	DELXB	2374.8	DELYS	.34496E-01		
DELZB	1.2373	KUTTA	1	PITERR	-.52102E-03	YAWERR	.14526E-04	PITERB	-.52102E-03		
YAWERR	.14526E-04	DRLAMY	.24372E-05	FB	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPWIG	-.18746E-06	RPWIG	-.15411E-07	DELVR	.40454E-08	DPWIO	-.24372E-06	G	32.161		
VERC	1099.8	IDER	0	IACT	0	ICLIDE	0	IRAP	0		
KAGE	2	KAVY	0	F1	.00000	DRLAMP	.00000	NUM	C		
IPRINT	1	KMPS	20	NDT	128	NDTA	256	NULSKP	2		
PEFL	.10788	PWIG	-.38016E-06	RHB	.20889E-02	S2	1.0000	DELREL	.40454E-08		
RED	.00000	RET	.00000	REG	-.39677E-08	RPSI	.00000	RTHTA	.00000		
SMEGY	.93625E-05	SMEGZ	.47389E-03	NX	33						

PROJECTILE:

TYPE	13.001	RSA	.4999EE-03	DELVP	*.10848	U	807.90	V	**26278		
H	103.71	THTA	*.17100E-01	PHD	*.11164E-03	DELZ	243.60	TOTACC	23.744		
DZ	117.51	DY	*.12994E-01	DPHI	*.29606E-05	DTHTA	.70923E-02	DX	606.01		
DPSI	.5C391E-03	DR	.15434E-02	DQ	.25353	DP	.80171E-04	DW	14.142		
DU	-10.762	DV	*.35792	VRW	414.53	MACH	.74045	GAP	695.18		
PSI	.29482E-03	P	*.86970E-06	Q	.70923E-02	R	.50470E-03	DELVY	.33899E-03		
AZR	*106.58	DELXV	.00000	DELVV	.00000	DELZV	.00000	X	11582.		
Y	*.34815	Z	*4243.6	AMB	1.4777	XT	13120.	YT	.00000		
DTHTA	.70923E-02	CPHI	1.0000	SPHI	*.11154E-03	CPSI	1.0000	SPSI	*29482E-03		
CPSIS	1.0000	GZB	32.156	GYB	*.37519E-02	GXB	.54992				

ALTSPILOT:

DCPHIC	.00000	DELXS	1557.5	PEQ	*.10845	DELMIS	.00000	TXED	**89787E-02		
DELZS	.74593	OMEGA	.00000	DYEF	*.14264E-02	DPEF	.13528E-01	DTHTAS	*.16518E-01		
RTM	1557.5	KT	10.000	PEFL	.10840	NULL	E	DELR	*24613E-05		
OMEGZ	.44140E-03	PSRG	.00000	PED	*.47891E-02	PEF	*.18118E-01	PITERS	**47891E-03		
PHIS	*.31995E-05	PSIS	*.90001E-04	PXED	*.40365E-05	THBS	*.27882	PSBS	**19854E-03		
DEL1	.339C3E-03	RLAMV	*.23882E-06	RLAMP	.00000	THTAS	*.13947	THRBS	.49248E-04		
YEF	.353?4E-03	PEF	*.18115E-01	YED	.80171E-04	PED	**47891E-02	YEF	.3532?E-03		
YBRG	.00000	YEG	.34397E-03	DELYS	.93719E-02	YAWERR	.60171E-05	YAWERS	.60171E-05		
LAMYR	.60171E-04	LAMPR	*.47891E-02	QSA	.70923E-02	GAPS	141.08	DPSIS	*28587E-02		
IACC	2	PSRBS	*.92713E-05	REN	.00000						

LOGIC:

GATE 1	T	GATE 2	C	F	GATE 3	T	GATE 4	T	GATE 5	T					
GATE 6	T	GATE 7	T												

AERODYNAMICS:

FLC	.89107E-01	ALS	.28968E-06	CNR	*149.41	CMQ	*168.28	CY	**17080E-02		
CAZ	.33655	CLP	*20.017	CN	.75587	CYCG	*.14672E-03	CMCG	.20609E-01		
AXB	.1C920E-01	CLB	*.15725E-04	CMB	*.26691E-01	CNB	*.16870?E-02	TMASD	**94250E-02		
DTHASD	-3.0930	PSISD	.33586E-02	DPSISD	-5.0856	ALPHA	.12768	BETA	**.32258E-03		

RAP:

RTT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000		
XLTA	1.6667										

OPRLG PRINT:

DELXB	1582.3	DELYB	*.13081	DELZB	217.24	DELXS	1557.5	DELYS	.93719E-02		
DELZS	.74593	KUTTA	1	PITERR	*.47891E-03	YAWERR	.60171E-05	PITERS	**47891E-03		
YAWERR	.6C171E-05	DRLAMV	*.29606E-06	PS	.00000	DRPSI	.00000	DRTHTA	.00000		
DRPHIG	*.26433E-05	RPHIG	*.44494E-07	DELVR	.42957E-07	DPHIO	*.29606E-05	G	32.161		
VSKP	11CC.0	ISKP	0	IACT	0	ICGIDE	0	IRAP	0		
KAGE	2	KAIV	0	FI	.00000	DRLAMP	.00000	NUM	0		
IPRINT	1	NPPS	20	NOT	198	NOTA	256	NULSKP	2		
PEFL	.10840	PHIG	*.31995E-05	RHO	.20955E-02	S2	1.0000	DELRBL	.42957E-07		
RPD	.00000	RET	.00000	REG	*.42944E-07	RPSI	.00000	RTHTA	.00000		
OMEGY	.58458E-05	OMEGZ	.44140E-03	NX	93						

PROJECTILE:

TIME	14.001	NSA	.15555E+02	DELVP	*.11180	U	798.94	V	*.70599		
W	104.36	THTA	*.26083E+01	PHD	*.11121E+03	DELZ	120.59	TOTACC	23.510		
DZ	125.16	DY	.68125E+01	DPHI	*.12271E+04	DTHTA	*.29046E+02	DX	795.95		
DPSI	.15681E+02	DR	.80077E+02	DQ	.82838	DP	.30505E+03	DW	6.3199		
DL	*9.2405	DV	-1.1181	VRW	805.79	MACH	.73213	GAP	682.72		
PSI	.95760E+03	P	*.15053E+04	Q	*.29047E+02	R	.15678E+02	DELVY	.94032E+03		
AZE	*108.53	DELXV	.00000	DELVV	.00000	DELZV	.00000	X	10381.		
Y	*.32693	Z	*4120.6	AMB	3.0130	XT	13120.	YT	.00000		
DTHTA	*.29046E+02	CPHI	1.0000	DPHI	*.11121E+03	CPSI	1.0000	SPSI	.95760E+03		
CPSIS	1.0000	GZB	32.150	GYB	*.49786E+02	BXB	.83878				

AUTOPILOT:

DDPHIC	.00000	DELXS	749.01	PEC	*.11182	DELMIB	.00000	TXED	*.87983E+02		
DELZB	.24539	BMEGA	.00000	DYEF	.23911E+02	DPEF	.38971E+01	DTHTAS	.13134E+02		
RTM	749.01	KT	10.000	PEPL	.11115	NULL	2	DELR	.87245E+05		
BMEGI	.30196E+03	PSRG	.00000	PED	*.32762E+02	PEF	*.13364E+01	PITERB	*.32762E-03		
PHIG	*.83107E-05	PSIS	*.56243E+03	PXED	*.25986E+04	THBS	*.26923	PSBB	*.12262E+02		
DEL1	.94048E+03	RLAMY	.39608E+05	RLAMP	.00000	THTAS	*.13529	THRBS	.67599E+03		
YEF	.98817E+03	PEF	*.15264E+01	YED	.35065E+03	PED	*.32762E+02	YEF	.98817E+03		
YRRB	.00000	YEB	.93747E+03	DELYS	.26264E+01	YAWERR	.35065E+04	YAWERB	.35065E+04		
LAMYR	.35065E+03	LAMPR	*.32762E+02	BBA	*.29046E+02	CAPB	138.54	DPBIB	*.46487E+02		
IACC	2	PSRBS	*.50697E+04	REN	.00000						

LOGIC:

GATE 1	T	GATE 2	F	GATE 3	T	GATE 4	T	GATE 5	T		
GATE 6	T	GATE 7	T								

AERODYNAMICS:

CLO	.88992E+01	ALB	.66472E+05	CNR	*169.84	CMQ	*165.76	CY	*.45502E+02		
CAI	.33635	CLP	*19.880	CN	.76171	CYCQ	*.72479E+03	CMCQ	.42787E+01		
AKB	.81037E+01	CLB	.54669E+04	CMB	.10695E+01	CNB	*.52085E+02	THASB	*.15918E+02		
DTHASC	3.1864	PSISC	*.30932E+02	DPSISD	1.8508	ALPHA	.12989	BETA	*.87939E+03		

RAM:

STT	.00000	CTT	1.0000	SPT	.00000	CPT	1.0000	TH	.00000
XLTA	1.6667								

DEBUG PRINT:

DELXB	742.14	DELYB	*.39500	DELZB	101.27	DELXS	749.01	DELYS	.26264E+01
DELZS	.24539	KLTTA	1	PITERR	*.32762E-03	YAWERR	.35065E+04	PITERB	*.32762E-03
YAWERB	.98065E+04	DRLAMY	*.12271E+03	FB	.00000	DRPSI	.00000	DRTHTA	.00000
DRPHIC	*.11747E-04	RPHIC	.27488E+06	DELVR	.15227E+06	DPHIC	*.12271E+04	G	32.161
VSKC	1100.5	IGKR	0	IXCT	0	IGUIDE	0	IRAP	0
KAGE	2	NAVY	0	P1	.00000	DRLAMP	.00000	NUM	0
IPRINT	1	NPPB	20	NDT	128	NDTA	856	NULSKR	2
PEPL	.11115	PHIG	*.83107E-05	RHB	.21033E+02	S2	1.0000	DELRBL	.15227E+06
REC	.00000	RET	.00000	REG	*.15999E+06	RPSI	.00000	RTHTA	.00000
BMEGY	.32318E+04	BMEGZ	.30196E+03	NX	93				

IMPACT:

TIME	14.937								

PROJECTILE:

TYPE	=	14.937	RBA	=	.46901	DELVR	=	-.13604	U	=	788.27	V	=	19.775
W	=	181.08	THTA	=	-.13648E-01	PHD	=	-.22293E-03	DELZ	=	-.73242E-01	TOTACC	=	30.086
AZ	=	131.83	DY	=	.19826	DPHI	=	-.25698E-02	DTHTA	=	.21851	CX	=	788.79
DPSI	=	.47439	DR	=	19.711	DQ	=	.99688	DP	=	.68279E-01	DW	=	177.27
DU	=	-47.428	DV	=	-356.81	VRW	=	797.76	MACH	=	.72458	GAP	=	871.72
PSI	=	.28299E-01	P	=	.29577E-02	Q	=	.21832	R	=	.47644	DELVY	=	.11386
AZE	=	-121.44	DELXV	=	.88173	DELVV	=	.15338	DELZV	=	-.22255	X	=	13119.
Y	=	-.15435	Z	=	-3999.9	AMB	=	6.4049	XT	=	13120.	YT	=	.00000
DTHTA	=	.21851	CPHI	=	1.0000	SPHI	=	-.22233E-03	CPSI	=	.99968	SPSI	=	.28297E-01
CPSIS	=	1.0000	GZB	=	32.189	GYB	=	-.18263E-01	GXB	=	.43878			

ALTSPILOT:

DCPHIC	=	.00000	DELXS	=	.88409	PEQ	=	-.13604	DELMIS	=	.27028	TXEQ	=	-.70904E-02
DPLZS	=	-.21425	BMEGA	=	.00000	DVEP	=	6.8579	DPEP	=	6.7448	DTHTAS	=	1.4529
RTM	=	1.6799	KT	=	10.000	PEPL	=	.13963	NULL	=	1	DELR	=	.24386E-02
BMEGZ	=	-.16562E-01	PSRQ	=	.00000	PEQ	=	.17453	PEP	=	.13639	PITERS	=	.00000
PHIS	=	-.36722E-02	PSIS	=	-.19471E-01	PXEQ	=	-.63768E-03	THBS	=	.29755	PSIS	=	-.52376E-01
DEL1	=	.11386	RLAMY	=	-.11074E-02	RLAMP	=	.00000	THTAS	=	-.14529	THRSS	=	-.34837E-02
YEP	=	.12503	PEP	=	.13639	YEQ	=	.17453	PEQ	=	.17453	YEP	=	.12809
YERS	=	.00000	YEQ	=	.11975	DELYS	=	.14864	YAWERR	=	.16191	YAWERS	=	.00000
LAMYR	=	.17453	LAMPR	=	.17453	QSA	=	.21969	CAPS	=	136.31	CPSIS	=	.19471
IACC	=	1	PSRBS	=	-.67191E-02	REN	=	.00000						

LOGIC:

GATE 1	=	T	GATE 2	=	F	GATE 3	=	T	GATE 4	=	T	GATE 5	=	T	
GATE 6	=	T	GATE 7	=	T										

AERODYNAMICS:

CLC	=	.88869E-01	ALB	=	-.12897E+02	CNR	=	.16C.4R	CPS	=	-146.81	CY	=	.43340
CAT	=	.39678	CLP	=	-19.756	CN	=	.89394	CYCQ	=	-1.6525	CMCQ	=	.92443E-01
ANB	=	114.49	CLB	=	.18C14E-01	CMB	=	-.70753	CNB	=	-1.8008	TMASQ	=	.15993
DTMASC	=	-16.886	PSISC	=	.19961	DPSISD	=	20.157	ALPHA	=	.15241	BETA	=	-.24791E-01

RAP:

STT	=	.00000	CTT	=	1.0000	SPT	=	-.00000	CPT	=	1.0000	TH	=	.00000
XLTA	=	1.6667												

DEBUG PRINT:

DELXB	=	.90878	DELYB	=	.13182	DELZB	=	-.85574E-01	DELXS	=	.88409	DELYS	=	.14866
DELZS	=	-.21625	KUTTA	=	1	PITERR	=	.23989	YAWERR	=	.16191	PITERS	=	.00000
YAWERS	=	.00000	DRLAMY	=	-.25698E-01	FS	=	.00000	DRPSI	=	.00000	DRTHTA	=	.00000
DRPHIS	=	-.23847E-02	RPHIS	=	-.10340E-03	DELVR	=	.62558E-04	DPHIS	=	-.25698E-02	G	=	32.162
VSKS	=	11C14C	ISKR	=	0	IACT	=	0	IGUIDE	=	0	IRAP	=	0
KAGE	=	1	KAVY	=	0	F1	=	.00000	DRLAMP	=	.00000	NUP	=	0
IPRINT	=	1	KPRS	=	50	NOT	=	128	NOTA	=	256	NULSKR	=	2
PEPL	=	.13963	PHIQ	=	-.36722E-02	RHO	=	.21109E-02	S2	=	1.0000	CELROL	=	.42558E-04
REC	=	.00000	RET	=	.00000	REQ	=	-.49526E-04	RPSI	=	.00000	RTHTA	=	.00000
BMEGY	=	.16562E-01	BMEGZ	=	-.16562E-01	NX	=	33						

IMPACT:

PCAT	=	14.936	PCAX	=	19118.	PCAY	=	-.15488	PCAZ	=	-4000.1	PCA	=	1.6799

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