AD 730362

AD

USAAVLABS TECHNICAL REPORT 70-74C

STABILITY AND CONTROL OF HELICOPTERS IN STEEP APPROACHES

VOLUME III

DERIVATIVES AND TRANSFER FUNCTIONS FOR THE YHC-1A TANDEM-ROTOR HELICOPTER AND THE S-58 SINGLE-ROTOR HELICOPTER

By

Julian Wolkovitch

John A. Hoffman

May 1971

EUSTIS DIRECTORATE

U. S. ARMY AIR MOBILITY RESEARCH AND DEVELOPMENT LABORATORY

FORT EUSTIS, VIRGINIA

CONTRACT DAAJ02-69-C-0004

MECHANICS RESEARCH, INC.

LOS ANGELES, CALIFORNIA

D D C
RECEIVED
SEP 27 1971
D

Approved for public release;
distribution unlimited.

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
Springfield, Va. 22151

301

Best
Available
Copy

DISCLAIMERS

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission, to manufacture, use, or sell any patented invention that may in any way be related thereto.

DISPOSITION INSTRUCTIONS

Destroy this report when no longer needed. Do not return it to the originator.

ACCESSION for
CFSTI WHITE SECTION ☑
DDC BUFF SECTION ☐
UNAN. GED. ☐
JUSTIFICATION.....
.....
BY.....
DISTRIBUTION/AVAILABILITY CODES
DIST. | AVAIL. and/or SPECIAL
A | 23

NOTICE TO USERS

Portions of this document have been judged by the NTIS to be of poor reproduction quality and not fully legible. However, in an effort to make as much information as possible available to the public, the NTIS sells this document with the understanding that if the user is not satisfied, the document may be returned for refund.

If you return this document, please include this notice together with the IBM order card (label) to:

National Technical Information Service
U.S. Department of Commerce
Attn: 952.12
Springfield, Virginia 22151

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)* Mechanics Research, Inc. 9841 Airport Blvd. Los Angeles, California	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP NA

3. REPORT TITLE

STABILITY AND CONTROL OF HELICOPTERS IN STEEP APPROACHES
VOLUME III. DERIVATIVES AND TRANSFER FUNCTIONS FOR THE YHC-1A TANDEM-ROTOR HELICOPTER AND THE S-58 SINGLE-ROTOR HELICOPTER.

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

Final Report

5. AUTHOR(S) *(First name, middle initial, last name)*

Julian Wolkovitch
John A. Hoffman

6. REPORT DATE May 1971	7a. TOTAL NO. OF PAGES 299	7b. NO. OF REFS None

8a. CONTRACT OR GRANT NO. DAAJ02-69-C-0004 b. PROJECT NO. c. 1F162204A142 d.	9a. ORIGINATOR'S REPORT NUMBER(S) USAAVLABS Technical Report 70-74C 9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)* MRI Report No. 2284-1

10. DISTRIBUTION STATEMENT

Approved for public release; distribution unlimited.

11. SUPPLEMENTARY NOTES Volume III of a 4-volume report	12. SPONSORING MILITARY ACTIVITY Eustis Directorate U.S. Army Air Mobility R&D Laboratory Fort Eustis, Virginia

13. ABSTRACT

Derivatives and transfer functions are presented for the Boeing-Vertol YHC-1A tandem-rotor helicopter and for the Sikorsky S-58 single-rotor helicopter. The flight conditions considered for the YHC-1A include forward speeds from 0 to 80 knots and descent rates from 0 to 25 fps. For the S-58 forward speeds of 0 to 100 knots and descent rates of 0 to 22.5 fps are considered.

DD FORM 1 NOV 65 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

UNCLASSIFIED

Security Classification

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A ROLE	LINK A WT	LINK B ROLE	LINK B WT	LINK C ROLE	LINK C WT
HELICOPTER STABILITY AND CONTROL						
HELICOPTER AERODYNAMICS						
HELICOPTER STABILITY DERIVATIVES						
HELICOPTER TRANSFER FUNCTIONS						
V/STOL STEEP APPROACH						
VORTEX-RING STATE						
SIKORSKY S-58 STABILITY AND CONTROL						
LOCKHEED AH-56A STABILITY AND CONTROL						
BOEING-VERTOL YHC-1A STABILITY AND CONTROL						
MOSTAB DIGITAL COMPUTER PROGRAM						

UNCLASSIFIED
Security Classification

DEPARTMENT OF THE ARMY
U. S. ARMY AIR MOBILITY RESEARCH & DEVELOPMENT LABORATORY
EUSTIS DIRECTORATE
FORT EUSTIS, VIRGINIA 23604

The report has been reviewed by the Eustis Directorate, U. S. Army Air Mobility Research and Development Laboratory, and is judged to be technically sound.

The primary effort is to examine the behavior of rotary-wing aircraft in steep approaches, from the standpoint of aerodynamics and dynamics, and the resultant effects on human and automatic control.

The report is presented in four volumes. Volume I summarizes the main results of the study. Volume II describes the MOSTAB program. Volume III presents derivatives and transfer functions for the YHC-1A tandem-rotor helicopter and the S-58 single-rotor helicopter. Volume IV presents derivatives and transfer functions for the AH-56A compound helicopter and data on low-altitude turbulence representation.

The program was conducted under the technical management of Mr. William D. Vann, Aeromechanics Division.

Project 1F162214A142
Contract DAAJ02-69-C-0004
USAAVLABS Technical Report 70-74C
May 1971

STABILITY AND CONTROL OF HELICOPTERS IN STEEP APPROACHES

VOLUME III

DERIVATIVES AND TRANSFER FUNCTIONS FOR THE YHC-1A TANDEM-ROTOR HELICOPTER AND THE S-58 SINGLE-ROTOR HELICOPTER

MRI REPORT NO. 2284-1

By

Julian Wolkovitch
John A. Hoffman

NOT REPRODUCIBLE

Prepared by

Mechanics Research, Inc.
Los Angeles, California

for

EUSTIS DIRECTORATE
U.S. ARMY AIR MOBILITY RESEARCH AND DEVELOPMENT LABORATORY
FORT EUSTIS, VIRGINIA

Approved for public release;
distribution unlimited.

ABSTRACT

Derivatives and transfer functions are presented for the Boeing-Vertol YHC-1A tandem-rotor helicopter and for the Sikorsky S-58 single-rotor helicopter. The flight conditions considered for the YHC 1-A include forward speeds from 0 to 80 knots and descent rates from 0 to 25 fps. For the S-58 forward speeds of 0 to 100 knots and descent rates of 0 to 22.5 fps are considered.

FOREWORD

This research was performed by Mechanics Research, Inc. under United States Army Aviation Materiel Laboratories* Contract DAAJ02-69-C-0004, Project IF 162204A142. The AVLABS Project Monitor was Mr. W. D. Vann.

The authors express their gratitude to Mr. Vann and Mr. Robert P. Smith of AVLABS for constant encouragement and assistance. The authors also thank their colleagues at Mechanics Research, Inc. who contributed to this report: in particular Mr. D. W. Lochtie who gave significant technical support.

Published as received
by NTIS
Largely illegible

*Redesignated Eustis Directorate, U.S. Army Air Mobility Research and Development Laboratory

TABLE OF CONTENTS

	Page
ABSTRACT	iii
FOREWORD	v
LIST OF SYMBOLS	viii
PART V. YHC-1A DERIVATIVES AND TRANSFER FUNCTIONS	1
PART VI. DERIVATIVES AND TRANSFER FUNCTIONS FOR SIKORSKY S-58	135
DISTRIBUTION	289

LIST OF SYMBOLS

A	Polynomial coefficients
A_i	Coefficient of transfer function numerator for generalized degree of freedom i
A_{1s}	Lateral cyclic pitch, radians
B	Polynomial coefficient
B_i	Coefficient of transfer function numerator for generalized degree of freedom i
B_{1s}	Longitudinal cyclic pitch, radians
C	Polynomial coefficient
C_D	Drag coefficient, $(\text{Drag})/(1/2)\rho U_o^2 S_W$
C_i	Coefficient of transfer function numerator for generalized degree of freedom i
C_L	Lift coefficient, $(\text{Lift})/(1/2)\rho U_o^2 S_W$
D	Polynomial coefficient
D_i	Coefficient of transfer function numerator for generalized degree of freedom i
E	Polynomial coefficient
g	Acceleration due to gravity
i	Generalized degree of freedom
I_x, I_y, I_z	Moments of inertia
I_{xz}	Product of inertia referred to stability axes
j	$= \sqrt{-1}$
$\ell_{x,y,z}$	Distance from center of gravity to pilot's location

L	Roll acceleration
L_i'	$= \dfrac{L_i + \dfrac{I_{xz}}{I_x} N_i}{1 - \dfrac{I_{xz}^2}{I_x I_z}}$
m	Airplane mass
M	Pitch acceleration
N	Yaw acceleration
N_i'	$= \dfrac{N_i + \dfrac{I_{xz}}{I_z} L_i}{1 - \dfrac{I_{xz}^2}{I_x I_z}}$
p	Rate of roll
q	Rate of pitch
r	Yaw rate
s	$= \sigma + j\omega$, Laplace transfer complex variable
S	Wing Area
T	Thrust
T_i	Time constant of particular mode characterized by subscript
$T_{1/2}$	Time to half amplitude
u	Perturbation velocity along the x axis
U	Forward speed
U_o	Trim forward speed

v	Sideslip velocity
V	True air speed
w	Perturbation velocity along the z axis
W	Gross weight
X	Acceleration along X axis (forward acceleration)
y	Spanwise distance from airplane c.g.
Y	Acceleration along Y axis (side acceleration)
Z	Acceleration along Z axis (downward acceleration)
α	Angle of attack
γ	Flight path angle to horizontal
δ	Generalized input (due to control or gust)
ζ_i	Damping ratio of second-order mode, particularized by subscript
θ	Angle of pitch
θ_o	Main rotor collective pitch, radians
$\theta_{o_{TR}}$	Tail rotor collective pitch, radians
ρ	Air density (assumed sea level standard)
σ	Real part of Laplace transform complex variable s
φ	Angle of bank
ψ	Angle of yaw
ω	Imaginary part of Laplace transform complex variable s
ω_i	Undamped natural frequency of a second-order mode, particularized by subscript (e.g., ω_d, ω_p)

Special Subscripts:

a	Roll control (aileron, differential thrust or equivalent)
d	Dutch roll
DR	Yaw control
e	Pitch control (elevator, tail jet or equivalent)
o	Basic (unperturbed) condition
p	Phugoid
R	Roll subsidence
s	Spiral
sp	Short-period
φ	Bank angle

V. YHC-1A DERIVATIVES AND TRANSFER FUNCTIONS

INTRODUCTION

This part presents the derivatives and transfer functions for the YHC-1A. The format follows that of Reference 33 of the main text and is largely self-explanatory; however, the following points should be noted.

All derivatives are quoted in units of angular or linear acceleration per unit perturbation quantity. The derivatives in body axes were obtained from Reference 29 of the main text and are quoted at the head of the first page of the input for each case. The print-out also shows the derivatives in stability axes, and in stability axes "primed", i.e., with the product of inertias eliminated from explicit appearance in the equations of motion through the transformation

$$L_i = \frac{L_i + \frac{I_{xz}}{I_x} N_i}{1 - \frac{(I_{xz})^2}{I_x I_z}}, \quad N_i = \frac{N_i + \frac{I_{xz}}{I_z} L_i}{1 - \frac{(I_{xz})^2}{I_x I_z}}$$

where $i = u, w, p, q, r,$ or δ

Note that I_{xz}, I_x, I_z must be referred to stability axes in this transformation.

The input format also includes some redundant data (e.g., span) which are arbitrarily set to zero.

The transfer function data include:

(1) Damping ratios and undamped natural frequencies of oscillatory modes, denoted by Z and W, with appropriate subscripts; e.g., ZDR, WDR for the dutch roll mode.

(2) Coefficients of the denominator denoted by A,B,C,D,E,

(3) Coefficients of each numerator denoted by A,B,C,D with appropriate subscripts

(4) d.c. gain and root-locus gain

(5) roll to equivalent sideslip velocity ratio ϕ/V_e, where $V_e = U_o\beta(\sigma^{1/2})$, σ = air density ratio (=1 for the sea level conditions considered here).

The longitudinal controls are denoted in the print-out as 'cyclic' and 'collective'. The lateral controls are denoted as 'cyclic' and 'tail rotor'. These labels are not well-chosen for the YHC-1A tandem-rotor configuration, however they are standard for the print-out of the computer program employed.

For a full discussion of the derivatives and transfer functions, see the main text of this report.

COMPUTER PRINT-OUT DATA.

ROOTS OF A/C LATERAL DIRECTIONAL TRANSFER FUNCTIONS

RUN NO. L1

VERTOL YHC-1A LEVEL FLIGHT AT 80 KNOTS

INPUT DATA

DIMENSIONAL STABILITY DERIVATIVES
UNITS ARE 1 PER RADIAN
(BODY AXES DIFFER BY .2311+01 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

YV =	-.1512-00	LV =	-.2440-01	NV =	-.4150-02
YP =	-.1233+01	LP =	-.6255-00	NP =	-.5340-01
YR =	-.5820-01	LR =	.1170-01	NR =	-.5440-01
YVD =	-.0000	LVD =	-.0000	NVD =	-.0000
YPD =	-.0000	LPD =	-.0000	NPD =	-.0000
YRD =	-.0000	LRD =	-.0000	NRD =	-.0000
YA =	.9696-00	LA =	.4580-00	NA =	.2630-01
YDR=	.9850-01	LDR=	-.1391-00	NDR=	.1714-00

U =	.1350+03	UZ =	.5450+01	GAMA =	-.0000
MACH =	-.0000	RHO =	.2380-02	S =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
HT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02
SPAN =	-.0000				

DIMENSIONAL STABILITY DERIVATIVES,PER RADIAN,
STABILITY AXES

YV =	-.1512-00	LV =	-.2707-01	NV =	-.3994-02
YP =	-.1234+01	LP =	-.6761-00	NP =	-.5194-01
YR =	-.8431-02	LR =	.2157-01	NR =	-.5201-01
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.9696-00	LA =	.4911-00	NA =	.2375-01
YDR=	.9850-01	LDR=	-.8967-01	NDR=	.1709-00

DIMENSIONAL DERIVATIVES, PRIMED

YV =	-.1512-00	LV =	-.2584-01	NV =	-.2441-02
YP =	-.1234+01	LP =	-.6712-00	NP =	-.9819-02
YR =	-.8431-02	LR =	.5046-01	NR =	-.5709-01
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.9696-00	LA =	.4950-00	NA =	-.7805-02
YDR=	.9850-01	LDR=	-.1852-00	NDR=	.1888-00

IN STABILITY AXES, U= .1351+03
.IXX= .8731+04 IZZ= .7226+05 IXZ=-.4569+04

LATERAL DIRECTIONAL DENOMINATOR ROOTS

ROOTS (COMPLEX FORM)

.2806+000	.6421+000
.2806+000	-.6421+000
-.7683-001	.6085-031
-.1363+001	.1127-029

TS = -.130155+02 TR = -.733159-00
ZDR = -.400525-00 WDR = .700764-00 RAD/SEC
= .111530+00 CYCLES/SEC

DUTCH ROLL MODE

PERIOD = .97854+01 TIME TO DOUBLE AMP. = .24696+01
TIME TO TEN TIMES AMP. = .82038+01
CYCLES TO DOUBLE AMP. = .25238-00
CYCLES TO TEN TIMES AMP. = .83838-00

COEFFICIENTS

A = .10000+01 B = .87945-00 C = -.21292-00
D = .64870-00 E = .51462-01

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L1          NUMERATOR CHARACTERISTICS FOR CYCLIC

                SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     VO = 0.0
            ROOTS (COMPLEX FORM)
             -.5201-001          .0000
             -.5670+000          .4179+001
             -.5670+000         -.4179+001

  ZVB =  .134439-00  WVB =  .421796+01  1/TVB = -.520148-01
     D.C. GAIN =  .174357+02, ROOT LOCUS GAIN =  .969600-00

  AVB =  .969600-00  BVB =  .115007+01 CVB =  .173076+02
  DVB =  .897274-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PO = 0.0
            ROOTS (COMPLEX FORM)
              .0000              .0000
              .5426+000          .0000
             -.6995+000          .0000

  1/TPB1 =  .000000     1/TPB2 =  .542674-00  1/TPB3 = -.699558-00
     D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .495009-00

  APB =  .495009-00  BPB =  .776591-01 CPB = -.187921-00
  DPB =  .000000

                YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     NO = 0.0
            ROOTS (COMPLEX FORM)
              .4116+000         -.1446+001
              .4116+000          .1446+001
             -.2571+001         -.1879-030

  ZRB = -.273715-00  WRB =  .150399+01  1/TRB = -.257166+01
     D.C. GAIN = -.882299-00, ROOT LOCUS GAIN = -.780547-02

  ARB = -.780547-02  BRB = -.136466-01 CRB = -.112912-02
  DRB = -.434048-01
```

```
PHI/VE(SIDESLIP)=   .3221-01 PHI/BETA=   .4354+01
FOR ROOT(  .2807-00,  .6421-00 J)

PHI/VE(SIDESLIP)=   .3221-01 PHI/BETA=   .4354+01
FOR ROOT(  .2807-00, -.6421-00 J)

PHI/VE(SIDESLIP)=   .4481-00 PHI/BETA=   .6056+02
FOR ROOT( -.7683-01,  .6086-31 J)

PHI/VE(SIDESLIP)=   .2723-01 PHI/BETA=   .3680+01
FOR ROOT( -.1364+01,  .1128-29 J)


            (DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
                 BY AN ACCELEROMETER, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 AYO = 0.0
        ROOTS (COMPLEX FORM)
          .0000              .0000
          .1330+001          .0000
         -.6898+000          .9309+000
         -.6898+000         -.9309+000
         -.4928-001         -.8185-033

   WAY =  .115870+01     ZAY =  .595339-00
1/TAY1 =  .133078+01 1/TAY2 = -.689819-00
    D.C. GAIN = -.165924+01, ROOT LOCUS GAIN =  .969600-00

AAY =  .969600-00  BAY =  .951621-01 CAY = -.476079-00
DAY = -.175595+01  EAY = -.853876-01 FAY =  .000000

            (DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
                 INITIAL FLIGHT PATH, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 VGO = 0.0
        ROOTS (COMPLEX FORM)
          .5988+000          .0000
         -.6470+000          .0000
         -.2496-001          .4041+001
         -.2496-001         -.4041+001

   WVG =  .404142+01     ZVG =  .617835-02
1/TVG1 =  .598847-00 1/TVG2 = -.647054-00
    D.C. GAIN = -.119243+03, ROOT LOCUS GAIN =  .969600-00

AVG =  .969600-00  BVG =  .951621-01 CVG =  .154632+02
DVG =  .744673-00  EVG = -.613646+01
```

```
(DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
     PLANE, PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE,
     PHO = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
  .5426+000          .0000
 -.6995+000          .0000

1/TPH1 =  .000000     1/TPH2 =  .542674-00  1/TPH3 = -.699558-00
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .495009-00

APH =  .495009-00  BPH =  .776591-01 CPH = - .187921-00
DPH =  .000000

TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
     FROM ORIGINAL BODY AXES,
RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
     TO ORIGIN OF AXES ARE,
     LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L1          NUMERATOR CHARACTERISTICS FOR CYCLIC

SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VO=0.0
ROOTS (COMPLEX FORM)
 -.7347-002          .0000
 -.4092+000          .3796+001
 -.4092+000         -.3796+001

ZVB =  .107177+00  WVB =  .381850+01  1/TVB = -.734705-02
   D.C. GAIN =  .244880+01, ROOT LOCUS GAIN =  .117636+01

AVB =  .117636+01  BVB =  .971505-00 CVB =  .171595+02
DVB =  .126020-00

ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
PERTURBATIONS ABOUT AN INITIAL VALUE,
     PO = 0.0
ROOTS (COMPLEX FORM)
  .5363+000          .5125-018
  .9796-002          .1157-031
 -.7040+000          .1174-031

1/TPB1 =  .536385-00  1/TPB2 =  .979603-02  1/TPB3 = -.704077-00
   D.C. GAIN =  .355792-01, ROOT LOCUS GAIN =  .494921-00

APB =  .494921-00  BPB =  .781462-01 CPB = -.187723-00
DPB =  .183098-02
```

```
          YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
          PERTURBATIONS ABOUT AN INITIAL VALUE,
               NO = 0,0
       ROOTS (COMPLEX FORM)
         .2074+001          .0000
        -.6056+000          .1196+001
        -.6056+000         -.1196+001

 ZRB =  .451732-00  WRB =  .134078+01  1/TRB =  .207498+01
    D.C. GAIN = -.881581-00, ROOT LOCUS GAIN =  .121624-01

 ARB =  .121624-01  BRB = -.105039-01 CRB = -.870624-02
 DRB = -.453679-01


          (DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
               BY AN ACCELEROMETER ,PER DELTA CYCLIC
          PERTURBATIONS ABOUT AN INITIAL VALUE,
               AYO = 0,0
       ROOTS (COMPLEX FORM)
         .0000              .0000
        -.3407-001          .0000
         .1462+001          .0000
        -.6785+000          .9983+000
        -.6785+000         -.9983+000

   WAY =  .120711+01    ZAY =  .562110-00
1/TAY1 = -.340721-01 1/TAY2 =  .146203+01
    D.C. GAIN = -.165924+01, ROOT LOCUS GAIN =  .117636+01

 AAY =  .117636+01  BAY = -.834035-01 CAY = -.624085-00
 DAY = -.252720+01  EAY = -.853876-01 FAY =  .000000

          (DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
               INITIAL FLIGHT PATH, PER DELTA CYCLIC
          PERTURBATIONS ABOUT AN INITIAL VALUE,
               VGO = 0,0
       ROOTS (COMPLEX FORM)
         .6255+000          .0000
        -.6219+000          .0000
         .3363-001          .3661+001
         .3363-001         -.3661+001

   WVG =  .366169+01    ZVG = -.918464-02
1/TVG1 =  .625566-00 1/TVG2 = -.621929-00
    D.C. GAIN = -.119243+03, ROOT LOCUS GAIN =  .117636+01

 AVG =  .117636+01  BVG = -.834035-01 CVG =  .153152+02
 DVG = -.265809-01  EVG = -.613646+01
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L1          NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     V0 = 0.0
            ROOTS (COMPLEX FORM)
             -.1446-002          .0000
             -.9203+000          .0000
              .2569+003          .0000

  1/TVB1 = -.144639-02  1/TVB2 = -.920399-00  1/TVB3 =  .256961+03
     D.C. GAIN = -.654738-00, ROOT LOCUS GAIN =  .989000-01

  AVB =  .989000-01  BVB = -.252199+02 CVB = -.233324+02
  DVB = -.336941-01

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     P0 = 0.0
            ROOTS (COMPLEX FORM)
              .0000              .0000
              .1888+001          .0000
             -.2059+001          .0000

  1/TPB1 =  .000000     1/TPB2 =  .188847+01  1/TPB3 = -.205906+01
     D.C. GAIN =  .000000   , ROOT LOCUS GAIN = -.185206-00

  APB = -.185206-00  BPB = -.315945-01 CPB =  .720169-00
  DPB =  .000000

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     N0 = 0.0
            ROOTS (COMPLEX FORM)
              .2393+000         -.7980+000
              .2393+000          .7980+000
             -.1309+001         -.6384-030

  ZRB = -.287281-00  WRB =  .833209-00  1/TRB = -.130945+01
     D.C. GAIN =  .333543+01, ROOT LOCUS GAIN =  .188817-00

  ARB =  .188817-00  BRB =  .156853-00 CRB =  .127197-01
  DRB =  .171647-00
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000                .0000
 -.3239-002            .7215-021
 -.7344+000           -.9606-035
 -.1147+001            .5989+001
 -.1147+001           -.5989+001

   WAY =  .609812+01     ZAY =  .188194-00
1/TAY1 = -.323990-02 1/TAY2 = -.734469-00
   D.C. GAIN =  .169375-00, ROOT LOCUS GAIN =  .985000-01

 AAY =  .985000-01  BAY =  .298748-00 CAY =  .382995+01
 DAY =  .270271+01  EAY =  .871634-02 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
  .2947+001            .2186+001
  .2947+001           -.2186+001
 -.2903+001            .2197-028
 -.6023+001            .7801-028

   WVG =  .366947+01     ZVG = -.803132-00
1/TVG1 = -.290391+01 1/TVG2 = -.602320+01
   D.C. GAIN =  .450783+03, ROOT LOCUS GAIN =  .985000-01

 AVG =  .985000-01  BVG =  .298748-00 CVG = -.213368+01
 DVG =  .168537+01  EVG =  .231981+02

(DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
     PLANE, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     PHO = 0.0
ROOTS (COMPLEX FORM)
  .0000                .0000
  .1888+001            .0000
 -.2059+001            .0000

 1/TPH1 =  .000000     1/TPH2 =  .188847+01  1/TPH3 = -.205906+01
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN = -.185206-00

 APH = -.185206-00  BPH = -.315945-01 CPH =  .720169-00
 DPH =  .000000
```

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES,
                RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE,
                     LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L1            NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE,
                     V0=0.0
            ROOTS (COMPLEX FORM)
              .1145+000          .0000
             -.9920+000          .0000
              .7979+001          .0000

  1/TVB1 =  .114515+00  1/TVB2 = -.992097-00  1/TVB3 =  .797997+01
     D.C. GAIN =  .560014+02, ROOT LOCUS GAIN =  .317882+01

  AVB =  .317882+01  BVB = -.225772+02 CVB = -.226227+02
  DVB =  .288194+01

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE,
                     P0 = 0.0
            ROOTS (COMPLEX FORM)
              .9631-002          .0000
              .1830+001          .0000
             -.2037+001          .0000

  1/TPB1 =  .963115-02  1/TPB2 =  .183096+01  1/TPB3 = -.203727+01
     D.C. GAIN = -.134503-00, ROOT LOCUS GAIN = -.192669-00

  APB = -.192669-00  BPB = -.378940-01 CPB =  .719070-00
  DPB = -.692179-02

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE,
                     N0 = 0.0
            ROOTS (COMPLEX FORM)
              .2041+000          .8401+000
              .2041+000         -.8401+000
             -.1266+001         -.3722-029

  ZRB = -.236154-00  WRB =  .864580-00  1/TRB = -.126627+01
     D.C. GAIN =  .333271+01, ROOT LOCUS GAIN =  .181195-00

  ARB =  .181195-00  BRB =  .155452-00 CRB =  .417506-01
  DRB =  .171508-00
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER ,PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
 -.1553-002          .4715-028
  .8523-001          .1267+001
  .8523-001         -.1267+001
 -.1094+001          .7867-031

  WAY =  .127012+01     ZAY = -.671050-01
1/TAY1 = -.155335-02 1/TAY2 =  .852314-01
   D.C. GAIN =  .169375-00, ROOT LOCUS GAIN =  .317882+01

AAY =  .317882+01  BAY =  .294143+01 CAY =  .453971+01
DAY =  .561835+01  EAY =  .871634-02 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
  .1001+001          .1221+001
  .1001+001         -.1221+001
 -.1464+001         -.8834+000
 -.1464+001          .8834+000

WVG1 =  .157956+01  ZVG1 = -.634193-00
WVG2 =  .171024+01  ZVG2 =  .856260-00
   D.C. GAIN =  .450783+03, ROOT LOCUS GAIN =  .317882+01

AVG =  .317882+01  BVG =  .294143+01 CVG = -.142392+01
DVG =  .460100+01  EVG =  .231981+02
```

ROOTS OF A/C LATERAL DIRECTIONAL TRANSFER FUNCTIONS

RUN NO. L2

VERTOL YHC-1A 1500 FT/MIN DESCENT 80 KNOTS

INPUT DATA

DIMENSIONAL STABILITY DERIVATIVES
UNITS ARE 1 PER RADIAN
(BODY AXES DIFFER BY .1372+02 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

YV =	-.1826-00	LV =	-.2890-02	NV =	-.7100-02
YP =	-.1733+01	LP =	-.7973-00	NP =	-.5920-01
YR =	-.1924-00	LR =	-.5690-01	NR =	-.3700-01
YVD =	-.0000	LVD =	-.0000	NVD =	-.0000
YPD =	-.0000	LPD =	-.0000	NPD =	-.0000
YRD =	-.0000	LRD =	-.0000	NRD =	-.0000
YA =	.8768-00	LA =	.4263-00	NA =	.2310-01
YDR=	.7000-01	LDR=	-.1326-00	NDR=	.1554-00

U =	.1333+03	UZ =	.3255+02	GAMA =	-.1050+02
MACH =	-.0000	RHO =	.2380-02	S =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
WT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02
SPAN =	-.0000				

DIMENSIONAL STABILITY DERIVATIVES,PER RADIAN,
STABILITY AXES

YV =	-.1826-00	LV =	-.1554-01	NV =	-.6833-02
YP =	-.1729+01	LP =	-.8654-00	NP =	-.4057-01
YR =	.2242-00	LR =	.8721-01	NR =	-.2543-01
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.8768-00	LA =	.4451-00	NA =	.9509-02
YDR=	.7000-01	LDR=	.1546-00	NDR=	.1555-00

DIMENSIONAL DERIVATIVES, PRIMED

YV =	-.1826-00	LV =	-.2371-01	NV =	-.1095-01
YP =	-.1729+01	LP =	-.9972-00	NP =	-.1701-00
YR =	.2242-00	LR =	.7242-01	NR =	-.1908-01
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.8768-00	LA =	.5021-00	NA =	.7398-01
YDR=	.7000-01	LDR=	.3192-00	NDR=	.2124-00

IN STABILITY AXES, U= .1372+03
.IXX= .9446+04 IZZ= .7154+05 IXZ= .8109+04

LATERAL DIRECTIONAL DENOMINATOR ROOTS

ROOTS (COMPLEX FORM)

.7719+000	.0000
-.1404+000	-.3912-016
.2330-002	-.7074-028
-.1832+001	.1431-026

T1 = .129536+01 T2 = -.712123+01 T3 = .429027+03
T4 = -.545619-00

COEFFICIENTS

A =	.10000+01	B =	.11989+01	C =	-.12687+01
D =	-.19573-00	E =	.46311-03		

```
                TRANSFER FUNCTIONS FOR STABILITY AXES.
                     ORIGIN AT AIRPLANE C.G.

RUN NO. L2            NUMERATOR CHARACTERISTICS FOR CYCLIC

                SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE.
                     VO = 0.0
            ROOTS (COMPLEX FORM)
             -.3113-001          .0000
              .2119+001          .0000
              .9381+001          .0000

  1/TVB1 = -.311359-01  1/TVB2 =  .211945+01  1/TVB3 =  .938190+01
     D.C. GAIN =  .117219+04, ROOT LOCUS GAIN =  .876800-00

  AVB =  .876800-00  BVB = -.100571+02 CVB =  .171207+02
  DVB =  .542846-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE.
                     PO = 0.0
            ROOTS (COMPLEX FORM)
              .9233+000          .0000
             -.4273-001          .0000
             -.1051+001          .0000

  1/TPB1 =  .923368-00  1/TPB2 = -.427383-01  1/TPB3 = -.105153+01
     D.C. GAIN = -.449948+02, ROOT LOCUS GAIN =  .502146-00

  APB =  .502146-00  BPB =  .858158-01 CPB = -.484806-00
  DPB = -.208373-01

                YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE.
                     NO = 0.0
            ROOTS (COMPLEX FORM)
              .1195+001          .0000
             -.5443+000         -.9907+000
             -.5443+000          .9907+000

  ZRB =  .481513-00  WRB =  .113046+01  1/TRB =  .119566+01
     D.C. GAIN = -.242770+03, ROOT LOCUS GAIN =  .735798-01

  ARB =  .735798-01  BRB = -.787282-02 CRB = -.174608-02
  DRB = -.112428+00
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER, PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000                .0000
  .1258+001            .0000
 -.3543-001            .2294-023
 -.6336+000           -.1359+001
 -.6336+000            .1359+001

   WAY =  .149952+01     ZAY =  .422598-00
1/TAY1 =  .125803+01 1/TAY2 = -.354362-01
    D.C. GAIN = -.189786+03, ROOT LOCUS GAIN =  .876800-00

 AAY =  .876800-00  BAY =  .392810-01 CAY =  .573856-00
 DAY = -.245994+01  EAY = -.878911-01 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
  .9474+000            .0000
 -.9667+000            .0000
 -.1278-001            .4382+001
 -.1278-001           -.4382+001

   WVG =  .438289+01     ZVG =  .291774-02
1/TVG1 =  .947476-00 1/TVG2 = -.966700-00
    D.C. GAIN = -.333121+05, ROOT LOCUS GAIN =  .876800-00

 AVG =  .876800-00  BVG =  .392810-01 CVG =  .160404+02
 DVG =  .303255-00  EVG = -.154270+02


 PHI/VE(SIDESLIP)=   .1791-01 PHI/BETA=   .2457+01
 FOR ROOT(  .7720-00,  .0000    J)

 PHI/VE(SIDESLIP)=   .1642-00 PHI/BETA=   .2253+02
 FOR ROOT( -.1404-00, -.3913-16 J)

 PHI/VE(SIDESLIP)=   .1617+02 PHI/BETA=   .2219+04
 FOR ROOT(  .2331-02, -.7074-28 J)

 PHI/VE(SIDESLIP)=   .1508-01 PHI/BETA=   .2070+01
 FOR ROOT( -.1833+01,  .1431-26 J)
```

```
                (DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
                     PLANE, PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PHO = 0.0
            ROOTS (COMPLEX FORM)
              .0000              .0000
              .9105+000          .0000
             -.1089+001          .0000

  1/TPH1 =  .000000     1/TPH2 =  .910541-00  1/TPH3 = -.108920+01
     D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .480329-00

  APH =  .480329-00  BPH =  .858135-01 CPH = -.476370-00
  DPH =  .000000

                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES,
                RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE,
                     LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L2           NUMERATOR CHARACTERISTICS FOR CYCLIC

                SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT AN INITIAL VALUE,
                     VO=0.0
            ROOTS (COMPLEX FORM)
              .9838-001          .0000
              .1145+001          .1462+001
              .1145+001         -.1462+001

  ZVB = -.616874-00  WVB =  .185774+01  1/TVB =  .983858-01
     D.C. GAIN = -.301856+04, ROOT LOCUS GAIN =  .411694+01

  AVB =  .411694+01  BVB = -.984103+01 CVB =  .151368+02
  DVB = -.139791+01

                ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT AN INITIAL VALUE,
                     PO = 0.0
            ROOTS (COMPLEX FORM)
              .9061+000          .0000
              .1369-001          .0000
             -.1101+001          .0000

  1/TPB1 =  .906162-00  1/TPB2 =  .136954-01  1/TPB3 = -.110107+01
     D.C. GAIN =  .138785+02, ROOT LOCUS GAIN =  .470359-00

  APB =  .470359-00  BPB =  .852339-01 CPB = -.470554-00
  DPB =  .642722-02
```

```
YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
PERTURBATIONS ABOUT AN INITIAL VALUE,
     NO = 0.0
ROOTS (COMPLEX FORM)
  .1053+001          .0000
 -.5602+000          .5045+000
 -.5602+000         -.5045+000

ZRB =  .743074-00  WRB =  .753929-00  1/TRB =  .105377+01
   D.C. GAIN = -.246514+03, ROOT LOCUS GAIN =  .190597-00

ARB =  .190597-00  BRB =  .127088-01 CRB = -.116700+00
DRB = -.114162+00

(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER ,PER DELTA CYCLIC
PERTURBATIONS ABOUT AN INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
  .1116+001          .0000
 -.5793+000          .7843+000
 -.5793+000         -.7843+000
 -.2010-001         -.1155-032

   WAY =  .975134-00    ZAY =  .594171-00
1/TAY1 =  .111688+01 1/TAY2 = -.579396-00
   D.C. GAIN = -.189786+03, ROOT LOCUS GAIN =  .411694+01

AAY =  .411694+01  BAY =  .255330-00 CAY = -.141005+01
DAY = -.440069+01  EAY = -.878911-01 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA CYCLIC
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
  .9678+000          .0000
 -.6425-001          .2071+001
 -.6425-001         -.2071+001
 -.9013+000          .1482-030

   WVG =  .207250+01    ZVG =  .310054-01
1/TVG1 =  .967866-00 1/TVG2 = -.642588-01
   D.C. GAIN = -.333121+05, ROOT LOCUS GAIN =  .411694+01

AVG =  .411694+01  BVG =  .255330-00 CVG =  .140565+02
DVG = -.163750+01  EVG = -.154270+02
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L2            NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     VO = 0.0
            ROOTS (COMPLEX FORM)
             -.2009-001          .0000
             -.4104+000          .0000
              .4229+003          .0000

  1/TVB1 = -.200954-01  1/TVB2 = -.410465-00  1/TVB3 =  .422902+03
     D.C. GAIN = -.527266+03, ROOT LOCUS GAIN =  .700000-01

  AVB =  .700000-01  BVB = -.295730+02 CVB = -.127454+02
  DVB = -.244180-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PO = 0.0
            ROOTS (COMPLEX FORM)
             -.1010+000         -.8421+000
             -.1010+000          .8421+000
             -.4263-001         -.6162-032

  ZPB =  .119103+00  WPB =  .848140-00  1/TPB = -.426318-01
     D.C. GAIN =  .211381+02, ROOT LOCUS GAIN =  .319211-00

  APB =  .319211-00  BPB =  .780994-01 CPB =  .232371-00
  DPB =  .978918-02

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     NO = 0.0
            ROOTS (COMPLEX FORM)
              .5800-001          .4863+000
              .5800-001         -.4863+000
             -.1036+001          .2557-030

  ZRB = -.118424+00  WRB =  .489828-00  1/TRB = -.103660+01
     D.C. GAIN =  .114051+03, ROOT LOCUS GAIN =  .212363-00

  ARB =  .212363-00  BRB =  .195499-00 CRB =  .254137-01
  DRB =  .528177-01
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
 -.2192-001          -.9209-019
 -.9423-007           .6103-041
 -.3349+000           .1296-041
  .3272+001          -.8135+001
  .3272+001           .8135+001

  WAY =  .876926+01    ZAY = -.373220-00
1/TAY1 = -.942318-07 1/TAY2 = -.334909-00
   D.C. GAIN =  .853660+02, ROOT LOCUS GAIN =  .700000-01

AAY =  .700000-01  BAY = -.433222-00 CAY =  .522000+01
DAY =  .191749+01  EAY =  .395334-01 FAY =  .372529-08

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
 -.1226+000           .7049+000
 -.1226+000          -.7049+000
  .3217+001          -.1385+002
  .3217+001           .1385+002

WVG1 =  .715546-00  ZVG1 =  .171475-00
WVG2 =  .142202+02  ZVG2 = -.226237-00
   D.C. GAIN =  .156497+05, ROOT LOCUS GAIN =  .700000-01

AVG =  .700000-01  BVG = -.433222-00 CVG =  .140803+02
DVG =  .324299+01  EVG =  .724746+01

(DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
     PLANE, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     PHO = 0.0
ROOTS (COMPLEX FORM)
  .0000               .0000
 -.7480-001          -.8988+000
 -.7480-001           .8988+000

ZPH =  .829320-01  WPH =  .901946-00  1/TPH =  .000000
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .275165-00

APH =  .275165-00  BPH =  .411648-01 CPH =  .223849-00
DPH =  .000000
```

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES,
                RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE,
                     LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L2          NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE,
                     V0=0.0
            ROOTS (COMPLEX FORM)
              .5240-001          .0000
             -.4551+000          .0000
              .5753+001          .0000

  1/TVB1 =  .524026-01  1/TVB2 = -.455158-00  1/TVB3 =  .575376+01
     D.C. GAIN =  .144150+04, ROOT LOCUS GAIN =  .486441+01

  AVB =  .486441+01  BVB = -.260294+02 CVB = -.113886+02
  DVB =  .667569-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE,
                     P0 = 0.0
            ROOTS (COMPLEX FORM)
             -.6363-001          .9184+000
             -.6363-001         -.9184+000
              .1371-001         -.1348-032

  ZPB =  .691197-01  WPB =  .920697-00  1/TPB =  .137146-01
     D.C. GAIN = -.652000+01, ROOT LOCUS GAIN =  .259724-00

  APB =  .259724-00  BPB =  .294947-01 CPB =  .219710-00
  DPB = -.301949-02

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE,
                     R0 = 0.0
            ROOTS (COMPLEX FORM)
             -.1195-001          .5155+000
             -.1195-001         -.5155+000
             -.7192+000          .8474-032

  ZRB =  .231779-01  WRB =  .515651-00  1/TRB = -.715201-00
     D.C. GAIN =  .115810+03, ROOT LOCUS GAIN =  .262024-00

  ARB =  .262024-00  BRB =  .238445-00 CRB =  .798104-01
  DRB =  .536322-01
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER ,PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
 -.4451+000          .3868-020
 -.9423-007          .5883-033
 -.8989-001         -.1120+001
 -.8989-001          .1120+001
 -.1445-001         -.2118-032

   WAY =  .112381+01     ZAY =  .799956-01
1/TAY1 = -.942320-07 1/TAY2 = -.898998-01
   D.C. GAIN =  .853660+02, ROOT LOCUS GAIN =  .486441+01

AAY =  .486441+01  BAY =  .311035+01 CAY =  .657678+01
DAY =  .282924+01  EAY =  .395334-01 FAY =  .372529-08

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
 -.1253+000          .7658+000
 -.1253+000         -.7658+000
 -.1944+000         -.1560+001
 -.1944+000          .1560+001

WVG1 =  .776066-00  ZVG1 =  .161460-00
WVG2 =  .157282+01  ZVG2 =  .123600+00
   D.C. GAIN =  .156497+05, ROOT LOCUS GAIN =  .486441+01

AVG =  .486441+01  BVG =  .311035+01 CVG =  .154371+02
DVG =  .415474+01  EVG =  .724746+01
```

ROOTS OF A/C LATERAL DIRECTIONAL TRANSFER FUNCTIONS

RUN NO. L3

VERTOL YHC-1A LEVEL FLIGHT AT 60 KNOTS

INPUT DATA

DIMENSIONAL STABILITY DERIVATIVES
UNITS ARE 1 PER RADIAN
(BODY AXES DIFFER BY .4712+01 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

YV =	-.1182+00	LV =	-.1720-01	NV =	-.2900-02
YP =	-.1248+01	LP =	-.6527-00	NP =	-.3950-01
YR =	-.1281-00	LR =	-.2270-01	NR =	-.5020-01
YVD =	-.0000	LVD =	-.0000	NVD =	-.0000
YPD =	-.0000	LPD =	-.0000	NPD =	-.0000
YRD =	-.0000	LRD =	-.0000	NRD =	-.0000
YA =	.9643-00	LA =	.4558-00	NA =	.2660-01
YDR=	.1059+00	LDR=	-.1354-00	NDR=	.1703-00
U =	.1007+03	UZ =	.8300+01	GAMA =	.0000
MACH =	-.0000	RHO =	.2380-02	S =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
HT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02
SPAN =	-.0000				

DIMENSIONAL STABILITY DERIVATIVES,PER RADIAN,
STABILITY AXES

YV =	-.1182+00	LV =	-.2067-01	NV =	-.2681-02
YP =	-.1254+01	LP =	-.7375-00	NP =	-.3610-01
YR =	-.2515-01	LR =	.9896-03	NR =	-.4647-01
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.9643-00	LA =	.5127-00	NA =	.2149-01
YDR=	.1059+00	LDR=	-.2809-01	NDR=	.1694-00

DIMENSIONAL DERIVATIVES, PRIMED

YV =	-.1182+00	LV =	-.2019-01	NV =	-.2167-02
YP =	-.1254+01	LP =	-.7337-00	NP =	-.1703-01
YR =	-.2515-01	LR =	.1146-01	NR =	-.4705-01
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.9643-00	LA =	.5108-00	NA =	.8192-02
YDR=	.1059+00	LDR=	-.6641-01	NDR=	.1721-00

IN STABILITY AXES, U= .1010+03
.IXX= .8460+04 IZZ= .7253+05 IXZ=-.1895+04

LATERAL DIRECTIONAL DENOMINATOR ROOTS

ROOTS (COMPLEX FORM)

.2253+000	.6039+000
.2253+000	-.6039+000
-.5847-001	.1571-030
-.1291+001	.9552-030

TS = -.171021+02 TR = -.774435-00
ZDR = -.349603-00 WDR = .644670-00 RAD/SEC
= .102602+00 CYCLES/SEC

DUTCH ROLL MODE

PERIOD = .10403+02 TIME TO DOUBLE AMP, = .30755+01
TIME TO TEN TIMES AMP, = .10217+02
CYCLES TO DOUBLE AMP, = .29564-00
CYCLES TO TEN TIMES AMP, = .98210-00

COEFFICIENTS

A =	.10000+01	B =	.89898-00	C =	-.11730+00
D =	.52692-00	E =	.31379-01		

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L3          NUMERATOR CHARACTERISTICS FOR CYCLIC

                SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     VO = 0.0
           ROOTS (COMPLEX FORM)
            -.4635-001          .0000
             .3943+000          .4150+001
             .3943+000         -.4150+001

  ZVB = -.945856-01  WVB =  .416893+01  1/TVB = -.463569-01
     D.C. GAIN =  .247591+02, ROOT LOCUS GAIN =  .964300-00

  AVB =  .964300-00  BVB = -.715785-00 CVB =  .167243+02
  DVB =  .776919-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PO = 0.0
           ROOTS (COMPLEX FORM)
             .0000              .0000
             .3682+000          .0000
            -.4956+000          .0000

  1/TPB1 =  .000000     1/TPB2 =  .368286-00  1/TPB3 = -.495615-00
     D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .510842-00

  APB =  .510842-00  BPB =  .650449-01 CPB = -.932430-01
  DPB =  .000000

                YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     NO = 0.0
           ROOTS (COMPLEX FORM)
             .1728+001          .0000
            -.6314+000          .1320+001
            -.6314+000         -.1320+001

  ZRB =  .431529-00  WRB =  .146333+01  1/TRB =  .172825+01
     D.C. GAIN = -.966140-00, ROOT LOCUS GAIN =  .819202-02

  ARB =  .819202-02  BRB = -.381183-02 CRB = -.338611-03
  DRB = -.303166-01
```

```
PHI/VE(SIDESLIP)=   .2765-01 PHI/BETA=   .2793+01
FOR ROOT(  .2254-00,  .6040-00 J)

PHI/VE(SIDESLIP)=   .2765-01 PHI/BETA=   .2793+01
FOR ROOT(  .2254-00, -.6040-00 J)

PHI/VE(SIDESLIP)=   .4680-00 PHI/BETA=   .4729+02
FOR ROOT( -.5847-01,  .1572-30 J)

PHI/VE(SIDESLIP)=   .2800-01 PHI/BETA=   .2829+01
FOR ROOT( -.1291+01,  .9553-30 J)


            (DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
                 BY AN ACCELEROMETER, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 AYO = 0.0
        ROOTS (COMPLEX FORM)
          .0000              .0000
          .1128+001          .0000
         -.5998+000          .9366+000
         -.5998+000         -.9366+000
         -.4515-001          .1316-031

   WAY =  .111225+01    ZAY =  .539350-00
1/TAY1 =  .112885+01 1/TAY2 = -.599891-00
    D.C. GAIN = -.193793+01, ROOT LOCUS GAIN =  .964300-00

 AAY =  .964300-00  BAY =  .111949+00 CAY = -.109997+00
 DAY = -.135174+01  EAY = -.608105-01 FAY =  .000000

            (DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
                 INITIAL FLIGHT PATH, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 VGO = 0.0
        ROOTS (COMPLEX FORM)
          .4084+000          .0000
         -.4541+000          .0000
         -.3517-001          .4138+001
         -.3517-001         -.4138+001

   WVG =  .413839+01    ZVG =  .850080-02
1/TVG1 =  .408417-00 1/TVG2 = -.454151-00
    D.C. GAIN = -.976202+02, ROOT LOCUS GAIN =  .964300-00

 AVG =  .964300-00  BVG =  .111949+00 CVG =  .163391+02
 DVG =  .742706-00  EVG = -.306324+01
```

```
            (DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
                 PLANE, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 PHO = 0,0
         ROOTS (COMPLEX FORM)
           .0000              .0000
           .3682+000          .0000
          -.4956+000          .0000

1/TPH1 =  .000000     1/TPH2 =  .368286-00  1/TPH3 = -.495615-00
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .510842-00

APH =  .510842-00  BPH =  .650449-01 CPH = -.932430-01
DPH =  .000000


            TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                 FROM ORIGINAL BODY AXES,
            RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                 TO ORIGIN OF AXES ARE,
                 LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L3          NUMERATOR CHARACTERISTICS FOR CYCLIC

            SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 VO=0,0
         ROOTS (COMPLEX FORM)
          -.1586-001          .0000
           .1977+000          .3016+001
           .1977+000         -.3016+001

ZVB = -.654093-01  WVB =  .302299+01  1/TVB = -.158604-01
   D.C. GAIN =  .839026+01, ROOT LOCUS GAIN =  .181646+01

AVB =  .181646+01  BVB = -.689535-00 CVB =  .165883+02
DVB =  .263279-00

            ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 PO = 0,0
         ROOTS (COMPLEX FORM)
           .2744-001          .1300-025
           .3517+000         -.7679-042
          -.5073+000          .1154-039

1/TPB1 =  .274481-01  1/TPB2 =  .351748-00  1/TPB3 = -.507309-00
   D.C. GAIN =  .793631-01, ROOT LOCUS GAIN =  .508443-00

APB =  .508443-00  BPB =  .651382-01 CPB = -.929001-01
DPB =  .249034-02
```

```
          YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
          PERTURBATIONS ABOUT AN INITIAL VALUE,
               NO = 0.0
       ROOTS (COMPLEX FORM)
         .8967+000          .0000
        -.4637+000          .6760+000
        -.4637+000         -.6760+000

ZRB =  .565650-00  WRB =  .819865-00  1/TRB =  .896710-00
   D.C. GAIN = -.962875-00, ROOT LOCUS GAIN =  .501272-01

ARB =  .501272-01  BRB =  .154414-02 CRB = -.799686-02
DRB = -.302142-01

          (DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
               BY AN ACCELEROMETER ,PER DELTA CYCLIC
          PERTURBATIONS ABOUT AN INITIAL VALUE,
               AYO = 0.0
       ROOTS (COMPLEX FORM)
         .0000              .0000
         .1037+001          .0000
        -.5405+000          .8324+000
        -.5405+000         -.8324+000
        -.3274-001         -.4391-031

   WAY =  .992574-00     ZAY =  .544617-00
1/TAY1 =  .103781+01 1/TAY2 = -.540573-00
   D.C. GAIN = -.193793+01, ROOT LOCUS GAIN =  .181646+01

 AAY =  .181646+01  BAY =  .138199-00 CAY = -.245944-00
 DAY = -.186538+01  EAY = -.608105-01 FAY =  .000000

          (DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
               INITIAL FLIGHT PATH, PER DELTA CYCLIC
          PERTURBATIONS ABOUT AN INITIAL VALUE,
               VGO = 0.0
       ROOTS (COMPLEX FORM)
         .4228+000          .0000
        -.4379+000          .8372-026
        -.3049-001          .3017+001
        -.3049-001         -.3017+001

   WVG =  .301736+01     ZVG =  .101065-01
1/TVG1 =  .422897-00 1/TVG2 = -.437989-00
   D.C. GAIN = -.976202+02, ROOT LOCUS GAIN =  .181646+01

 AVG =  .181646+01  BVG =  .138199-00 CVG =  .162032+02
 DVG =  .229065-00  EVG = -.306324+01
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L3          NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     VO = 0.0
           ROOTS (COMPLEX FORM)
            -.2476-002          .0000
            -.8641+000          .0000
             .1635+003          .0000

  1/TVB1 = -.247611-02  1/TVB2 = -.864157-00  1/TVB3 =  .163582+03
     D.C. GAIN = -.118128+01, ROOT LOCUS GAIN =  .105900+00

  AVB =  .105900+00  BVB = -.172316+02 CVB = -.150128+02
  DVB = -.370677-01

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PO = 0.0
           ROOTS (COMPLEX FORM)
             .0000              .0000
             .2263+001          .0000
            -.2431+001          .0000

  1/TPB1 =  .000000     1/TPB2 =  .226356+01  1/TPB3 = -.243128+01
     D.C. GAIN =  .000000   , ROOT LOCUS GAIN = -.664099-01

  APB = -.664099-01  BPB = -.111384-01 CPB =  .365477-00
  DPB =  .000000

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE.
                     NO = 0.0
           ROOTS (COMPLEX FORM)
             .1940+000         -.7112+000
             .1940+000          .7112+000
            -.1245+001         -.6101-030

  ZRB = -.263164-00  WRB =  .737279-00  1/TRB = -.124522+01
     D.C. GAIN =  .371323+01, ROOT LOCUS GAIN =  .172140-00

  ARB =  .172140-00  BRB =  .147553-00 CRB =  .103922-01
  DRB =  .116518+00
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000                .0000
 -.3498-002           -.3510-018
 -.6915+000           -.1281-036
 -.4197+000            .4296+001
 -.4197+000           -.4296+001

   WAY =  .431691+01     ZAY =  .963088-01
1/TAY1 = -.349866-02 1/TAY2 = -.691538-00
   D.C. GAIN =  .152139-00, ROOT LOCUS GAIN =  .105900+00

AAY =  .105900+00  BAY =  .161654-00 CAY =  .203461+01
DAY =  .137163+01  EAY =  .477397-02 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     VGC = 0.0
ROOTS (COMPLEX FORM)
  .2000+001            .2424+001
  .2000+001           -.2424+001
 -.2763+001           -.1902+001
 -.2763+001            .1902+001

WVG1 =  .314283+01  ZVG1 = -.636481-00
WVG2 =  .335488+01  ZVG2 =  .823753-00
   D.C. GAIN =  .375190+03, ROOT LOCUS GAIN =  .105900+00

AVG =  .105900+00  BVG =  .161654-00 CVG = -.103786+00
DVG =  .101297+01  EVG =  .117731+02

(DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
     PLANE, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     PHO = 0.0
ROOTS (COMPLEX FORM)
  .0000                .0000
  .2263+001            .0000
 -.2431+001            .0000

1/TPH1 =  .000000     1/TPH2 =  .226356+01  1/TPH3 = -.243128+01
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN = -.664099-01

APH = -.664099-01  BPH = -.111384-01 CPH =  .365477-00
DPH =  .000000
```

```
            TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                 FROM ORIGINAL BODY AXES,
            RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                 TO ORIGIN OF AXES ARE,
                 LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L3          NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

            SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 VO=0.0
         ROOTS (COMPLEX FORM)
           .1205+000          .0000
          -.9371+000          .0000
           .5850+001          .0000

 1/TVB1 =  .120596+00  1/TVB2 = -.937148-00  1/TVB3 =  .585034+01
    D.C. GAIN =  .617302+02, ROOT LOCUS GAIN =  .292965+01

 AVB =  .292965+01  BVB = -.147472+02 CVB = -.143263+02
 DVB =  .193704+01

            ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 PO = 0.0
         ROOTS (COMPLEX FORM)
           .2638-001          .0000
           .1973+001          .0000
          -.2288+001          .0000

 1/TPB1 =  .263876-01  1/TPB2 =  .197310+01  1/TPB3 = -.228858+01
    D.C. GAIN = -.305021-00, ROOT LOCUS GAIN = -.803258-01

 APB = -.803258-01  BPB = -.232215-01 CPB =  .363388-00
 DPB = -.957129-02

            YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 NO = 0.0
         ROOTS (COMPLEX FORM)
           .1488+000          .7559+000
           .1488+000         -.7559+000
          -.1177+001          .1172-027

 ZRB = -.193206-00  WRB =  .770518-00  1/TRB = -.117755+01
    D.C. GAIN =  .370068+01, ROOT LOCUS GAIN =  .166103-00

 ARB =  .166103-00  BRB =  .146140-00 CRB =  .403790-01
 DRB =  .116124+00
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER ,PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
  .7484-001         -.1038+001
  .7484-001          .1038+001
 -.1428-002         -.1271-031
 -.1051+001          .7857-031

   WAY =  .104158+01     ZAY = -.718530-01
1/TAY1 = -.142854-02 1/TAY2 = -.105144+01
    D.C. GAIN =  .152139-00, ROOT LOCUS GAIN =  .292965+01

AAY =  .292965+01  BAY =  .264603+01 CAY =  .272106+01
DAY =  .334574+01  EAY =  .477397-02 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
  .7784+000          .1099+001
  .7784+000         -.1099+001
 -.1230+001         -.8370+000
 -.1230+001          .8370+000

WVG1 =  .134736+01  ZVG1 = -.577761-00
WVG2 =  .148783+01  ZVG2 =  .826740-00
   D.C. GAIN =  .375190+03, ROOT LOCUS GAIN =  .292965+01

AVG =  .292965+01  BVG =  .264603+01 CVG =  .582657-00
DVG =  .298708+01  EVG =  .117731+02
```

ROOTS OF A/C LATERAL DIRECTIONAL TRANSFER FUNCTIONS

RUN NO. L4

VERTOL YHC-1A 1500FT/MIN DESCENT AT 60 KNOTS

INPUT DATA

DIMENSIONAL STABILITY DERIVATIVES
UNITS ARE 1 PER RADIAN
(BODY AXES DIFFER BY .1930+02 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

YV =	-.1517-00	LV =	-.3710-02	NV =	-.4560-02
YP =	-.1862+01	LP =	-.8746-00	NP =	-.4000-01
YR =	-.2282-00	LR =	-.7680-01	NR =	-.3300-01
YVD =	-.0000	LVD =	-.0000	NVD =	-.0000
YPD =	-.0000	LPD =	-.0000	NPD =	-.0000
YRD =	-.0000	LRD =	-.0000	NRD =	-.0000
YA =	.8469-00	LA =	.4323-00	NA =	.2385-01
YDR=	.7300-01	LDR=	-.1355-00	NDR=	.1591-00

U =	.9850+02	UZ =	.3450+02	GAMA =	-.1390+02
MACH =	-.0000	RHO =	.2380-02	S =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
HT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02
SPAN =	-.0000				

DIMENSIONAL STABILITY DERIVATIVES,PER RADIAN,
STABILITY AXES

YV =	-.1517-00	LV =	-.1210-01	NV =	-.4290-02
YP =	-.1833+01	LP =	-.7364-00	NP =	-.1021-01
YR =	.4001-00	LR =	.1255-00	NR =	-.2700-01
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.8469-00	LA =	.3724-00	NA =	.4334-02
YDR=	.7300-01	LDR=	.2240-00	NDR=	.1613-00

DIMENSIONAL DERIVATIVES, PRIMED

YV =	-.1517-00	LV =	-.2279-01	NV =	-.1171-01
YP =	-.1833+01	LP =	-.9881-00	NP =	-.2759-00
YR =	.4001-00	LR =	.1228+00	NR =	-.3024-02
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.8469-00	LA =	.4983-00	NA =	.1381-00
YDR=	.7300-01	LDR=	.5518-00	NDR=	.3994-00

IN STABILITY AXES, U= .1044+03
.IXX= .1160+05 IZZ= .6939+05 IXZ= .1397+05

LATERAL DIRECTIONAL DENOMINATOR ROOTS

ROOTS (COMPLEX FORM)

.1343+000	.5715-022
.5420+000	.2773-037
-.4810-001	.9176-036
-.1771+001	.1295-034

T1 =	.744596+01	T2 =	.184483+01	T3 =	-.207865+02
T4 =	-.944631-00				

COEFFICIENTS

A =	.10000+01	B =	.11428+01	C =	-.10724+01
D =	.74812-01	E =	.62030-02		

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L4          NUMERATOR CHARACTERISTICS FOR CYCLIC

                SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     VO = 0.0
            ROOTS (COMPLEX FORM)
              .1123+001          .0000
             -.3856-001          .0000
              .1595+002          .0000

  1/TVB1 =  .112300+01  1/TVB2 = -.385622-01  1/TVB3 =  .159545+02
     D.C. GAIN =  .943316+02, ROOT LOCUS GAIN =  .846900-00

  AVB =  .846900-00  BVB = -.144303+02 CVB =  .146161+02
  DVB =  .985137-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PO = 0.0
            ROOTS (COMPLEX FORM)
              .7139+000          .0000
             -.7408-001          .0000
             -.7899+000          .0000

  1/TPB1 =  .713962-00  1/TPB2 = -.740632-01  1/TPB3 = -.789911-00
     D.C. GAIN = -.335563+01, ROOT LOCUS GAIN =  .498332-00

  APB =  .498332-00  BPB =  .747557-01 CPB = -.278239-00
  DPB = -.208149-01

                YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     NO = 0.0
            ROOTS (COMPLEX FORM)
              .8234+000          .0000
             -.4478+000          .7342+000
             -.4478+000         -.7342+000

  ZRB =  .520698-00  WRB =  .860042-00  1/TRB =  .823485-00
     D.C. GAIN = -.135595+02, ROOT LOCUS GAIN =  .138085-00

  ARB =  .138085-00  BRB =  .994421-02 CRB =  .293065-03
  DRB = -.841092-01
```

```
PHI/VE(SIDESLIP)=    .1809-00 PHI/BETA=    .1888+02
FOR ROOT(  .1343-00,  .0000    J)

PHI/VE(SIDESLIP)=    .2946-01 PHI/BETA=    .3074+01
FOR ROOT(  .5421-00,  .2773-37 J)

PHI/VE(SIDESLIP)=    .1003+01 PHI/BETA=    .1047+03
FOR ROOT( -.4811-01,  .9176-36 J)

PHI/VE(SIDESLIP)=    .1547-01 PHI/BETA=    .1614+01
FOR ROOT( -.1771+01,  .1296-[illegible] J)


              (DERIVATIVE OF) SI[illegible] ACCELERATION AS MEASURED
                   BY AN ACCELERO[illegible]TER, PER DELTA CYCLIC
              PERTURBATIONS ABOUT INITIAL VALUE.
                   AYO = 0.0
          ROOTS (COMPLEX FORM)
            .0000              .0000
            .9289+000          .0000
           -.4695-001         -.1366-021
           -.4301+000         -.1404+001
           -.4301+000          .1404+001

   WAY =  .146889+01     ZAY =  .292835-00
1/TAY1 =  .928911-00 1/TAY2 = -.465526-01
    D.C. GAIN = -.127388+02, ROOT LOCUS GAIN =  .846900-00

 AAY =  .846900-00  BAY = -.186949-01 CAY =  .114782+01
 DAY = -.164384+01  EAY = -.790186-01 FAY =  .000000

              (DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
                   INITIAL FLIGHT PATH, PER DELTA CYCLIC
              PERTURBATIONS ABOUT INITIAL VALUE.
                   VGO = 0.0
          ROOTS (COMPLEX FORM)
            .7199+000          .0000
           -.7564+000          .0000
            .2929-001          .4362+001
            .2929-001         -.4362+001

   WVG =  .436269+01     ZVG = -.471962-02
1/TVG1 =  .719926-00 1/TVG2 = -.756448-00
    D.C. GAIN = -.141514+04, ROOT LOCUS GAIN =  .846900-00

 AVG =  .846900-00  BVG = -.186949-01 CVG =  .156961+02
 DVG =  .615723-00  EVG = -.877823+01
```

```
              (DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
                   PLANE, PER DELTA CYCLIC
              PERTURBATIONS ABOUT INITIAL VALUE,
                   PHO = 0.0
          ROOTS (COMPLEX FORM)
            .7003+000          .0000
            .8818-009          .0000
           -.8561+000          .0000

 1/TPH1 =  .700375-00  1/TPH2 =  .881819-09  1/TPH3 = -.856119-00
    D.C. GAIN =  .375353-07, ROOT LOCUS GAIN =  .450567-00

 APH =  .450567-00  BPH =  .701729-01 CPH = -.270162-00
 DPH =  .232831-09

              TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                   FROM ORIGINAL BODY AXES,
              RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                   TO ORIGIN OF AXES ARE,
                   LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L4          NUMERATOR CHARACTERISTICS FOR CYCLIC

              SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
              PERTURBATIONS ABOUT AN INITIAL VALUE,
                   VB=0.0
          ROOTS (COMPLEX FORM)
            .7296-001         -.8930-026
            .1144+001          .8658+000
            .1144+001         -.8658+000

 ZVB = -.707548-00  WVB =  .143530+01  1/TVB =  .729693-01
    D.C. GAIN = -.142078+03, ROOT LOCUS GAIN =  .586280+01

 AVB =  .586280+01  BVB = -.138503+02 CVB =  .130572+02
 DVB = -.881309-00

              ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
              PERTURBATIONS ABOUT AN INITIAL VALUE,
                   PO = 0.0
          ROOTS (COMPLEX FORM)
            .6935+000          .0000
            .3139-001          .0000
           -.8833+000          .0000

 1/TPB1 =  .693968-00  1/TPB2 =  .313993-01  1/TPB3 = -.883307-00
    D.C. GAIN =  .131528+01, ROOT LOCUS GAIN =  .424671-00

 APB =  .424671-00  BPB =  .672594-01 CPB = -.262695-00
 DPB =  .819867-02
```

```
            YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 WO = 0.0
        ROOTS (COMPLEX FORM)
          .7739+000          .0000
         -.4447+000          .4241+000
         -.4447+000         -.4241+000

ZRB =  .723718-00  WRR =  .614604-00  1/TRB =  .773974-06
   D.C. GAIN = -.139065+02, ROOT LOCUS GAIN =  .295053-00

ARB =  .295053-00  BRB =  .341156-01 CRB = -.916993-01
DRB = -.862615-01


            (DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
                 BY AN ACCELEROMETER ,PER DELTA CYCLIC
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 AYO = 0.0
        ROOTS (COMPLEX FORM)
          .0000              .0000
          .8146+000          .0000
         -.4424+000         -.6732+000
         -.4424+000          .6732+000
         -.2549-001         -.4121-031

   WAY =  .805585-00    ZAY =  .549221-00
1/TAY1 =  .814468-00 1/TAY2 = -.442444-00
   D.C. GAIN = -.127388+02, ROOT LOCUS GAIN =  .586280+01

 AAY =  .586280+01  BAY =  .561270-00 CAY = -.411069-00
 DAY = -.311029+01  EAY = -.790185-01 FAY =  .000000

            (DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
                 INITIAL FLIGHT PATH, PER DELTA CYCLIC
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 VGO = 0.0
        ROOTS (COMPLEX FORM)
          .7301+000          .0000
         -.6185-001          .1707+001
         -.6185-001         -.1707+001
         -.7021+000         -.1786-026

   WVG =  .170898+01    ZVG =  .361921-01
1/TVG1 =  .730121-00 1/TVG2 = -.618517-01
   D.C. GAIN = -.141516+04, ROOT LOCUS GAIN =  .586280+01

 AVG =  .586280+01  BVG =  .561270-00 CVG =  .140972+02
 DVG = -.858723-00  EVG = -.877423+01
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L4          NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     VO = 0.0
            ROOTS (COMPLEX FORM)
             -.2385-001          .0000
             -.1512+000          .0000
              .5249+003          .0000

  1/TVB1 = -.238529-01  1/TVB2 = -.151227-00  1/TVB3 =  .524913+03
     D.C. GAIN = -.222834+02, ROOT LOCUS GAIN =  .730000-01

  AVB =  .730000-01  BVB = -.383059+02 CVB = -.670857+01
  DVB = -.138223-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PO = 0.0
            ROOTS (COMPLEX FORM)
             -.7871-001         -.5655+000
             -.7871-001          .5655+000
             -.7424-001          .8281-032

  ZPB =  .137850-00  WPB =  .571012-00  1/TPB = -.742418-01
     D.C. GAIN =  .215321+01, ROOT LOCUS GAIN =  .551757-00

  APB =  .551757-00  BPB =  .127825-00 CPB =  .186352-00
  DPB =  .133563-01

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     NO = 0.0
            ROOTS (COMPLEX FORM)
              .6182-001          .4189+000
              .6182-001         -.4189+000
             -.8374+000          .1224-030

  ZRB = -.146003-00  WRB =  .423446-00  1/TRB = -.837464-00
     D.C. GAIN =  .870073+01, ROOT LOCUS GAIN =  .359412-00

  ARB =  .359412-00  BRB =  .256554-00 CRB =  .272273-01
  DRB =  .539704-01
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000                .0000
 -.3938-001            .0000
 -.8258-001            .0000
  .5506+001            .6909+001
  .5506+001           -.6909+001

   WAY =  .883558+01     ZAY = -.623240-00
1/TAY1 = -.393873-01 1/TAY2 = -.825870-01
   D.C. GAIN =  .298855+01, ROOT LOCUS GAIN =  .730000-01

AAY =  .730000-01  BAY = -.795073-00 CAY =  .560110+01
DAY =  .692508-00  EAY =  .185379-01 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
 -.7261-001            .5235+000
 -.7261-001           -.5235+000
  .5518+001           -.1567+002
  .5518+001            .1567+002

WVG1 =  .528534-00  ZVG1 =  .137393-00
WVG2 =  .166198+02  ZVG2 = -.332033-00
   D.C. GAIN =  .908070+03, ROOT LOCUS GAIN =  .730000-01

AVG =  .730000-01  BVG = -.795073-00 CVG =  .200672+02
DVG =  .270342+01  EVG =  .563274+01

(DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
     PLANE, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     PHO = 0.0
ROOTS (COMPLEX FORM)
  .0000                .0000
 -.6950-001           -.6190+000
 -.6950-001            .6190+000

ZPH =  .111569+00  WPH =  .622971-00  1/TPH =  .000000
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .449259-00

APH =  .449259-00  BPH =  .624506-01 CPH =  .174354-00
DPH =  .000000
```

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES.
                RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE.
                     LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L4          NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE.
                     V0=0.0
            ROOTS (COMPLEX FORM)
              .9605-001          .0000
             -.2404+000          .0000
              .3488+001          .0000

  1/TVB1 =  .960959-01  1/TVB2 = -.240411-00  1/TVB3 =  .348828+01
     D.C. GAIN =  .129414+03, ROOT LOCUS GAIN =  .894017+01

  AVB =  .894017+01  BVB = -.334713+02 CVB = -.522450+01
  DVB =  .802792-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE.
                     P0 = 0.0
            ROOTS (COMPLEX FORM)
             -.8012-001          .8444+000
             -.8012-001         -.8444+000
              .3109-001         -.6740-032

  ZPB =  .928673-01  WPB =  .647243-00  1/TPB =  .310918-01
     D.C. GAIN = -.843970-00, ROOT LOCUS GAIN =  .401931-00

  APB =  .401931-00  BPB =  .358310-01 CPB =  .166875-00
  DPB = -.923918-02

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE.
                     R0 = 0.0
            ROOTS (COMPLEX FORM)
              .1492-001          .4293+000
              .1492-001         -.4293+000
             -.5790+000         -.1460-020

  ZRB = -.347443-01  WRB =  .429572-00  1/TRB = -.979070-00
     D.C. GAIN =  .892338+01, ROOT LOCUS GAIN =  .921598-00

  ARB =  .921598-00  BRB =  .284386-00 CRB =  .172070-01
  DRB =  .353918-01
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER ,PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
 -.2344+000          .2658-015
 -.1027+000         -.8535+000
 -.1027+000          .8535+000
 -.1196-001         -.7956-030

   WAY =  .859701-00     ZAY =  .119461+00
1/TAY1 = -.234469-00 1/TAY2 = -.102700+00
   D.C. GAIN =  .298856+01, ROOT LOCUS GAIN =  .894017+01

AAY =  .894017+01  BAY =  .403949+01 CAY =  .708517+01
DAY =  .163348+01  EAY =  .185380-01 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
 -.7484-001          .5478+000
 -.7484-001         -.5478+000
 -.1490+000         -.1427+001
 -.1490+000          .1427+001

WVG1 =  .553202-00  ZVG1 =  .138904-00
WVG2 =  .143484+01  ZVG2 =  .103897+00
   D.C. GAIN =  .908070+03, ROOT LOCUS GAIN =  .894017+01

AVG =  .894017+01  BVG =  .403949+01 CVG =  .215513+02
DVG =  .364439+01  EVG =  .563274+01
```

ROOTS OF A/C LATERAL DIRECTIONAL TRANSFER FUNCTIONS

RUN NO. L5

VERTOL VHC-1A HOVER

INPUT DATA

DIMENSIONAL STABILITY DERIVATIVES
UNITS ARE 1 PER RADIAN
(BODY AXES DIFFER BY .9278+01 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

YV =	-.2664-00	LV =	-.7800-02	NV =	.1800-03
YP =	-.7651-00	LP =	-.5073-00	NP =	-.1880-01
YR =	-.1252-00	LR =	-.2300-01	NR =	-.5850-01
YVD =	-.0000	LVD =	-.0000	NVD =	-.0000
YPD =	-.0000	LPD =	-.0000	NPD =	-.0000
YRD =	-.0000	LRD =	-.0000	NRD =	-.0000
YA =	.9980-00	LA =	.4654-00	NA =	.3000-01
YDR=	.1466-00	LDR=	-.1264-00	NDR=	.1758-00

U =	.1010+01	UZ =	.1650-00	GAMA =	.0000
MACH =	-.0000	RHO =	.2380-02	S =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
WT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02
SPAN =	-.0000				

DIMENSIONAL STABILITY DERIVATIVES,PER RADIAN,
STABILITY AXES

YV =	-.2664-00	LV =	-.8027-02	NV =	.3359-03
YP =	-.7753-00	LP =	-.5726-00	NP =	-.1704-01
YR =	-.2057-03	LR =	-.1126-01	NR =	-.5472-01
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.9980-00	LA =	.5340-00	NA =	.1981-01
YDR=	.1466-00	LDR=	.1035+00	NDR=	.1746-00

DIMENSIONAL DERIVATIVES, PRIMED

YV =	-.2664-00	LV =	-.8035-02	NV =	-.2105-04
YP =	-.7753-00	LP =	-.5888-00	NP =	-.4391-01
YR =	-.2057-03	LR =	-.3233-01	NR =	-.5711-01
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.9980-00	LA =	.5506-00	NA =	.4500-01
YDR=	.1466-00	LDR=	.1719-00	NDR=	.1853-00

IN STABILITY AXES, U= .1023+01
.IXX= .8566+04 IZZ= .7242+05 IXZ= .3214+04

LATERAL DIRECTIONAL DENOMINATOR ROOTS

ROOTS (COMPLEX FORM)

.5964-001	.5118+000
.5964-001	-.5118+000
-.5701-001	-.2465-031
-.9746+000	-.1556-030

TS = -.175406+02 TR = -.102606+01
ZDR = -.115755+00 WDR = .515302-00 RAD/SEC
= .820129-01 CYCLES/SEC

DUTCH ROLL MODE

PERIOD = .12276+02 TIME TO DOUBLE AMP. = .11620+02
TIME TO TEN TIMES AMP. = .38602+02
CYCLES TO DOUBLE AMP. = .94662-00
CYCLES TO TEN TIMES AMP. = .31446+01

COEFFICIENTS

A =	.10000+01	B =	.91232-00	C =	.19803-00
D =	.26730-00	E =	.14754-01		

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L5            NUMERATOR CHARACTERISTICS FOR CYCLIC

                SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     VO = 0.0
            ROOTS (COMPLEX FORM)
             -.5446-001          .0000
             -.5878-001          .4214+001
             -.5878-001         -.4214+001

  ZVB =  .139469-01  WVB =  .421490+01  1/TVB = -.544669-01
     D.C. GAIN =  .654530+02, ROOT LOCUS GAIN =  .998000-00

  AVB =  .998000-00  BVB =  .171693-00 CVB =  .177362+02
  DVB =  .965689-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PO = 0.0
            ROOTS (COMPLEX FORM)
              .0000              .0000
             -.5762-001          .0000
             -.2486+000          .0000

  1/TPB1 =  .000000     1/TPB2 = -.576254-01  1/TPB3 = -.248678-00
     D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .550612-00

  APB =  .550612-00  BPB =  .168654-00 CPB =  .789037-02
  DPB =  .000000

                YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     NO = 0.0
            ROOTS (COMPLEX FORM)
              .2144+000          .5380+000
              .2144+000         -.5380+000
             -.7464+000         -.1556-030

  ZRB = -.370322-00  WRB =  .579214-00  1/TRB = -.746481-00
     D.C. GAIN =  .763781-00, ROOT LOCUS GAIN =  .449967-01

  ARB =  .449967-01  BRB =  .142860-01 CRB =  .686401-03
  DRB =  .112688-01
```

```
PHI/VE(SIDESLIP)=    .1885-01 PHI/BETA=    .1929-01
FOR ROOT(  .5965-01,  .5118-00 J)

PHI/VE(SIDESLIP)=    .1885-01 PHI/BETA=    .1929-01
FOR ROOT(  .5965-01, -.5118-00 J)

PHI/VE(SIDESLIP)=    .1439-02 PHI/BETA=    .1473-02
FOR ROOT( -.5701-01, -.2465-31 J)

PHI/VE(SIDESLIP)=    .2146-01 PHI/BETA=    .2196-01
FOR ROOT( -.9746-00, -.1556-30 J)


            (DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
                 BY AN ACCELEROMETER, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 AYO = 0.0
        ROOTS (COMPLEX FORM)
          .0000              .0000
         -.5432-001          .0000
          .1592+001          .0000
         -.8781+000          .1427+001
         -.8781+000         -.1427+001

   WAY =  .167610+01     ZAY =  .523945-00
1/TAY1 = -.543204-01 1/TAY2 =  .159251+01
    D.C. GAIN = -.164388+02, ROOT LOCUS GAIN =  .998000-00

 AAY =  .998000-00  BAY =  .217742-00 CAY =  .211372-01
 DAY = -.446428+01  EAY = -.242537-00 FAY =  .000000

            (DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
                 INITIAL FLIGHT PATH, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 VGO = 0.0
        ROOTS (COMPLEX FORM)
         -.3680-001          .8988-019
         -.1766-001         -.2719-033
         -.8185-001         -.4215+001
         -.8185-001          .4215+001

   WVG =  .421626+01     ZVG =  .194145-01
1/TVG1 = -.368029-01 1/TVG2 = -.176624-01
    D.C. GAIN =  .781645-00, ROOT LOCUS GAIN =  .998000-00

 AVG =  .998000-00  BVG =  .217742-00 CVG =  .177508+02
 DVG =  .966392-00  EVG =  .115323-01
```

```
            (DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
                 PLANE, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 PHO = 0.0
        ROOTS (COMPLEX FORM)
          .0000                .0000
         -.5762-001            .0000
         -.2486+000            .0000

1/TPH1 =  .000000     1/TPH2 = -.576254-01  1/TPH3 = -.248678-00
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .550612-00

APH =  .550612-00  BPH =  .168654-00 CPH =  .789037-02
DPH =  .000000

            TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                 FROM ORIGINAL BODY AXES,
            RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                 TO ORIGIN OF AXES ARE,
                 LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L5          NUMERATOR CHARACTERISTICS FOR CYCLIC

            SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 VO=0.0
        ROOTS (COMPLEX FORM)
         -.6514-001            .3133-026
         -.1013+000            .2328+001
         -.1013+000           -.2328+001

ZVB =  .434713-01  WVB =  .233110+01  1/TVB = -.651435-01
   D.C. GAIN =  .782674+02, ROOT LOCUS GAIN =  .326210+01

AVB =  .326210+01  BVB =  .873640-00 CVB =  .177694+02
DVB =  .115475+01

            ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
            PERTURBATIONS ABOUT AN INITIAL VALUE,
                 PO = 0.0
        ROOTS (COMPLEX FORM)
         -.1916+000           -.8466-001
         -.1916+000            .8466-001
          .7718-001            .9239-031

ZPB =  .914731-00  WPB =  .209534-00  1/TPB =  .771829-01
   D.C. GAIN = -.123144+00, ROOT LOCUS GAIN =  .536153-00

APB =  .536153-00  BPB =  .164144-00 CPB =  .767647-02
DPB = -.181685-02
```

```
          YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
          PERTURBATIONS ABOUT AN INITIAL VALUE,
               NO = 0,0
       ROOTS (COMPLEX FORM)
         .1224+000          -.3681+000
         .1224+000           .3681+000
        -.5548+000           .1078-030

ZRB = -.315568-00  WRB =  .387934-00  1/TRB = -.554873-00
   D.C. GAIN =  .753789-00, ROOT LOCUS GAIN =  .133183-00

ARB =  .133183-00  BRB =  .412910-01 CRB =  .194958-02
DRB =  .111213-01

          (DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
               BY AN ACCELEROMETER ,PER DELTA CYCLIC
          PERTURBATIONS ABOUT AN INITIAL VALUE,
               AYO = 0.0
       ROOTS (COMPLEX FORM)
         .0000               .0000
         .1023+001           .0000
        -.6241+000           .9442+000
        -.6241+000          -.9442+000
        -.5672-001           .1368-026

   WAY =  .113187+01    ZAY =  .551460-00
1/TAY1 =  .102315+01 1/TAY2 = -.624181-00
    D.C. GAIN = -.164388+02, ROOT LOCUS GAIN =  .326210+01

 AAY =  .326210+01  BAY =  .919689-00 CAY =  .542798-01
 DAY = -.427521+01  EAY = -.242537-00 FAY =  .000000

          (DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
               INITIAL FLIGHT PATH, PER DELTA CYCLIC
          PERTURBATIONS ABOUT AN INITIAL VALUE,
               VGO = 0.0
       ROOTS (COMPLEX FORM)
        -.5280-001           .1536-026
        -.1231-001           .4749-041
        -.1084+000           .2329+001
        -.1084+000          -.2329+001

   WVG =  .233172+01    ZVG =  .464912-01
1/TVG1 = -.528095-01 1/TVG2 = -.123127-01
    D.C. GAIN =  .781645-00, ROOT LOCUS GAIN =  .326210+01

 AVG =  .326210+01  BVG =  .919689-00 CVG =  .177840+02
 DVG =  .115545+01  EVG =  .115323-01
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L5            NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     VO = 0.0
            ROOTS (COMPLEX FORM)
             -.2265-001          .0000
              .7896+000          .6038+001
              .7896+000         -.6038+001

  ZVB = -.129661-00  WVB =  .609012+01  1/TVB = -.226565-01
     D.C. GAIN =  .834973+01, ROOT LOCUS GAIN =  .146600-00

  AVB =  .146600-00  BVB = -.228204-00 CVB =  .543209+01
  DVB =  .123191+00

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PO = 0.0
            ROOTS (COMPLEX FORM)
              .0000              .0000
             -.6694-001          .0000
             -.2148+000          .0000

  1/TPB1 =  .000000     1/TPB2 = -.669438-01  1/TPB3 = -.214862-00
     D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .171872-00

  APB =  .171872-00  BPB =  .484346-01 CPB =  .247215-02
  DPB =  .000000

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     NO = 0.0
            ROOTS (COMPLEX FORM)
              .6881-001         -.5160+000
              .6881-001          .5160+000
             -.9520+000         -.6162-032

  ZRB = -.132159-00  WRB =  .520663-00  1/TRB = -.952085-00
     D.C. GAIN =  .324116+01, ROOT LOCUS GAIN =  .185276-00

  ARB =  .185276-00  BRB =  .150901-00 CRB =  .259505-01
  DRB =  .478198-01
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
 -.2173-001          .0000
  .2167+001          .0000
 -.9410+000          .1885+001
 -.9410+000         -.1885+001

  WAY =  .210744+01    ZAY =  .446540-00
1/TAY1 = -.217329-01 1/TAY2 =  .216711+01
   D.C. GAIN = -.207844+01, ROOT LOCUS GAIN =  .146600-00

AAY =  .146600-00  BAY = -.385947-01 CAY =  .522434-01
DAY = -.140984+01  EAY = -.306651-01 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
 -.1343-001          .9262-001
 -.1343-001         -.9262-001
  .1450+000         -.6171+001
  .1450+000          .6171+001

WVG1 =  .935964-01  ZVG1 =  .143556-00
WVG2 =  .617303+01  ZVG2 = -.235003-01
   D.C. GAIN =  .331697+01, ROOT LOCUS GAIN =  .146600-00

AVG =  .146600-00  BVG = -.385947-01 CVG =  .558652+01
DVG =  .149749-00  EVG =  .489383-01

(DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
     PLANE, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     PHO = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
 -.6694-001          .0000
 -.2148+000          .0000

1/TPH1 =  .000000     1/TPH2 = -.669438-01  1/TPH3 = -.214862-00
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .171872-00

APH =  .171872-00  BPH =  .484346-01 CPH =  .247215-02
DPH =  .000000
```

```
TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
     FROM ORIGINAL BODY AXES,
RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
     TO ORIGIN OF AXES ARE,
     LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L5          NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VO=0.0
ROOTS (COMPLEX FORM)
 -.2438+000        -.1198+001
 -.2438+000         .1198+001
 -.1660+000         .2542-031

ZVB =  .199424-00  WVB =  .122290+01  1/TVB = -.166085-00
   D.C. GAIN =  .627286+02, ROOT LOCUS GAIN =  .372617+01

AVB =  .372617+01  BVB =  .243630+01 CVB =  .587425+01
DVB =  .925493-00

ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     PO = 0.0
ROOTS (COMPLEX FORM)
 -.2547+000         .3108+000
 -.2547+000        -.3108+000
  .3415+000         .3039-033

ZPB =  .633838-00  WPB =  .401908-00  1/TPB =  .341539-00
   D.C. GAIN = -.522569-00, ROOT LOCUS GAIN =  .139752-00

APB =  .139752-00  BPB =  .234714-01 CPB = -.174416-02
DPB = -.770995-02

YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     NO = 0.0
ROOTS (COMPLEX FORM)
  .7232-001         .4968+000
  .7232-001        -.4968+000
 -.8890+000         .3636-030

ZRB = -.144038-00  WRB =  .502111-00  1/TRB = -.889011-00
   D.C. GAIN =  .319876+01, ROOT LOCUS GAIN =  .210563-00

ARB =  .210563-00  BRB =  .156735-00 CRB =  .260095-01
DRB =  .471942-01
```

```
TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
     FROM ORIGINAL BODY AXES,
RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
     TO ORIGIN OF AXES ARE,
     LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L5          NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VO=0.0
ROOTS (COMPLEX FORM)
 -.2438+000        -.1198+001
 -.2438+000         .1198+001
 -.1660+000         .2542-031

ZVB =  .199424-00  WVB =  .122290+01  1/TVB = -.166085-00
   D.C. GAIN =  .627286+02, ROOT LOCUS GAIN =  .372617+01

AVB =  .372617+01  BVB =  .243630+01 CVB =  .587425+01
DVB =  .925493-00

ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     PO = 0.0
ROOTS (COMPLEX FORM)
 -.2547+000         .3108+000
 -.2547+000        -.3108+000
  .3415+000         .3039-033

ZPB =  .633838-00  WPB =  .401908-00  1/TPB =  .341539-00
   D.C. GAIN = -.522569-00, ROOT LOCUS GAIN =  .139752-00

APB =  .139752-00  BPB =  .234714-01 CPB = -.174416-02
DPB = -.770995-02

YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     NO = 0.0
ROOTS (COMPLEX FORM)
  .7232-001         .4968+000
  .7232-001        -.4968+000
 -.8890+000         .3636-030

ZRB = -.144038-00  WRB =  .502111-00  1/TRB = -.889011-00
   D.C. GAIN =  .319876+01, ROOT LOCUS GAIN =  .210563-00

ARB =  .210563-00  BRB =  .156735-00 CRB =  .260095-01
DRB =  .471942-01
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER ,PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000                .0000
 -.4899-001            .6114-019
  .3601+000           -.8451-014
 -.5079+000            .4565+000
 -.5079+000           -.4565+000

   WAY =  .682945-00     ZAY =  .743741-00
1/TAY1 = -.489935-01 1/TAY2 =  .360141-00
    D.C. GAIN = -.207844+01, ROOT LOCUS GAIN =  .372617+01

 AAY =  .372617+01  BAY =  .262591+01 CAY =  .494405-00
 DAY = -.607543-00  EAY = -.306651-01 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
 -.8250-001            .4281-001
 -.8250-001           -.4281-001
 -.2698+000            .1203+001
 -.2698+000           -.1203+001

 WVG1 =  .929474-01  ZVG1 =  .887605-00
 WVG2 =  .123298+01  ZVG2 =  .218868-00
    D.C. GAIN =  .331697+01, ROOT LOCUS GAIN =  .372617+01

 AVG =  .372617+01  BVG =  .262591+01 CVG =  .602868+01
 DVG =  .952050-00  EVG =  .489383-01
```

ROOTS OF A/C LATERAL DIRECTIONAL TRANSFER FUNCTIONS

RUN NO. L6

VERTOL YHC-1A VERTICAL DESCENT AT 1500 FT/MIN

INPUT DATA

DIMENSIONAL STABILITY DERIVATIVES
UNITS ARE 1 PER RADIAN
(BODY AXES DIFFER BY .8748+02 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

YV =	-.8640-01	LV =	-.9960-02	NV =	.1220-02
YP =	-.1104+01	LP =	-.6304-00	NP =	-.2100-01
YR =	-.1844-00	LR =	-.5230-01	NR =	-.4990-01
YVD =	-.0000	LVD =	-.0000	NVD =	-.0000
YPD =	-.0000	LPD =	-.0000	NPD =	-.0000
YRD =	-.0000	LRD =	-.0000	NRD =	-.0000
YA =	.9806-00	LA =	.4590-00	NA =	.2425-01
YDR=	.1425-00	LDR=	-.1245+00	NDR=	.1728-00
U =	.1100+01	UZ =	.2500+02	GAMA =	-.9000+02
MACH =	-.0000	RHO =	.2380-02	S =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
HT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02
SPAN =	-.0000				

DIMENSIONAL STABILITY DERIVATIVES,PER RADIAN,
STABILITY AXES

YV =	-.8640-01	LV =	.1175-02	NV =	.9591-02
YP =	-.2328-00	LP =	-.5171-01	NP =	.5779-01
YR =	.1095+01	LR =	.2254-01	NR =	-.5739-00
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.9806-00	LA =	.2709-01	NA =	-.4165-00
YDR=	.1425-00	LDR=	.1737-00	NDR=	.1699-00

DIMENSIONAL DERIVATIVES, PRIMED

YV =	-.8640-01	LV =	.2900-02	NV =	.1443-01
YP =	-.2328-00	LP =	-.5064-01	NP =	.8951-02
YR =	.1095+01	LR =	-.6594-01	NR =	-.7405-00
YVD =	.0000	LVD =	.0000	NVD =	.0000
YPD =	.0000	LPD =	.0000	NPD =	.0000
YRD =	.0000	LRD =	.0000	NRD =	.0000
YA =	.9806-00	LA =	-.3541-01	NA =	-.5231-00
YDR=	.1425-00	LDR=	.2285-00	NDR=	.4985-00

IN STABILITY AXES, U= .2502+02
,IXX= .7104+05 IZZ= .9949+04 IXZ= .9835+04

LATERAL DIRECTIONAL DENOMINATOR ROOTS

ROOTS (COMPLEX FORM)

.5027-001	.7069+000
.5027-001	-.7069+000
-.5241-001	-.5315-031
-.9256+000	-.3328-030

TS = -.190780+02 TR = -.108033+01
ZDR = -.709417-01 WDR = .708749-00 RAD/SEC
= .112801+00 CYCLES/SEC

DUTCH ROLL MODE

PERIOD = .88876+01 TIME TO DOUBLE AMP. = .13786+02
TIME TO TEN TIMES AMP. = .45795+02
CYCLES TO DOUBLE AMP. = .15511+01
CYCLES TO TEN TIMES AMP. = .51528+01

COEFFICIENTS

A =	.10000+01	B =	.87750-00	C =	.45249-00
D =	.48643-00	E =	.24372-01		

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L6          NUMERATOR CHARACTERISTICS FOR CYCLIC

                SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     VO = 0.0
            ROOTS (COMPLEX FORM)
             -.5125-001          .0000
             -.1420+001          .0000
             -.1209+002          .0000

  1/TVB1 = -.512369-01  1/TVB2 = -.142021+01  1/TVB3 = -.120927+02
     D.C. GAIN =  .354181+02, ROOT LOCUS GAIN =  .980600-00

  AVB =  .980600-00  BVB =  .133011+02 CVB =  .175202+02
  DVB =  .863219-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     PO = 0.0
            ROOTS (COMPLEX FORM)
              .1314+001          .0000
             -.5434+000          .6327+000
             -.5434+000         -.6327+000

  ZPB =  .651524-00  WPB =  .834097-00  1/TPB =  .131439+01
     D.C. GAIN =  .132861+01, ROOT LOCUS GAIN = -.354108-01

  APB = -.354108-01  BPB =  .809689-02 CPB =  .259509-01
  DPB =  .323813-01

                YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     NO = 0.0
            ROOTS (COMPLEX FORM)
             -.5529-001          .1997-001
             -.5529-001         -.1997-001
             -.2481-006          .7222-034

  ZRB =  .940542-00  WRB =  .587920-01  1/TRB = -.248109-06
     D.C. GAIN = -.184058-07, ROOT LOCUS GAIN = -.523084-00

  ARB = -.523084-00  BRB = -.578494-01 CRB = -.188886-02
  DRB = -.448591-09
```

```
PHI/VE(SIDESLIP)=    .4565-02 PHI/BETA=    .1142+00
FOR ROOT(  .5028-01,  .7070-00 J)

PHI/VE(SIDESLIP)=    .4565-02 PHI/BETA=    .1142+00
FOR ROOT(  .5028-01, -.7070-00 J)

PHI/VE(SIDESLIP)=    .3164+02 PHI/BETA=    .7917+03
FOR ROOT( -.5242-01, -.5316-31 J)

PHI/VE(SIDESLIP)=    .9889-02 PHI/BETA=    .2475-00
FOR ROOT( -.9256-00, -.3328-30 J)

            (DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
                 BY AN ACCELEROMETER, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 AYO = 0.0
        ROOTS (COMPLEX FORM)
         -.1906-014          -.3795-026
          .1204+001           .2198-039
         -.6810+000           .6181+000
         -.6810+000          -.6181+000
         -.9825-001          -.2077-029

   WAY =  .919719-00     ZAY =  .740467-00
1/TAY1 =  .120481+01 1/TAY2 = -.681021-00
    D.C. GAIN = -.238876+01, ROOT LOCUS GAIN =  .980600-00

 AAY =  .980600-00  BAY =  .211311-00 CAY = -.770710-00
 DAY = -.104478+01  EAY = -.582194-01 FAY = -.111022-15

            (DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
                 INITIAL FLIGHT PATH, PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 VGO = 0.0
        ROOTS (COMPLEX FORM)
         -.5091-001           .6732-023
          .1372-007          -.1692-053
         -.8228-001           .4046+001
         -.8228-001          -.4046+001

   WVG =  .404749+01     ZVG =  .203302-01
1/TVG1 = -.509185-01 1/TVG2 =  .137237-07
    D.C. GAIN = -.460590-06, ROOT LOCUS GAIN =  .980600-00

 AVG =  .980600-00  BVG =  .211311-00 CVG =  .160726+02
 DVG =  .817974-00  EVG = -.112256-07
```

```
              (DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
                   PLANE, PER DELTA CYCLIC
              PERTURBATIONS ABOUT INITIAL VALUE,
                   PHO = 0.0
          ROOTS (COMPLEX FORM)
           -.5529-001        -.1997-001
           -.5529-001         .1997-001
           -.1918-014        -.8425-034

 ZPH =  .940540-00  WPH =  .587923-01  1/TPH = -.191888-14
    D.C. GAIN =  .142352-15, ROOT LOCUS GAIN =  .523084-00

 APH =  .523084-00  BPH =  .578494-01 CPH =  .180806-02
 DPH =  .346945-17

              TRANSFER FUNCTIONS FOR BODY AXES UP -.0000     DEGREES
                   FROM ORIGINAL BODY AXES,
              RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                   TO ORIGIN OF AXES ARE,
                   LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L6          NUMERATOR CHARACTERISTICS FOR CYCLIC

              SIDESLIP ALONG BODY Y AXIS PER DELTA CYCLIC
              PERTURBATIONS ABOUT AN INITIAL VALUE,
                   VO=0.0
          ROOTS (COMPLEX FORM)
           -.8394-001         .0000
           -.1255+001         .0000
            .1147+004         .0000

 1/TVB1 = -.839415-01  1/TVB2 = -.125539+01  1/TVB3 =  .114716+04
    D.C. GAIN =  .579826+02, ROOT LOCUS GAIN = -.116900-01

 AVB = -.116900-01  BVB =  .133947+02 CVB =  .179596+02
 DVB =  .141317+01

              ROLL RATE ABOUT BODY X AXIS PER DELTA CYCLIC
              PERTURBATIONS ABOUT AN INITIAL VALUE,
                   PO = 0.0
          ROOTS (COMPLEX FORM)
            .2995-001         .1226+000
            .2995-001        -.1226+000
           -.1715+000        -.7800-032

 ZPB = -.237301-00  WPB =  .126212-00  1/TPB = -.171503-00
    D.C. GAIN =  .584024-01, ROOT LOCUS GAIN =  .521022-00

 APB =  .521022-00  BPB =  .581477-01 CPB =  .294709-02
 DPB =  .142340-02
```

YAW RATE ABOUT BODY Z AXIS PER DELTA CYCLIC
PERTURBATIONS ABOUT AN INITIAL VALUE,
NO = 0.0

ROOTS (COMPLEX FORM)

.1036+001	.0000
-.4712+000	-.5589+000
-.4712+000	.5589+000

ZRB = .644609-00 WRB = .731101-00 1/TRB = .103688+01
D.C. GAIN = .132733+01, ROOT LOCUS GAIN = -.583700-01

ARB = -.583700-01 BRB = .950615-02 CRB = .258464-01
DRB = .323500-01

(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
BY AN ACCELEROMETER ,PER DELTA CYCLIC
PERTURBATIONS ABOUT AN INITIAL VALUE,
AYO = 0.0

ROOTS (COMPLEX FORM)

-.1906-014	.0000
-.1304+000	.0000
.2077+001	.0000
-.7389+000	.0000
.2487+002	.0000

1/TAY1 = -.130418-00 1/TAY2 = .207747+01
1/TAY3 = -.738945-00 1/TAY4 = .248753+02
D.C. GAIN = -.238876+01, ROOT LOCUS GAIN = -.116900-01

AAY = -.116900-01 BAY = .304915-00 CAY = -.331322-00
DAY = -.494828-00 EAY = -.582194-01 FAY = -.111022-15

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
INITIAL FLIGHT PATH, PER DELTA CYCLIC
PERTURBATIONS ABOUT AN INITIAL VALUE,
VGO = 0.0

ROOTS (COMPLEX FORM)

-.8297-001	.1034-022
.8286-008	-.1336-042
-.2668+002	.8203-033
.8285+002	-.7988-032

1/TVG1 = -.829718-01 1/TVG2 = .820633-08
1/TVG3 = -.266847+02 1/TVG4 = .928511+02
D.C. GAIN = -.460590-06, ROOT LOCUS GAIN = -.116900-01

AVG = -.116900-01 BVG = .304915-00 CVG = .169120+02
DVG = .136792+01 EVG = -.112256-07

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                     ORIGIN AT AIRPLANE C.G.

RUN NO.  L6          NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     V0 = 0.0
            ROOTS (COMPLEX FORM)
             -.5498-001          .0000
             -.1331+001          .0000
              .7796+002          .0000

 1/TVB1 = -.549896-01  1/TVB2 = -.133170+01  1/TVB3 =  .779693+02
    D.C. GAIN = -.333825+02, ROOT LOCUS GAIN =  .142500-00

 AVB =  .142500-00  BVB = -.109127+02 CVB = -.153961+02
 DVB = -.813606-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     P0 = 0.0
            ROOTS (COMPLEX FORM)
              .5346-001          .5852+000
              .5346-001         -.5852+000
             -.8032+000         -.4082-031

 ZPB = -.909810-01  WPB =  .587660-00  1/TPB = -.803289-00
    D.C. GAIN =  .260116+01, ROOT LOCUS GAIN =  .228528-00

 APB =  .228528-00  BPB =  .159137-00 CPB =  .592908-01
 DPB =  .633961-01

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT INITIAL VALUE,
                     N0 = 0.0
            ROOTS (COMPLEX FORM)
             -.1094+000          .1990-016
              .4792-006          .1373-029
             -.3680-001         -.5898-031

 1/TRB1 = -.109403+00  1/TRB2 =  .479203-06  1/TRB3 = -.368079-01
    D.C. GAIN = -.360349-07, ROOT LOCUS GAIN =  .458528-00

 ARB =  .458528-00  BRB =  .669408-01 CRB =  .183271-02
 DRB = -.878253-09
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     AYO = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
 -.4394-001          .1734-024
 -.6775+000          .1802+001
 -.6775+000         -.1802+001
 -.2541+001         -.3204-030

  WAY =  .192561+01    ZAY =  .351870-00
1/TAY1 = -.439425-01 1/TAY2 = -.677562-00
   D.C. GAIN =  .242132+01, ROOT LOCUS GAIN =  .142500-00

AAY =  .142500-00  BAY =  .561551-00 CAY =  .104359+01
DAY =  .138775+01  EAY =  .590131-01 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     VGO = 0.0
ROOTS (COMPLEX FORM)
 -.2862-007          .0000
 -.5582-001          .0000
  .8071+001          .0000
 -.1195+002          .0000

1/TVG1 = -.286262-07  1/TVG2 = -.558282-01
1/TVG3 =  .807144+01  1/TVG4 = -.119563+02
   D.C. GAIN = -.901745-06, ROOT LOCUS GAIN =  .142500-00

AVG =  .142500-00  BVG =  .561551-00 CVG = -.137210+02
DVG = -.767744-00  EVG = -.219776-07

(DERIVATIVE OF) BANK ANGLE PROJECTED ON VERTICAL
     PLANE, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT INITIAL VALUE,
     PHO = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
 -.3650-001          .0000
 -.1094+000          .0000

1/TPH1 =  .000000     1/TPH2 = -.365072-01  1/TPH3 = -.109483+00
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN = -.458528-00

APH = -.458528-00  BPH = -.669408-01 CPH = -.183271-02
DPH =  .000000
```

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES.
                RESPECTIVE X Y AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE.
                     LX =  .1700+02 LY =  .0000    AND LZ = -.0000

RUN NO.  L6            NUMERATOR CHARACTERISTICS FOR TAIL ROTOR

                SIDESLIP ALONG BODY Y AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE.
                     VO=0.0
            ROOTS (COMPLEX FORM)
              .1810-001          .0000
             -.1120+001          .0000
              .2971+001          .0000

  1/TVB1 =  .181013-01  1/TVB2 = -.112035+01  1/TVB3 =  .297108+01
     D.C. GAIN =  .107945+02. ROOT LOCUS GAIN =  .436636+01

  AVB =  .436636+01  BVB = -.816000+01 CVB = -.143878+02
  DVB =  .263086-00

                ROLL RATE ABOUT BODY X AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE.
                     PO = 0.0
            ROOTS (COMPLEX FORM)
             -.1422+000         -.1448+000
             -.1422+000          .1448+000
              .1509+000          .2764-029

  ZPB =  .700853-00  WPB =  .203013-00  1/TPB =  .150914-00
     D.C. GAIN =  .114340+00. ROOT LOCUS GAIN = -.448039-00

  APB = -.448039-00  BPB = -.598808-01 CPB =  .775340-03
  DPB =  .278673-02

                YAW RATE ABOUT BODY Z AXIS PER DELTA TAIL ROTOR
                PERTURBATIONS ABOUT AN INITIAL VALUE.
                     NO = 0.0
            ROOTS (COMPLEX FORM)
              .5961-001          .5719+000
              .5961-001         -.5719+000
             -.7709+000          .1232-030

  ZRB = -.103676+00  WRB =  .575017-00  1/TRB = -.770941-00
     D.C. GAIN =  .259864+01. ROOT LOCUS GAIN =  .248462-00

  ARB =  .248462-00  BRB =  .161926-00 CRB =  .593140-01
  DRB =  .633348-01
```

```
(DERIVATIVE OF) SIDE ACCELERATION AS MEASURED
     BY AN ACCELEROMETER ,PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     AY0 = 0.0
ROOTS (COMPLEX FORM)
  .0000              .0000
  .8669-001          .7750+000
  .8669-001         -.7750+000
 -.2442-001          .3967-031
 -.9080+000          .3898-030

 WAY =  .780664-00    ZAY = -.111051+00
1/TAY1 = -.244235-01 1/TAY2 = -.908014-00
   D.C. GAIN =  .242132+01, ROOT LOCUS GAIN =  .436636+01

AAY =  .436636+01  BAY =  .331429+01 CAY =  .205193+01
DAY =  .246444+01  EAY =  .590131-01 FAY =  .000000

(DERIVATIVE OF) LATERAL GROUND SPEED, PERPENDICULAR TO
     INITIAL FLIGHT PATH, PER DELTA TAIL ROTOR
PERTURBATIONS ABOUT AN INITIAL VALUE,
     VG0 = 0.0
ROOTS (COMPLEX FORM)
  .2446-001          .0000
  .1353+001          .0000
  .7113-007          .0000
 -.2136+001          .0000

1/TVG1 =  .244633-01  1/TVG2 =  .135347+01
1/TVG3 =  .711370-07  1/TVG4 = -.213698+01
   D.C. GAIN = -.901745-06, ROOT LOCUS GAIN =  .436636+01

AVG =  .436636+01  BVG =  .331429+01 CVG = -.127127+02
DVG =  .308948-00  EVG = -.219776-07
```

ROOTS OF A/C LONGITUDINAL TRANSFER FUNCTIONS

RUN NO. L1

VERTOL YHC-1A LEVEL FLIGHT AT 80 KNOTS

INPUT DATA

UNITS ARE 1 PER RADIAN
DIMENSIONAL STABILITY DERIVATIVES
(BODY AXES DIFFER BY .2311+01 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

XU =	-.4640-01	ZU =	.1400-01	MU =	-.5820-02
XW =	.8540-01	ZW =	-.9206-00	MW =	.1154-01
XQ =	.7308-00	ZQ =	-.1820+01	MQ =	-.1522+01
XUD =	-.0000	ZUD =	-.0000	MUD =	-.0000
XWD =	-.0000	ZWD =	-.0000	MWD =	-.0000
XQD =	-.0000	ZQD =	-.0000	MQD =	-.0000
XD =	.1641-00	ZD =	.5253-00	MD =	.4814-00
XT =	.6830-00	ZT =	-.9490+01	MT =	.6720-01
U =	.1350+03	UZ =	.5450+01	GAMA =	-.0000
MACH =	-.0000	RHO =	.2380-02	G =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
HT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9223+04	IZ =	.7179+05	G =	.3220+02

DIMENSIONAL STABILITY DERIVATIVES, PER RADIAN,
STABILITY AXES

XU =	-.4382-01	ZU =	-.2139-01	MU =	-.5350-02
XW =	.5001-01	ZW =	-.9232-00	MW =	.1177-01
XQ =	.6568-00	ZQ =	-.1848+01	MQ =	-.1522+01
XUD =	.0000	ZUD =	.0000	MUD =	.0000
XWD =	.0000	ZWD =	.0000	MWD =	.0000
XQD =	.0000	ZQD =	.0000	MQD =	.0000
XD =	.1851-00	ZD =	.5183-00	MD =	.4814-00
XT =	.2998-00	ZT =	-.9510+01	MT =	.6720-01

IN STABILITY AXES, U = .1351+03 AND G = 9.0
ZIY = .7591+05 AND ZIXZ = -.4569+04

THE CHARACTERISTICS OF THE LONGITUDINAL DENOMINATOR ARE
ROOTS (COMPLEX FORM)

-.2119+000	.3312+000
-.2119+000	-.3312+000
.4327+000	-.5206-033
-.2498+001	-.3941-020

```
  ZSP =     .538736-00        WSP =     .393188-00 RAD/SEC
                                  =     .625778-01 CYCLES/SEC
1/TP1 =     .432770-00     1/TP2 =    -.249812+01

SHORT PERIOD MODE

 PERIOD =     .18968+02        TIME TO HALF AMP. =     .32723+01
                            TIME TO ONE TENTH AMP. =     .10870+02

                              CYCLES TO HALF AMP. =     .17252-00
                          CYCLES TO ONE TENTH AMP. =     .57308-00
                     ONE OVER CYCLES TO HALF AMP. =     .57966+01
                ONE OVER CYCLES TO ONE TENTH AMP. =     .17449+01
                                            2*ZWN =     .42365-00
                                              WSR =     .15460-00

                              COEFFICIENTS

  A =    .100000+01      B =    .248900+01      C =   -.515303-01
  D =   -.138715-00      E =   -.147136-00
```

NOT REPRODUCIBLE

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                    ORIGIN AT AIRPLANE C.G.

RUN NO.  L1            NUMERATOR CHARACTERISTICS FOR CYCLIC

                THETA PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     THO =  .0000
            ROOTS (COMPLEX FORM)
             -.4255-001          .0000
             -.9350+000          .0000

  1/TTH1 = -.425546-01  1/TTH2 = -.935054-00
     D.C. GAIN = -.114609+00, ROOT LOCUS GAIN =  .481400-00

  ATH =  .481400-00  BTH =  .470621-00 CTH =  .191553-01

                X AXIS VELOCITY PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .1351+03
            ROOTS (COMPLEX FORM)
             -.1146+001          .0000
              .6842+001          .0000
             -.9988+001          .0000

  1/TUB1 = -.114638+01  1/TUB2 =  .684228+01  1/TUB3 = -.998883+01
     D.C. GAIN =  .867957+02, ROOT LOCUS GAIN =  .185150-00

  AUB =  .185150-00  BUB =  .794835-00 CUB = -.119864+02
  DUB = -.145067+02

                Z AXIS VELOCITY, W, PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
             -.2079-001          .5741-001
             -.2079-001         -.5741-001
             -.1253+003          .9249-025

  ZWB =  .340515-00  WWB =  .610649-01  1/TWB = -.125339+03
     D.C. GAIN = -.144925+01, ROOT LOCUS GAIN =  .518255-00

  AWB =  .518255-00  BWB =  .649791+02 CWB =  .270333+01
  DWB =  .242221-00
```

```
          Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  AZO = 0.0
         ROOTS (COMPLEX FORM)
           .0000                .0000
          -.3853-001            .0000
           .1093+002            .0000
          -.1074+002            .0000

1/TAZ1 =  .000000      1/TAZ2 = -.385341-01
1/TAZ3 =  .109388+02  1/TAZ4 = -.107419+02
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .518255-00

AAZ =  .518255-00  BAZ = -.820894-01 CAZ = -.609010+02
DAZ = -.234662+01  EAZ =  .000000

          X AXIS ACCELERATION,AX,PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  AXO = 0.0
         ROOTS (COMPLEX FORM)
          -.7529-001            .4214+000
          -.7529-001           -.4214+000
          -.2071+001            .3726+001
          -.2071+001           -.3726+001

WAX1 =  .428121-00  ZAX1 =  .175862-00
WAX2 =  .426329+01  ZAX2 =  .485817-00
   D.C. GAIN = -.369042+01, ROOT LOCUS GAIN =  .185150-00

AAX =  .185150-00  BAX =  .794835-00 CAX =  .351463+01
DAX =  .647308-00  EAX =  .614801-00

             HORIZ. VELOCITY PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  SDO =  .135150+03
         ROOTS (COMPLEX FORM)
          -.1146+001            .0000
           .6842+001            .0000
          -.9988+001            .0000

1/TSD1 = -.114638+01  1/TSD2 =  .684228+01  1/TSD3 = -.998883+01
   D.C. GAIN =  .867957+02, ROOT LOCUS GAIN =  .185150-00

ASD =  .185150-00  BSD =  .794835-00 CSD = -.119864+02
DSD = -.145067+02
```

```
            RATE OF CLIMB PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 HDO =  .000000    , POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
         -.3853-001          .0000
          .1093+002          .0000
         -.1074+002          .0000

1/THD1 = -.385341-01  1/THD2 =  .109388+02  1/THD3 = -.107419+09
   D.C. GAIN = -.140402+02, ROOT LOCUS GAIN = -.518255-00

AHD = -.518255-00  BHD =  .820894-01 CHD =  .609010+02
DHD =  .234662+01

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                 FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 USTABO =  .135150+03
        ROOTS (COMPLEX FORM)
         -.1146+001          .0000
          .6842+001          .0000
         -.9988+001          .0000

1/TUS1 = -.114638+01  1/TUS2 =  .684226+01  1/TUS3 = -.998883+01
   D.C. GAIN =  .867957+02, ROOT LOCUS GAIN =  .185150-00

AUS =  .185150-00  BUS =  .794835-00 CUS = -.119864+02
DUS = -.145067+02

            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                 FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
         -.3853-001          .0000
          .1093+002          .0000
         -.1074+002          .0000

1/TWS1 = -.385341-01  1/TWS2 =  .109388+02  1/TWS3 = -.107419+09
   D.C. GAIN =  .140402+02, ROOT LOCUS GAIN =  .518255-00

AWS =  .518255-00  BWS = -.820894-01 CWS = -.609010+02
DWS = -.234662+01
```

```
              TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                   FROM ORIGINAL BODY AXES.
              RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
                   TO ORIGIN OF AXES ARE,
                   LX =  .1700+02 LY = -.0000    AND LZ = -.0000

RUN NO.  L1          NUMERATOR CHARACTERISTICS FOR CYCLIC

              X AXIS VELOCITY PER DELTA CYCLIC
              PERTURBATIONS ABOUT INITIAL VALUE,
                   U0 =  .1350+03
          ROOTS (COMPLEX FORM)
           -.1709+001          .0000
           -.3219+001          .0000
            .1605+002          .0000

 1/TUB1 = -.170964+01  1/TUB2 = -.321971+01  1/TUB3 =  .160575+02
    D.C. GAIN =  .867836+02, ROOT LOCUS GAIN =  .164100-00

 AUB =  .164100-00  BUB = -.182613+01 CUB = -.120857+02
 DUB = -.145046+02

              Z AXIS VELOCITY, W, PER DELTA CYCLIC
              PERTURBATIONS ABOUT INITIAL VALUE,
                   W0 =  .5450+01, POSITIVE DOWN
          ROOTS (COMPLEX FORM)
            .6295-001          .0000
           -.9523-001          .0000
            .7469+001          .0000

 1/TWB1 =  .629567-01  1/TWB2 = -.952304-01  1/TWB3 =  .746947+01
    D.C. GAIN =  .205202+01, ROOT LOCUS GAIN = -.765850+01

 AWB = -.765850+01  BWB =  -.569577+02 CWB =  .189213+01
 DWB = -.342966-00

           X AXIS ACCELERATION,AX,PER DELTA CYCLIC
              PERTURBATIONS ABOUT INITIAL VALUE,
                   AX0 = 0.0
          ROOTS (COMPLEX FORM)
           -.5624-001         -.3193+000
           -.5624-001          .3193+000
           -.2373+001          .5485+001
           -.2373+001         -.5485+001

 WAX1 =  .324224-00  ZAX1 =  .173480-00
 WAX2 =  .597718+01  ZAX2 =  .397122-00
    D.C. GAIN = -.368741+01, ROOT LOCUS GAIN =  .164100-00

 AAX =  .164100-00  BAX =  .797498-00 CAX =  .596764+01
 DAX =  .741410-00  EAX =  .616299-00
```

```
Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
   PERTURBATIONS ABOUT INITIAL VALUE,
          AZO = 0.0
ROOTS (COMPLEX FORM)
  .8722-002          .1277-025
 -.4694-001         -.3209-045
 -.5064+000         -.2770+001
 -.5064+000          .2770+001


   WAZ =  .281626+01     ZAZ =  .179842-00
1/TAZ1 =  .872242-02 1/TAZ2 = -.469461-01
   D.C. GAIN = -.146818-00, ROOT LOCUS GAIN = -.765850+01

AAZ = -.765850+01  BAZ = -.805052+01 CAZ = -.610354+02
DAZ = -.231861+01  EAZ =  .248729-01

          VELOCITY PERTURBATIONS PARALLEL TO INITIAL
               FLIGHT PATH, DUE TO DELTA CYCLIC
          PERTURBATIONS ABOUT INITIAL VALUE,
               USTABO =  .139150+03
ROOTS (COMPLEX FORM)
 -.1396+001          .0000
  .6383+001          .0000
 -.9846+001          .0000

1/TUS1 = -.139613+01  1/TUS2 =  .638317+01  1/TUS3 = -.984687+01
   D.C. GAIN =  .861589+02, ROOT LOCUS GAIN =  .164100-00

AUS =  .164100-00  BUS =  .797498-00 CUS = -.952083+01
DUS = -.144002+02

          VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
               FLIGHT PATH, DUE TO DELTA CYCLIC
          PERTURBATIONS ABOUT INITIAL VALUE,
               WSTABO = 0.0, POSITIVE FOR DOWN
ROOTS (COMPLEX FORM)
 -.4779-001          .0000
 -.5016+000         -.2784+001
 -.5016+000          .2784+001

ZWS =  .177339-00  WWS =  .282901+01  1/TWS = -.477981-01
   D.C. GAIN =  .175288+02, ROOT LOCUS GAIN = -.765850+01

AWS = -.765850+01  BWS = -.805052+01 CWS = -.616605+02
DWS = -.292970+01
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                    ORIGIN AT AIRPLANE C.G.

RUN NO.  L1          NUMERATOR CHARACTERISTICS FOR COLLECTIVE

                THETA PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                      THO =  .0000
            ROOTS (COMPLEX FORM)
              .7449+000          .0000
             -.2246-001          .0000

  1/TTW1 =  .744299-00  1/TTW2 = -.224647-01
     D.C. GAIN =  .672277-02, ROOT LOCUS GAIN =  .672000-01

  ATW =  .672000-01  BTW = -.485973-01 CTW = -.112362-02

                X AXIS VELOCITY PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                      UO =  .1351+03
            ROOTS (COMPLEX FORM)
              .7564+000          .0000
              .1921+001          .0000
             -.3683+001          .0000

  1/TUB1 =  .756481-00  1/TUB2 =  .192155+01  1/TUB3 = -.368374+01
     D.C. GAIN = -.980361+01, ROOT LOCUS GAIN =  .299755-00

  AUB =  .299755-00  BUB =  .301465-00 CUB = -.752140+01
  DUB =  .160511+01

                Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                      WO =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
              .3923+000          .3855-015
             -.5084+000         -.4392+000
             -.5084+000          .4392+000

  ZWB =  .756678-00  WWB =  .671926-00  1/TWB =  .392335-00
     D.C. GAIN = -.100747+02, ROOT LOCUS GAIN = -.950982+01

  AWB = -.950982+01  BWB = -.593916+01 CWB = -.499582-00
  DWB =  .168490+01
```

```
          Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                    AZO = 0.0
         ROOTS (COMPLEX FORM)
           .0000              .0000
           .4950+000          .0000
          -.2091+000          .0000
          -.1865+001          .0000

1/TAZ1 =  .000000      1/TAZ2 =  .495011-00
1/TAZ3 = -.209117-00  1/TAZ4 = -.186544+01
   D.C. GAIN =  .000000    , ROOT LOCUS GAIN = -.950982+01

AAZ = -.950982+01  BAZ = -.150212+02 CAZ =  .605617+01
DAZ =  .183636+01  EAZ =  .000000

          X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                    AXO = 0.0
         ROOTS (COMPLEX FORM)
           .7140+000          .0000
           .1746-001         -.3098+000
           .1746-001          .3098+000
          -.1754+001         -.1633-030

  WAX =  .310391-00     ZAX = -.562826-01
1/TAX1 =  .714003-00 1/TAX2 =  .174697-01
   D.C. GAIN =  .216473-00, ROOT LOCUS GAIN =  .299755-00

AAX =  .299755-00  BAX =  .301465-00 CAX = -.357559-00
DAX =  .431740-01  EAX = -.361804-01

             HORIZ. VELOCITY PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                    SDO =  .135150+03
         ROOTS (COMPLEX FORM)
           .7564+000          .0000
           .1921+001          .0000
          -.3683+001          .0000

1/TSD1 =  .756481-00  1/TSD2 =  .192155+01  1/TSD3 = -.368374+01
   D.C. GAIN = -.960381+01, ROOT LOCUS GAIN =  .299755-00

ASD =  .299755-00  BSD =  .301445-00 CSD = -.252140+01
DSD =  .160511+01
```

```
            RATE OF CLIMB PER DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 HDO =  .000000    , POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
          .4950+000          .0000
         -.2091+000          .0000
         -.1865+001          .0000

1/THD1 =  .495011-00  1/THD2 = -.209117-00  1/THD3 = -.186544+01
   D.C. GAIN =  .109872+02, ROOT LOCUS GAIN =  .950982+01

AHD =  .950982+01  BHD =  .150212+02 CHD = -.605617+01
DHD = -.183636+01

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 USTABO =  .135150+03
        ROOTS (COMPLEX FORM)
          .7564+000          .0000
          .1921+001          .0000
         -.3683+001          .0000

1/TUS1 =  .756481-00  1/TUS2 =  .192155+01  1/TUS3 = -.368374+01
   D.C. GAIN = -.960361+01, ROOT LOCUS GAIN =  .299755-00

AUS =  .299755-00  BUS =  .301445-00 CUS = -.252140+01
DUS =  .160511+01

            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
          .4950+000          .0000
         -.2091+000          .0000
         -.1865+001          .0000

1/TWS1 =  .495011-00  1/TWS2 = -.209117-00  1/TWS3 = -.186544+01
   D.C. GAIN = -.109872+02, ROOT LOCUS GAIN = -.950982+01

AWS = -.950982+01  BWS = -.150212+02 CWS =  .605617+01
DWS =  .183636+01
```

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000     DEGREES
                     FROM ORIGINAL BODY AXES.
                RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE,
                     LX =  .1700+02 LY = -.0000     AND LZ = -.0000

RUN NO.  L1          INTEGRATOR CHARACTERISTICS FOR COLLECTIVE

                Y AXIS VELOCITY PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     U0 =  .1350+03
           ROOTS (COMPLEX FORM)
             .8852+000          .3063+000
             .8852+000         -.3063+000
            -.2562+001          .2026-030

  ZUB = -.945010-00  WUB =  .936815-00  1/TUB = -.256228+01
     D.C. GAIN = -.914937+01, ROOT LOCUS GAIN =  .683000-00

  AUB =  .683000-00  BUB =  .540720-00 CUB = -.249920+01
  DUB =  .153567+01

                Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     W0 =  .5450+01, POSITIVE DOWN
           ROOTS (COMPLEX FORM)
             .4019+000          .9508-015
            -.4406+000         -.4634+000
            -.4406+000          .4634+000

  ZWB =  .659098-00  WWB =  .639519-00  1/TWB =  .401947-00
     D.C. GAIN = -.104577+02, ROOT LOCUS GAIN = -.106324+02

  AWB = -.106324+02  BWB = -.509755+01 CWB = -.581751-00
  DWB =  .174786+01

            X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     AX0 = 0.0
           ROOTS (COMPLEX FORM)
            -.5061-001          .2181+000
            -.5061-001         -.2181+000
             .5829+000          .2266-030
            -.1609+001         -.1055-025

    WAX =  .223987-00     ZAX =  .225984-00
 1/TAX1 =  .542987-00 1/TAX2 = -.180966+01
     D.C. GAIN =  .216297-00, ROOT LOCUS GAIN =  .683000-00

  AAX =  .683000-00  BAX =  .904960-00 CAX = -.601487-00
  DAX = -.309134-01  EAX = -.361510-01
```

```
          Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                  AZ0 = 0.0
        ROOTS (COMPLEX FORM)
          .7923-003          -.6918-021
          .4993+000          -.1565-034
         -.2142+000          -.2993-033
         -.1618+001          -.1726-032

1/TAZ1 =  .792332-03  1/TAZ2 =  .499349-00
1/TAZ3 = -.214246-00  1/TAZ4 = -.161882+01
   D.C. GAIN =  .872941-02, ROOT LOCUS GAIN = -.106324+02

AAZ = -.106324+02  BAZ = -.141722+02 CAZ =  .605593+01
DAZ =  .183661+01  EAZ = -.145900-02

             VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                  FLIGHT PATH, DUE TO DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                  USTAB0 =  .135150+03
        ROOTS (COMPLEX FORM)
          .8131+000          .3113+000
          .8131+000         -.3113+000
         -.2954+001         -.3340-029

ZUS = -.933873-00  WUS =  .870723-00  1/TUS = -.295420+01
   D.C. GAIN = -.915273+01, ROOT LOCUS GAIN =  .683000-00

AUS =  .683000-00  BUS =  .906960-00 CUS = -.276357+01
DUS =  .152975+01

             VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                  FLIGHT PATH, DUE TO DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                  WSTAB0 = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
          .5007+000          .0000
         -.2212+000          .0000
         -.1612+001          .0000

1/TWS1 =  .500730-00  1/TWS2 = -.221290-00  1/TWS3 = -.161237+01
   D.C. GAIN = -.113656+02, ROOT LOCUS GAIN = -.106324+02

AWS = -.106324+02  BWS = -.141722+02 CWS =  .596867+01
DWS =  .189959+01
```

ROOTS OF A/C LONGITUDINAL TRANSFER FUNCTIONS

RUN NO. L2

VERTOL VWC-1A 1500 FT/MIN DESCENT 80 KNOTS

INPUT DATA

UNITS ARE 1 PER RADIAN
DIMENSIONAL STABILITY DERIVATIVES
(BODY AXES DIFFER BY .1372+02 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

XU =	-.4310-01	ZU =	.1790-01	MU =	-.6350-02
XW =	.1065+00	ZW =	-.9805-00	MW =	.6830-02
XQ =	.1370+01	ZQ =	-.2420+01	MQ =	-.1623+01
XUD =	-.0000	ZUD =	-.0000	MUD =	-.0000
XWD =	-.0000	ZWD =	-.0000	MWD =	-.0000
XQD =	-.0000	ZQD =	-.0000	MQD =	-.0000
XD =	.1460-00	ZD =	.7154-00	MD =	.5034-00
XT =	.8270-00	ZT =	-.9053+01	MT =	.1088+00

U =	.1333+03	UZ =	.3255+02	GAMA =	-.1050+02
MACH =	-.0000	RHO =	.2380-02	S =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
HT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02

DIMENSIONAL STABILITY DERIVATIVES, PER RADIAN,
STABILITY AXES

XU =	-.6720-01	ZU =	-.2052-00	MU =	-.4549-02
XW =	-.1165+00	ZW =	-.9564-00	MW =	.8141-02
XQ =	.7568-00	ZQ =	-.2676+01	MQ =	-.1623+01
XUD =	.0000	ZUD =	.0000	MUD =	.0000
XWD =	.0000	ZWD =	.0000	MWD =	.0000
XQD =	.0000	ZQD =	.0000	MQD =	.0000
XD =	.3115-00	ZD =	.6603-00	MD =	.5034-00
XT =	-.1344+01	ZT =	-.3991+01	MT =	.1088+00

IN STABILITY AXES, U = .1372+03 AND W = 0.0
ZIY = .7591+05 AND ZIXZ = .8109+04

THE CHARACTERISTICS OF THE LONGITUDINAL DENOMINATOR ARE
ROOTS (COMPLEX FORM)

-.3490+000	.2898+000
-.3490+000	-.2898+000
.4062+000	-.7819-031
-.2354+001	.1651-026

ZSP = .769325-00 WN = .453746-00 RAD/SEC

= .722194-01 CYCLES/SEC

1/TP1 = .408221-00 1/TP2 = -.235467+01

SHORT PERIOD MODE

PERIOD = .21674+02 TIME TO HALF AMP. = .19856+01

TIME TO ONE TENTH AMP. = .65059+01

CYCLES TO HALF AMP. = .91610-01

CYCLES TO ONE TENTH AMP. = .30432-00

ONE OVER CYCLES TO HALF AMP. = .10916+02

ONE OVER CYCLES TO ONE TENTH AMP. = .32840+01

ZETAWN = .69819-00

WSQ = .20591-00

COEFFICIENTS

A = .100000+01 B = .244460+01 C = .609763-00

D = -.266632-00 E = -.196949-00

NOT REPRODUCIBLE

TRANSFER FUNCTIONS FOR STABILITY AXES.
ORIGIN AT SIMPLE C.G.

RUN NO. 62 [illegible] CHARACTERISTICS FOR CYCLIC

THETA PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE.
THO = -.1[illegible]+02
ROOTS (COMPLEX FORM)
-.3[illegible]-001 .0000
-.0931+000 .0000

1/TT-1 = -.[illegible]-01 1/TT-2 = -.093152-00
D.C. GAIN = -.072577-01. ROOT LOCUS GAIN = .5[illegible]-00

ATH = .503+[illegible]-00 BTH = .519230-00 CTH = .101547-01

Y AXIS VELOCITY PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE.
UO = .1372+03
ROOTS (COMPLEX FORM)
-.6561+000 .0000
.7452+001 .0000
-.1[illegible]35+002 .0000

1/TUH1 = -.05[illegible]-00 1/TUH2 = .745201+01 1/TUH3 = -.133521+02
D.C. GAIN = .[illegible]+02. ROOT LOCUS GAIN = .311537-00

AUH = .311537-00 BUH = .11[illegible]43+01 CUH = -.934434+02
DUH = -.157723+02

Z AXIS VELOCITY, W, PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE.
WO = .0000 , POSITIVE DOWN
ROOTS (COMPLEX FORM)
-.5221-001 .2150+000
-.5221-001 -.2150+000
-.1040+003 .5320-024

ZWH = .235[illegible]-00 BWH = .221326-00 1/TWH = -.1[illegible]+03
D.C. GAIN = -.1/[illegible]+02. ROOT LOCUS GAIN = .640347-00

AWH = .440347-00 BWH = .637400+02 CWH = .720726+01
DWH = .334562+01

NOT REPRODUCIBLE

```
          Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                   AZ0 = 0.0
         ROOTS (COMPLEX FORM)
          -.1723+001          -.3716-001
          -.1723-001           .3716-001
           .1031+002          -.2735-029
          -.9934+001          -.4560-029

   AAZ =  .409631-01     ZAZ =  .420727-00
1/TAZ1 =  .103191+02 1/TAZ2 = -.983408+01
   D.C. GAIN =  .570704-02, ROOT LOCUS GAIN =  .660347-00

 AAZ =  .660347-00  BAZ = -.294865-00 CAZ = -.469949+02
 DAZ = -.230941+01  EAZ = -.112399+00


          X AXIS ACCELERATION,AX,PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                   AX0 = 0.0
         ROOTS (COMPLEX FORM)
           .3433+000          .0000
          -.2399+000          .0000
           .3364+001          .0000
          -.7023+001          .0000

1/TAX1 =  .343325-00  1/TAX2 = -.239942-00
1/TAX3 =  .336459+01  1/TAX4 = -.702333+01
   D.C. GAIN = -.307924+01, ROOT LOCUS GAIN =  .311537-00

AAX =  .311537-00  BAX =  .110763+01 CAX = -.750532+01
DAX =  .467166-00  EAX =  .604452-00

             HORIZ. VELOCITY PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                   SD0 =  .134919+03
         ROOTS (COMPLEX FORM)
          -.1249+001          .0000
           .6113+001          .0000
          -.1100+002          .0000

1/TSD1 = -.124962+01  1/TSD2 =  .611385+01  1/TSD3 = -.110090+02
   D.C. GAIN =  .794250+02, ROOT LOCUS GAIN =  .185982-00

ASD =  .185982-00  BSD =  .114281+01 CSD = -.113603+02
DSD = -.156426+02
```

NOT REPRODUCIBLE

```
            RATE OF CLIMB PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 HDO = -.250057+02, POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
         -.3196-001          .0000
          .9637+001          .0000
         -.9680+001          .0000

1/THD1 = -.319637-01  1/THD2 =  .983718+01  1/THD3 = -.968047+01
   D.C. GAIN = -.109123+02, ROOT LOCUS GAIN = -.706062-00

AHD = -.706062-00  BHD =  .880775-01 CHD =  .672408+02
DHD =  .214915+01

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                 FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 USTABO =  .137217+03
        ROOTS (COMPLEX FORM)
         -.6561+000          .0000
          .7452+001          .0000
         -.1035+002          .0000

1/TUS1 = -.656196-00  1/TUS2 =  .745291+01  1/TUS3 = -.103521+02
   D.C. GAIN =  .800836+02, ROOT LOCUS GAIN =  .311537-00

AUS =  .311537-00  BUS =  .110763+01 CUS = -.234434+02
DUS = -.157723+02


            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                 FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
          .1151-001          .0000
          .1006+002          .0000
         -.9633+001          .0000

1/TWS1 =  .115151-01  1/TWS2 =  .100660+02  1/TWS3 = -.963303+01
   D.C. GAIN = -.374452+01, ROOT LOCUS GAIN =  .660347-00

AWS =  .660347-00  BWS = -.294865-00 CWS = -.640410+02
DWS =  .737478-00
```

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES.
                RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE,
                     LX =  .1700+02 LY = -.0000    AND LZ = -.0000

RUN NO.  L2          NUMERATOR CHARACTERISTICS FOR CYCLIC

                X AXIS VELOCITY PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .1333+03
            ROOTS (COMPLEX FORM)
             -.7961+000        -.6388+000
             -.7961+000         .6388+000
              .1059+003        -.7765-029

  ZUB =  .779964-00  WUB =  .102074+01  1/TUB =  .105974+03
     D.C. GAIN =  .818517+02, ROOT LOCUS GAIN =  .146000-00

  AUB =  .146000-00  BUB = -.152397+02 CUB = -.244839+02
  DUB = -.161206+02

                Z AXIS VELOCITY, W, PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .3255+02, POSITIVE DOWN
            ROOTS (COMPLEX FORM)
              .8132-001         .0000
             -.9933-001         .0000
              .7445+001         .0000

  1/TWB1 =  .813253-01  1/TWB2 = -.993310-01  1/TWB3 =  .744589+01
     D.C. GAIN =  .239510+01, ROOT LOCUS GAIN = -.784240+01

  AWB = -.784240+01  BWB =  .582524+02 CWB =  .111477+01
  DWB = -.471711-00

             X AXIS ACCELERATION,AX,PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     AXO = 0.0
            ROOTS (COMPLEX FORM)
             -.6596-001         .2619+000
             -.6596-001        -.2619+000
             -.3858+001         .6552+001
             -.3858+001        -.6552+001

  WAX1 =  .270086-00  ZAX1 =  .244247-00
  WAX2 =  .760402+01  ZAX2 =  .507435-00
     D.C. GAIN = -.312673+01, ROOT LOCUS GAIN =  .146000-00

  AAX =  .146000-00  BAX =  .114596+01 CAX =  .560118+01
  DAX =  .119597+01  EAX =  .415905-00
```

```
Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
   PERTURBATIONS ABOUT INITIAL VALUE,
        AZO = 0.0
ROOTS (COMPLEX FORM)
  .1198-001          .4519-026
 -.4321-001         -.4964-047
 -.5486+000         -.2869+001
 -.5486+000          .2869+001

 WAZ =  .292124+01    ZAZ =  .187624-00
1/TAZ1 =  .119881-01 1/TAZ2 = -.432126-01
   D.C. GAIN = -.176032-00, ROOT LOCUS GAIN = -.784240+01

AAZ = -.784240+01  BAZ = -.885077+01 CAZ = -.671587+02
DAZ = -.208523+01  EAZ =  .346693-01

        VELOCITY PERTURBATIONS PARALLEL TO INITIAL
             FLIGHT PATH, DUE TO DELTA CYCLIC
        PERTURBATIONS ABOUT INITIAL VALUE,
             USTABO =  .137217+03
ROOTS (COMPLEX FORM)
 -.1701+001          .0000
  .5402+001          .0000
 -.1154+002          .0000

1/TUS1 = -.170118+01  1/TUS2 =  .540214+01  1/TUS3 = -.115500+02
   D.C. GAIN =  .786360+02, ROOT LOCUS GAIN =  .146000-00

AUS =  .146000-00  BUS =  .114596+01 CUS = -.758267+01
DUS = -.154971+02

        VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
             FLIGHT PATH, DUE TO DELTA CYCLIC
        PERTURBATIONS ABOUT INITIAL VALUE,
             WSTABO = 0.0, POSITIVE FOR DOWN
ROOTS (COMPLEX FORM)
 -.4466-001          .0000
 -.5419+000         -.2888+001
 -.5419+000          .2888+001

ZWS =  .184429-00  WWS =  .293656+01  1/TWS = -.446696-01
   D.C. GAIN =  .153595+02, ROOT LOCUS GAIN = -.784240+01

AWS = -.784240+01  BWS = -.885077+01 CWS = -.680998+02
DWS = -.302503+01
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                    ORIGIN AT AIRPLANE C.G.

RUN NO.  L2          NUMERATOR CHARACTERISTICS FOR COLLECTIVE

                THETA PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     TH0 = -.1050+02
            ROOTS (COMPLEX FORM)
             -.7830-001          .0000
             -.3287+000          .0000

  1/TTH1 = -.783009-01  1/TTH2 = -.328723-00
     D.C. GAIN = -.142191-01, ROOT LOCUS GAIN =  .108800+00

  ATH =  .108800+00  BTH =  .442842-01 CTH =  .280044-02

                X AXIS VELOCITY PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     U0 =  .1372+03
            ROOTS (COMPLEX FORM)
             -.2831+000          -.9673-020
             -.7278+000          -.1436+001
             -.7278+000           .1436+001

  ZUB =  .451490-00  MUB =  .161064+01  1/TUB = -.283113-00
     D.C. GAIN =  .501237+01, ROOT LOCUS GAIN = -.134412+01

  AUB = -.134412+01  BUB = -.233713+01 CUB = -.404081+01
  DUB = -.947180-00

                Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     W0 =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
              .7135+000           .0000
             -.3724+000          -.4307+000
             -.3724+000           .4307+000

  ZWB =  .654113-00  MWB =  .569456-00  1/TWB =  .713571-00
     D.C. GAIN = -.105634+02, ROOT LOCUS GAIN = -.899078+01

  AWB = -.899078+01  BWB = -.282394-00 CWB =  .186391+01
  DWB =  .208045+01
```

NOT REPRODUCIBLE

```
          Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                   AZO = 0.0
         ROOTS (COMPLEX FORM)
           .1194-001          -.2021-017
          -.9384+000          -.6316-001
          -.9384+000           .6316-001
           .1730+000           .1422-027

   WAZ =  .940561-00     ZAZ =  .997742-00
1/TAZ1 =  .119406-01 1/TAZ2 = -.938438-00
   D.C. GAIN =  .634377-01, ROOT LOCUS GAIN = -.499078+01

AAZ = -.499078+01  BAZ = -.152116+02 CAZ = -.485105+01
DAZ =  .143633+01  EAZ = -.164329-01

          X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                   AXO = 0.0
         ROOTS (COMPLEX FORM)
          -.1961+000           .4681-023
           .3829+000           .4386-021
          -.7421+000          -.2364-033
          -.1183+001          -.2501-034

1/TAX1 = -.196139-00  1/TAX2 =  .382926-00
1/TAX3 = -.742154-00  1/TAX4 = -.118341+01
   D.C. GAIN = -.450190-00, ROOT LOCUS GAIN = -.134412+01

AAX = -.134412+01  BAX = -.233713+01 CAX = -.596113-00
DAX =  .414895-00  EAX =  .686642-01

             HORIZ. VELOCITY PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                   SDO =  .134919+03
         ROOTS (COMPLEX FORM)
          -.3830+000           .0000
           .2737+001           .0000
          -.3851+001           .0000

1/TSD1 = -.383094-00  1/TSD2 =  .273787+01  1/TSD3 = -.385117+01
   D.C. GAIN =  .649791+01, ROOT LOCUS GAIN =  .316823-00

ASD =  .316823-00  BSD =  .474091-00 CSD = -.320546+01
DSD = -.127976+01
```

RATE OF CLIMB PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
HDD = -.250037+02, POSITIVE FOR CLIMB

ROOTS (COMPLEX FORM)

-.9391+000	-.5150-001
-.9391+000	.5150-001
.1851+000	.9327-034

ZHD = .696482-00 WHD = .940573-00 1/THD = .185119-00
D.C. GAIN = .755469+01, ROOT LOCUS GAIN = .908517+01

AHD = .908517+01 BHD = .153627+02 CHD = .487546+01
DHD = -.146749+01

VELOCITY PERTURBATIONS PARALLEL TO INITIAL
FLIGHT PATH, DUE TO DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
USTARD = .137217+03

ROOTS (COMPLEX FORM)

-.2831+000	-.9477-020
-.7278+000	-.1436+001
-.7278+000	.1436+001

ZUS = .451490-00 WUS = .161364+01 1/TUS = -.283113-00
D.C. GAIN = .501237+01, ROOT LOCUS GAIN = -.134412+01

AUS = -.134412+01 BUS = -.233713+01 CUS = -.404091+01
DUS = -.987180-00

VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
FLIGHT PATH, DUE TO DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
WSTARD = 0.0, POSITIVE FOR DOWN

ROOTS (COMPLEX FORM)

-.7780+000	-.1329-017
.2148+000	.4466-035
-.1128+001	.1399-032

1/TWS1 = -.778047-00 1/TWS2 = .214631-00 1/TWS3 = -.112869+01
D.C. GAIN = -.861234+01, ROOT LOCUS GAIN = -.899078+01

AWS = -.899078+01 BWS = -.152114+02 CWS = -.421242+01
DWS = .149619+01

NOT REPRODUCIBLE

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES.
                RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE.
                     LX =  .1700+02 LY = -.0000    AND LZ = -.0000

RUN NO.  L2          NUMERATOR CHARACTERISTICS FOR COLLECTIVE

                X AXIS VELOCITY PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE.
                     UO =  .1333+03
            ROOTS (COMPLEX FORM)
             -.4546+000          .0000
             -.9495+000          .0000
              .4066+001          .0000

  1/TUB1 = -.454632-00  1/TUB2 = -.949549-00  1/TUB3 =  .406855+01
     D.C. GAIN =  .737512+01, ROOT LOCUS GAIN =  .827000-00

  AUB =  .827000-00  BUB = -.220343+01 CUB = -.436762+01
  DUB = -.145252+01

                Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE.
                     WO =  .3255+02, POSITIVE DOWN
            ROOTS (COMPLEX FORM)
              .5441+000          .0000
             -.3445+000         -.4271+000
             -.3445+000          .4271+000

  ZWB =  .627876-00  XWB =  .544826-00  1/TWB =  .544126-00
     D.C. GAIN = -.907291+01, ROOT LOCUS GAIN = -.109026+02

  AWB = -.109026+02  BWB = -.158157+01 CWB =  .804560-00
  DWB =  .178690+01

             X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE.
                     AXO = 0.0
            ROOTS (COMPLEX FORM)
              .8512-001          .3432+000
              .8512-001         -.3432+000
             -.8940+000          .2669+000
             -.8940+000         -.2669+000

  WAX1 =  .353614-00  ZAX1 = -.240729-00
  WAX2 =  .933073-00  ZAX2 =  .958207-00
     D.C. GAIN = -.457133-00, ROOT LOCUS GAIN =  .827000-00

  AAX =  .827000-00  BAX =  .133401+01 CAX =  .571651-00
  DAX =  .623321-01  EAX =  .900316-01
```

```
Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
   PERTURBATIONS ABOUT INITIAL VALUE,
        AZ0 = 0.0
ROOTS (COMPLEX FORM)
 -.3356-002          .1923-027
 -.8282+000         -.2537+000
 -.8282+000          .2537+000
  .1845+000         -.1422-029

  WAZ =  .866249-00     ZAZ =  .956143-00
1/TAZ1 = -.335670-02 1/TAZ2 = -.925258-00
   D.C. GAIN = -.257361-01, ROOT LOCUS GAIN = -.109026+02

AAZ = -.109026+02  BAZ = -.160846+02 CAZ = -.490160+01
DAZ =  .149375+01  EAZ =  .506669-02

     VELOCITY PERTURBATIONS PARALLEL TO INITIAL
          FLIGHT PATH, DUE TO DELTA COLLECTIVE
     PERTURBATIONS ABOUT INITIAL VALUE,
          USTAB0 =  .137217+03
ROOTS (COMPLEX FORM)
  .1492+001          .0000
 -.4082+000          .0000
 -.2701+001          .0000

1/TUS1 =  .149231+01  1/TUS2 = -.408257-00  1/TUS3 = -.270195+01
   D.C. GAIN =  .691229+01, ROOT LOCUS GAIN =  .827000-00

AUS =  .827000-00  BUS =  .133801+01 CUS = -.292617+01
DUS = -.136137+01

     VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
          FLIGHT PATH, DUE TO DELTA COLLECTIVE
     PERTURBATIONS ABOUT INITIAL VALUE,
          WSTAB0 = 0.0, POSITIVE FOR DOWN
ROOTS (COMPLEX FORM)
 -.8238+000         -.2702+000
 -.8238+000          .2702+000
  .1724+000          .1313-030

ZWS =  .950186-00  WWS =  .867072-00  1/TWS =  .172459-00
   D.C. GAIN = -.717750+01, ROOT LOCUS GAIN = -.109026+02

AWS = -.109026+02  BWS = -.160846+02 CWS = -.509853+01
DWS =  .141360+01
```

NOT REPRODUCIBLE

ROOTS OF A/C LONGITUDINAL TRANSFER FUNCTIONS

RUN NO. L3

VERTOL VMC-1A LEVEL FLIGHT AT 60 KNOTS

**PLOT DATA

NOT REPRODUCIBLE

UNITS ARE 1 PER RADIAN
DIMENSIONAL STABILITY DERIVATIVES
(BODY AXES TILTED BY .4712+01 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

XU =	-.3606-01	ZU =	-.2192-01	MU =	-.6700-02
XW =	.6944-01	ZW =	-.3015-00	MW =	.1363-01
XQ =	.8496-00	ZQ =	-.1814+01	MQ =	-.1460+01
XUD =	-.0000	ZUD =	-.0000	MUD =	-.0000
XWD =	-.0000	ZWD =	-.0000	MWD =	-.0000
XQD =	-.0000	ZQD =	-.0000	MQD =	-.0000
XD =	.1424-00	ZD =	.5682-00	MD =	.4502-00
XT =	.4025-00	ZT =	-.5520+01	MT =	.6760-01
U =	.1007+03	LZ =	.6300+01	GAMA =	.0000
MACH =	-.0000	HMU =	.2345-02	S =	-.0000
MAC =	-.0000	IYZ =	.7114+04	IY =	.7591+05
MT =	-.0000	YT =	-.0000	TOT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CT =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02

DIMENSIONAL STABILITY DERIVATIVES, PER RADIAN,
STABILITY AXES

XU =	-.3568-01	ZU =	-.5504-01	MU =	-.5558-02
XW =	.2632-01	ZW =	-.4019-00	MW =	.1413-01
XQ =	.6977-00	ZQ =	-.1578+01	MQ =	-.1460+01
XUD =	.0000	ZUD =	.0000	MUD =	.0000
XWD =	.0000	ZWD =	.0000	MWD =	.0000
XQD =	.0000	ZQD =	.0000	MQD =	.0000
XD =	.1086-00	ZD =	.5546-00	MD =	.4502-00
XT =	.9992-01	ZT =	-.5557+01	MT =	.6780-01

IN STABILITY AXES, U = .1010+03 AND W = 0.0
IZY = .7591+05 AND IXZ = -.1895+04

THE CHARACTERISTICS OF THE LONGITUDINAL DENOMINATOR ARE

ROOTS (COMPLEX FORM)

-.2135+000	.3447+000
-.2135+000	-.3447+000
.4727+000	.4212-033
-.2343+001	-.4651-030

ZSP = .526632-00 WSP = .405593-00 RAD/SEC

= .645522-01 CYCLES/SEC

1/TP1 = .472711-00 1/TP2 = -.234305+01

SHORT PERIOD MODE

PERIOD = .18223+02 TIME TO HALF AMP. = .32451+01

TIME TO ONE TENTH AMP. = .10780+02

CYCLES TO HALF AMP. = .17808-00

CYCLES TO ONE TENTH AMP. = .59156-00

ONE OVER CYCLES TO HALF AMP. = .56156+01

ONE OVER CYCLES TO ONE TENTH AMP. = .16905+01

2*Z*WN = .42720-00

WSQ = .16451-00

COEFFICIENTS

A = .100000+01	B = .229754+01	C = -.144079-00
D = -.165476-00	E = -.182205-00	

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                    ORIGIN AT AIRPLANE C.G.

RUN NO.  L3            NUMERATOR CHARACTERISTICS FOR CYCLIC

                THETA PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     THO =  .0000
            ROOTS (COMPLEX FORM)
             -.3538-001          .0000
             -.6172+000          .0000

 1/TTH1 = -.353840-01  1/TTH2 = -.617239-00
    D.C. GAIN = -.714499-01, ROOT LOCUS GAIN =  .450200-00

 ATH =  .450200-00  BTH =  .363851-00 CTH =  .130185-01

                X AXIS VELOCITY PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .1010+03
            ROOTS (COMPLEX FORM)
             -.8731+000          .0000
              .7069+001          .0000
             -.1020+002          .0000

 1/TUB1 = -.873144-00  1/TUB2 =  .706988+01  1/TUB3 = -.102016+02
    D.C. GAIN =  .651824+02, ROOT LOCUS GAIN =  .188593-00

 AUB =  .188593-00  BUB =  .755281-00 CUB = -.130864+02
 DUB = -.118766+02

                Z AXIS VELOCITY, W, PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
             -.1602-001          .1571+000
             -.1602-001         -.1571+000
             -.8193+002          .5366-025

 ZWB =  .101430+00  WWB =  .157945-00  1/TWB = -.819341+02
    D.C. GAIN = -.622130+01, ROOT LOCUS GAIN =  .554582-00

 AWB =  .554582-00  BWB =  .454570+02 CWB =  .146974+01
 DWB =  .113355+01
```

NOT REPRODUCIBLE

```
          Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  AZ0 = 0.0
        ROOTS (COMPLEX FORM)
          .0000              .0000
         -.4673-002          .0000
          .8233+001          .0000
         -.8171+001          .0000

1/TAZ1 =  .000000     1/TAZ2 = -.467363-02
1/TAZ3 =  .823397+01  1/TAZ4 = -.817161+01
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN =  .554582-00

AAZ =  .554582-00  BAZ = -.318842-01 CAZ = -.373151+02
DAZ = -.181859-00  EAZ =  .000000


          X AXIS ACCELERATION,AX,PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  AX0 = 0.0
        ROOTS (COMPLEX FORM)
         -.9685-001          .5817+000
         -.9685-001         -.5817+000
         -.1905+001          .1661+001
         -.1905+001         -.1661+001

WAX1 =  .589753-00  ZAX1 =  .164222-00
WAX2 =  .252799+01  ZAX2 =  .753784-00
   D.C. GAIN = -.230069+01, ROOT LOCUS GAIN =  .188593-00

AAX =  .188593-00  BAX =  .755281-00 CAX =  .141006+01
DAX =  .483446-00  EAX =  .419196-00

             HORIZ. VELOCITY PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  SOC =  .101041+03
        ROOTS (COMPLEX FORM)
         -.8731+000          .0000
          .7069+001          .0000
         -.1020+002          .0000

1/TSD1 = -.873144-00  1/TSD2 =  .706989+01  1/TSD3 = -.102016+02
   D.C. GAIN =  .651824+02, ROOT LOCUS GAIN =  .188593-00

ASD =  .188593-00  BSD =  .755281-00 CSD = -.130864+02
DSD = -.118766+02
```

```
            RATE OF CLIMB PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 HDC =  .000000   , POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
         -.4873-002          .0000
          .8233+001          .0000
         -.8171+001          .0000

1/THD1 = -.487363-02  1/THD2 =  .823397+01  1/THD3 = -.817161+01
   D.C. GAIN = -.998104-00, ROOT LOCUS GAIN = -.554582-00

AHD = -.554582-00  BHD =  .318942-01 CHD =  .373151+02
DHD =  .181859-00

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                 FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 USTABO =  .101041+03
        ROOTS (COMPLEX FORM)
         -.8731+000          .0000
          .7069+001          .0000
         -.1020+002          .0000

1/TUS1 = -.873144-00  1/TUS2 =  .706988+01  1/TUS3 = -.102016+02
   D.C. GAIN =  .651824+02, ROOT LOCUS GAIN =  .188593-00

AUS =  .188593-00  BUS =  .755261-00 CUS = -.130864+02
DUS = -.118766+02


            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                 FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
         -.4873-002          .0000
          .8233+001         -.0000
         -.8171+001          .0000

1/TWS1 = -.487363-02  1/TWS2 =  .823397+01  1/TWS3 = -.817161+01
   D.C. GAIN =  .998104-00, ROOT LOCUS GAIN =  .554582-00

AWS =  .554582-00  BWS = -.318942-01 CWS = -.373151+02
DWS = -.181859-00
```

```
TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
     FROM ORIGINAL BODY AXES.
RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
     TO ORIGIN OF AXES ARE.
     LX =  .1700+02 LY = -.0000    AND LZ = -.0000

RUN NO.  L3          NOMENATOR CHARACTERISTICS FOR CYCLIC

     X AXIS VELOCITY PER DELTA CYCLIC
     PERTURBATIONS ABOUT INITIAL VALUE.
          UO =  .1007+03
  ROOTS (COMPLEX FORM)
   -.1337+001          .0000
   -.2526+001          .0000
    .2479+002          .0000

1/TUB1 = -.133709+01  1/TUB2 = -.252643+01  1/TUB3 =  .247997+02
   D.C. GAIN =  .654732+02, ROOT LOCUS GAIN =  .142400-00

AUB =  .142400-00  BUB = -.298131+01 CUB = -.131629+02
DUB = -.119295+02

     Z AXIS VELOCITY, W, PER DELTA CYCLIC
     PERTURBATIONS ABOUT INITIAL VALUE.
          WO =  .6300+01, POSITIVE DOWN
  ROOTS (COMPLEX FORM)
   -.2528-002         -.6291-001
   -.2528-002          .6291-001
    .5486+001         -.2247-027

ZWB =  .401530-01  WWB =  .629649-01  1/TWB =  .548690+01
   D.C. GAIN = -.845894-00, ROOT LOCUS GAIN = -.708520+01

AWB = -.708520+01  BWB =  .368399+02 CWB =  .168484-00
DWB =  .154126-00

     X AXIS ACCELERATION,AX,PER DELTA CYCLIC
     PERTURBATIONS ABOUT INITIAL VALUE.
          AXO = 0.0
  ROOTS (COMPLEX FORM)
   -.4858-001          .3048+000
   -.4858-001         -.3048+000
   -.2603+001          .4900+001
   -.2603+001         -.4900+001

WAX1 =  .308669-00  ZAX1 =  .157409-00
WAX2 =  .554913+01  ZAX2 =  .469193-00
   D.C. GAIN = -.229291+01, ROOT LOCUS GAIN =  .142400-00

AAX =  .142400-00  BAX =  .755347-00 CAX =  .447053+01
DAX =  .496750-00  EAX =  .417779-00
```

NOT REPRODUCIBLE

```
Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE,
AZO = 0.0
ROOTS (COMPLEX FORM)
.2847-001          -.1776-020
-.3243-001         -.4485-016
-.4563+000          .2247+001
-.4563+000         -.2247+001


WAZ =  .229369+01     ZAZ =  .198974-00
1/TAZ1 =  .244796-01 1/TAZ2 = -.324368-01
D.C. GAIN = -.188939-00, ROOT LOCUS GAIN = -.708520+01

AAZ = -.708520+01  BAZ = -.649520+01 CAZ = -.372945+02
DAZ = -.141532-00  EAZ =  .344346-01

VELOCITY PERTURBATIONS PARALLEL TO INITIAL
FLIGHT PATH, DUE TO DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE,
USTABO =  .101041+03
ROOTS (COMPLEX FORM)
-.1111+001          .0000
.6798+001           .0000
-.1099+002          .0000

1/TUS1 = -.111101+01  1/TUS2 =  .679811+01  1/TUS3 = -.109915+02
D.C. GAIN =  .648802+02, ROOT LOCUS GAIN =  .142400-00

AUS =  .142400-00  BUS =  .755347-00 CUS = -.997692+01
DUS = -.118215+02

VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
FLIGHT PATH, DUE TO DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE,
WSTABO = 0.0, POSITIVE FOR DOWN
ROOTS (COMPLEX FORM)
-.3020-001          .2832-016
-.4432+000         -.2282+001
-.4432+000          .2282+001

ZWS =  .190660-00  WWS =  .232487+01  1/TWS = -.302082-01
D.C. GAIN =  .634911+01, ROOT LOCUS GAIN = -.708520+01

AWS = -.708520+01  BWS = -.649520+01 CWS = -.384853+02
DWS = -.115684+01
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                    ORIGIN AT AIRPLANE C.G.

RUN NO.  L3          NUMERATOR CHARACTERISTICS FOR COLLECTIVE

                THETA PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     THO =  .0000
            ROOTS (COMPLEX FORM)
              .9777+000          .0000
             -.2319-001          .0000

  1/TTH1 =  .977752-00  1/TTH2 = -.231926-01
     D.C. GAIN =  .843817-02, ROOT LOCUS GAIN =  .678000-01

  ATH =  .678000-01  BTH = -.647191-01 CTH = -.153747-02

                X AXIS VELOCITY PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .1010+03
            ROOTS (COMPLEX FORM)
              .9444+000          .0000
              .4106+001          .0000
             -.5532+001          .0000

  1/TUB1 =  .944480-00  1/TUB2 =  .410654+01  1/TUB3 = -.553235+01
     D.C. GAIN = -.117668+02, ROOT LOCUS GAIN =  .999169-01

  AUB =  .999169-01  BUB =  .480922-01 CUB = -.240455+01
  DUB =  .214396+01

                Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
              .4076+000         -.9711-017
             -.5592+000          .4236+000
             -.5592+000         -.4236+000

  ZWB =  .797164-00  WWB =  .701610-00  1/TWB =  .407623-00
     D.C. GAIN = -.942364+01, ROOT LOCUS GAIN = -.855713+01

  AWB = -.855713+01  BWB = -.608389+01 CWB = -.310540-00
  DWB =  .171703+01
```

NOT REPRODUCIBLE

```
          Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                   AZO = 0.0
        ROOTS (COMPLEX FORM)
          .0000                .0000
          .5475+000            .0000
         -.2169+000            .0000
         -.1842+001            .0000

1/TAZ1 =  .000000      1/TAZ2 =  .547569-00
1/TAZ3 = -.216916-00  1/TAZ4 = -.184220+01
   D.C. GAIN =  .000000   , ROOT LOCUS GAIN = -.855713+01

AAZ = -.855713+01  BAZ = -.129345+02 CAZ =  .622878+01
DAZ =  .187238+01  EAZ =  .000000


          X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                   AXO = 0.0
        ROOTS (COMPLEX FORM)
          .1213+001            .0000
          .9884-001           -.4537+000
          .9884-001            .4537+000
         -.1892+001            .6330-029

  WAX =  .464426-00     ZAX = -.212833-00
1/TAX1 =  .121369+01 1/TAX2 =  .988452-01
   D.C. GAIN =  .271709-00, ROOT LOCUS GAIN =  .999169-01

AAX =  .999169-01  BAX =  .480922-01 CAX = -.221387-00
DAX =  .600086-01  EAX = -.495067-01

             HORIZ. VELOCITY PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                   SDO =  .101041+03
        ROOTS (COMPLEX FORM)
          .9444+000            .0000
          .4106+001            .0000
         -.5532+001            .0000

1/TSD1 =  .944480-00  1/TSD2 =  .410654+01  1/TSD3 = -.553235+01
   D.C. GAIN = -.117668+02, ROOT LOCUS GAIN =  .999169-01

ASD =  .999169-01  BSD =  .480922-01 CSD = -.240495+01
DSD =  .214396+01
```

```
            RATE OF CLIMB PER DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WDO =  .000000   , POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
          .5475+000          .0000
         -.2169+000          .0000
         -.1842+001          .0000

1/TWD1 =  .547569-00  1/TWD2 = -.216916-00  1/TWD3 = -.184220+01
   D.C. GAIN =  .102762+02, ROOT LOCUS GAIN =  .855713+01

AWD =  .855713+01  BWD =  .129345+02 CWD = -.622878+01
DWD = -.187238+01

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 USTABO =  .101041+03
        ROOTS (COMPLEX FORM)
          .9444+000          .0000
          .4106+001          .0000
         -.5532+001          .0000

1/TUS1 =  .944480-00  1/TUS2 =  .410654+01  1/TUS3 = -.553235+01
   D.C. GAIN = -.117668+02, ROOT LOCUS GAIN =  .999169-01

AUS =  .999169-01  BUS =  .480922-01 CUS = -.240455+01
DUS =  .214396+01


            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
          .5475+000          .0000
         -.2169+000          .0000
         -.1842+001          .0000

1/TWS1 =  .547569-00  1/TWS2 = -.216916-00  1/TWS3 = -.184220+01
   D.C. GAIN = -.102762+02, ROOT LOCUS GAIN = -.855713+01

AWS = -.855713+01  BWS = -.129345+02 CWS =  .622878+01
DWS =  .187238+01
```

```
TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
     FROM ORIGINAL BODY AXES.
RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
     TO ORIGIN OF AXES ARE,
     LX =  .1700+02 LY = -.0000    AND LZ = -.0000

RUN NO.  L3          NUMERATOR CHARACTERISTICS FOR COLLECTIVE

X AXIS VELOCITY PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
     UO =  .1007+03
ROOTS (COMPLEX FORM)
  .8442+000          .5797+000
  .8442+000         -.5797+000
 -.2370+001         -.3678-028

ZUB = -.824333-00  WUB =  .102414+01  1/TUB = -.237095+01
   D.C. GAIN = -.109529+02, ROOT LOCUS GAIN =  .802500-00

AUB =  .802500-00  BUB =  .547688-00 CUB = -.237091+01
DUB =  .199567+01

Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
     WO =  .8300+01, POSITIVE DOWN
ROOTS (COMPLEX FORM)
  .4294+000         -.9959-017
 -.4710+000          .4821+000
 -.4710+000         -.4821+000

ZWB =  .698886-00  WWB =  .674048-00  1/TWB =  .429464-00
   D.C. GAIN = -.103584+02, ROOT LOCUS GAIN = -.967260+01

AWB = -.967260+01  BWB = -.495916+01 CWB = -.480874-00
DWB =  .188734+01

X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
     AXO = 0.0
ROOTS (COMPLEX FORM)
  .6255+000          .5289-017
 -.7864-001         -.2165+000
 -.7864-001          .2165+000
 -.1851+001          .8862-029

  WAX =  .230371-00    ZAX =  .341386-00
1/TAX1 =  .625549-00 1/TAX2 = -.786454-01
   D.C. GAIN =  .270791-00, ROOT LOCUS GAIN =  .802500-00

AAX =  .802500-00  BAX =  .111043+01 CAX = -.732298-00
DAX = -.940000-01  EAX = -.493394-01
```

```
          Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                   AZO = 0.0
         ROOTS (COMPLEX FORM)
           .2158-002          .6478-027
           .5568+000          .1973-044
          -.2253+000         -.1094-040
          -.1552+001         -.2208-040


1/TAZ1 =  .215815-02  1/TAZ2 =  .556844-00
1/TAZ3 = -.225396-00  1/TAZ4 = -.155216+01
   D.C. GAIN =  .223194-01, ROOT LOCUS GAIN = -.967260+01

AAZ = -.967260+01  BAZ = -.117866+02 CAZ =  .621568+01
DAZ =  .187098+01  EAZ = -.406670-02

             VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                  FLIGHT PATH, DUE TO DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                  USTABO =  .101041+03
         ROOTS (COMPLEX FORM)
           .7664+000          .5096+000
           .7664+000         -.5096+000
          -.2916+001          .4289-029

ZUS = -.832723-00  WUS =  .920426-00  1/TUS = -.291663+01
   D.C. GAIN = -.108829+02, ROOT LOCUS GAIN =  .802500-00

AUS =  .802500-00  BUS =  .111043+01 CUS = -.290808+01
DUS =  .198291+01

             VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                  FLIGHT PATH, DUE TO DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                  WSTABO = 0.0, POSITIVE FOR DOWN
         ROOTS (COMPLEX FORM)
           .5616+000          .0000
          -.2448+000          .0000
          -.1535+001          .0000

1/TWS1 =  .561690-00  1/TWS2 = -.244803-00  1/TWS3 = -.153544+01
   D.C. GAIN = -.112081+02, ROOT LOCUS GAIN = -.967260+01

AWS = -.967260+01  BWS = -.117866+02 CWS =  .603634+01
DWS =  .204217+01
```

ROOTS OF A/C LONGITUDINAL TRANSFER FUNCTIONS

RUN NO. L4

VERTOL YHC-1A 1500FT/MIN DESCENT AT 60 KNOTS

INPUT DATA

UNITS ARE 1 PER RADIAN
DIMENSIONAL STABILITY DERIVATIVES
(BODY AXES DIFFER BY .1930+02 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

XU =	-.3180-01	ZU =	-.2150-01	MU =	-.6960-02
XW =	.1092+00	ZW =	-.9058-00	MW =	.4690-02
XQ =	.1460+01	ZQ =	-.2410+01	MQ =	-.1566+01
XUD =	-.0000	ZUD =	-.0000	MUD =	-.0000
XWD =	-.0000	ZWD =	-.0000	MWD =	-.0000
XQD =	-.0000	ZQD =	-.0000	MQD =	-.0000
XD =	.1260-00	ZD =	.7732-00	MD =	.4717-00
XT =	.8800-00	ZT =	-.8010+01	MT =	.1162+00
U =	.9850+02	UZ =	.3450+02	GAMA =	-.1390+02
MACH =	-.0000	RHO =	.2380-02	S =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
HT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02

DIMENSIONAL STABILITY DERIVATIVES, PER RADIAN,
STABILITY AXES

XU =	-.9994-01	ZU =	-.3038-00	MU =	-.5018-02
XW =	-.1731-00	ZW =	-.8377-00	MW =	.6727-02
XQ =	.5813-00	ZQ =	-.2757+01	MQ =	-.1566+01
XUD =	.0000	ZUD =	.0000	MUD =	.0000
XWD =	.0000	ZWD =	.0000	MWD =	.0000
XQD =	.0000	ZQD =	.0000	MQD =	.0000
XD =	.3745-00	ZD =	.6881-00	MD =	.4717-00
XT =	-.1817+01	ZT =	-.7851+01	MT =	.1162+00

IN STABILITY AXES, U = .1044+03 AND W = 0.0
ZIY = .7591+05 AND ZIXZ = .1397+05

THE CHARACTERISTICS OF THE LONGITUDINAL DENOMINATOR ARE
ROOTS (COMPLEX FORM)

-.4285+000	.2513+000
-.4285+000	-.2513+000
.4084+000	-.1444-033
-.2054+001	.3112-030

```
  ZSP =     .862643-00      WSP =     .496837-00 RAD/SEC
                                =     .790742-01 CYCLES/SEC
1/TP1 =     .408454-00   1/TP2 =    -.205487+01

SHORT PERIOD MODE

 PERIOD =    .25002+02        TIME TO HALF AMP. =     .16173+01
                            TIME TO ONE TENTH AMP. =    .53724+01


                              CYCLES TO HALF AMP. =     .64685-01
                          CYCLES TO ONE TENTH AMP. =    .21488-00
                     ONE OVER CYCLES TO HALF AMP. =     .15459+02
                ONE OVER CYCLES TO ONE TENTH AMP. =     .46538+01
                                            2*Z*WN =     .85719-00
                                               WSQ =     .24685-00

                            COEFFICIENTS

  A =     .100000+01      B =     .250360+01      C =     .818813-00
  D =    -.313039-00      E =    -.207183-00
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                    ORIGIN AT AIRPLANE C.G.

RUN NO.  L4          NUMERATOR CHARACTERISTICS FOR CYCLIC

                THETA PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     THO = -.1390+02
            ROOTS (COMPLEX FORM)
             -.3117-001          .0000
             -.9122+000          .0000

  1/TTH1 = -.311755-01  1/TTH2 = -.912253-00
     D.C. GAIN = -.647500-01, ROOT LOCUS GAIN =  .471700-00

  ATH =  .471700-00  BTH =  .445015-00 CTH =  .134151-01

                X AXIS VELOCITY PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .1044+03
            ROOTS (COMPLEX FORM)
             -.5657+000          .0000
              .6830+001          .0000
             -.9082+001          .0000

  1/TUB1 = -.565798-00  1/TUB2 =  .683059+01  1/TUB3 = -.908261+01
     D.C. GAIN =  .634509+02, ROOT LOCUS GAIN =  .374509-00

  AUB =  .374509-00  BUB =  .105530+01 CUB = -.227572+02
  DUB = -.131460+02

                Z AXIS VELOCITY, W, PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
             -.8219-001          .2998+000
             -.8219-001         -.2998+000
             -.7099+002          .4085-026

  ZWB =  .264388-00  WWB =  .310869-00  1/TWB = -.709928+02
     D.C. GAIN = -.227853+02, ROOT LOCUS GAIN =  .688082-00

  AWB =  .688082-00  BWB =  .489620+02 CWB =  .809629+01
  DWB =  .472074+01
```

```
Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
   PERTURBATIONS ABOUT INITIAL VALUE,
          AZ0 = 0.0
ROOTS (COMPLEX FORM)
 -.1440-002          -.4944-001
 -.1440-002           .4968-001
  .8011+001           .1398-029
 -.7618+001           .7863-029

  WAZ =  .497074-01     ZAZ =  .289887-01
1/TAZ1 =  .801125+01 1/TAZ2 = -.761889+01
   D.C. GAIN =  .500863-00, ROOT LOCUS GAIN =  .688082-00

AAZ =  .688082-00  BAZ = -.267996-00 CAZ = -.419974+02
DAZ = -.121702+00  EAZ = -.103771+00


X AXIS ACCELERATION,AX,PER DELTA CYCLIC
   PERTURBATIONS ABOUT INITIAL VALUE,
          AX0 = 0.0
ROOTS (COMPLEX FORM)
  .2886+000           .0000
 -.1843+000           .0000
  .3352+001           .0000
 -.6274+001           .0000

1/TAX1 =  .288690-00  1/TAX2 = -.184346-00
1/TAX3 =  .335278+01  1/TAX4 = -.627494+01
   D.C. GAIN = -.202389+01, ROOT LOCUS GAIN =  .374509-00

AAX =  .374509-00  BAX =  .105530+01 CAX = -.801323+01
DAX =  .763894-00  EAX =  .419317-00

   HORIZ. VELOCITY PER DELTA CYCLIC
   PERTURBATIONS ABOUT INITIAL VALUE,
          SD0 =  .101311+03
ROOTS (COMPLEX FORM)
 -.9854+000           .0000
  .6376+001           .0000
 -.1088+002           .0000

1/TSD1 = -.985461-00  1/TSD2 =  .637689+01  1/TSD3 = -.108835+02
   D.C. GAIN =  .654431+02, ROOT LOCUS GAIN =  .198245-00

ASD =  .198245-00  BSD =  .106577+01 CSD = -.128784+02
DSD = -.135587+02
```

```
            RATE OF CLIMB PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 HDO = -.250719+02, POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
          .1531-002          .0000
          .7508+001          .0000
         -.7501+001          .0000

1/THD1 =  .153119-02  1/THD2 =  .750695+01  1/THD3 = -.750173+01
   D.C. GAIN =  .315520-00, ROOT LOCUS GAIN = -.757900-00

AHD = -.757900-00  BHD =  .663614-02 CHD =  .426926+02
DHD = -.653704-01

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                 FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 USTABO =  .10436/+03
        ROOTS (COMPLEX FORM)
         -.5657+000          .0000
          .6830+001          .0000
         -.9082+001          .0000

1/TUS1 = -.565798-00  1/TUS2 =  .683059+01  1/TUS3 = -.908261+01
   D.C. GAIN =  .634509+02, ROOT LOCUS GAIN =  .374509-00

AUS =  .374509-00  BUS =  .105530+01 CUS = -.227572+02
DUS = -.131460+02


            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                 FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
          .8655-001          .0000
          .7620+001          .0000
         -.7317+001          .0000

1/TWS1 =  .865501-01  1/TWS2 =  .762019+01  1/TWS3 = -.731726+01
   D.C. GAIN = -.160276+02, ROOT LOCUS GAIN =  .688082-00

AWS =  .688082-00  BWS = -.267996-00 CWS = -.383487+02
DWS =  .332064+01
```

NOT REPRODUCIBLE

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES.
                RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE,
                     LX =  .1700+02 LY = -.0000    AND LZ = -.0000

RUN NO.  L4          NUMERATOR CHARACTERISTICS FOR CYCLIC

                X AXIS VELOCITY PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .9850+02
           ROOTS (COMPLEX FORM)
            -.7885+000        -.5346+000
            -.7885+000         .5346+000
             .1221+003         .2407-023

  ZUB =  .827689-00  WUB =  .952731-00  1/TUB =  .122125+03
     D.C. GAIN =  .674160+02, ROOT LOCUS GAIN =  .126000-00

  AUB =  .126000-00  BUB = -.151891+02 CUB = -.241542+02
  DUB = -.139675+02

                Z AXIS VELOCITY, W, PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .3450+02, POSITIVE DOWN
           ROOTS (COMPLEX FORM)
             .1144-002        -.5305-001
             .1144-002         .5305-001
             .5379+001         .5750-030

  ZWB = -.215631-01  WWB =  .530696-01  1/TWB =  .537926+01
     D.C. GAIN = -.529833-00, ROOT LOCUS GAIN = -.724570+01

  AWB = -.724570+01  BWB =  .389931+02 CWB = -.109612+00
  DWB =  .109773+00

            X AXIS ACCELERATION,AX,PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     AXO = 0.0
           ROOTS (COMPLEX FORM)
            -.5545-001         .2576+000
            -.5545-001        -.2576+000
            -.4248+001        -.5576+001
            -.4248+001         .5576+001

  WAX1 =  .263525-00  ZAX1 =  .210439-00
  WAX2 =  .701053+01  ZAX2 =  .605997-00
     D.C. GAIN = -.207569+01, ROOT LOCUS GAIN =  .126000-00

  AAX =  .126000-00  BAX =  .108456+01 CAX =  .632006+01
  DAX =  .761181-00  EAX =  .430047-00
```

```
          Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  AZ0 = 0.0
        ROOTS (COMPLEX FORM)
          .3249-001          .1106-021
         -.2942-001         -.2518-036
         -.5169+000         -.2367+001
         -.5169+000          .2367+001


   WAZ =  .242312+01    ZAZ =  .213347-00
1/TAZ1 =  .324919-01 1/TAZ2 = -.294247-01
    D.C. GAIN = -.196320-00, ROOT LOCUS GAIN = -.724570+01

 AAZ = -.724570+01  BAZ = -.746935+01 CAZ = -.425134+02
 DAZ =  .137655-00  EAZ =  .406742-01

             VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                  FLIGHT PATH, DUE TO DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  USTAB0 =  .104367+03
        ROOTS (COMPLEX FORM)
         -.1346+001          .0000
          .6002+001          .0000
         -.1326+002          .0000

 1/TUS1 = -.134605+01  1/TUS2 =  .600289+01  1/TUS3 = -.132645+02
    D.C. GAIN =  .651821+02, ROOT LOCUS GAIN =  .126000-00

 AUS =  .126000-00  BUS =  .102456+01 CUS = -.880118+01
 DUS = -.135046+02

             VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                  FLIGHT PATH, DUE TO DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  WSTAB0 = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
         -.2769-001          .0000
         -.5015+000          .2405+001
         -.5015+000         -.2405+001

 ZWS =  .204142-00  WWS =  .245703+01  1/TWS = -.276990-01
    D.C. GAIN =  .584604+01, ROOT LOCUS GAIN = -.724570+01

 AWS = -.724570+01  BWS = -.746935+01 CWS = -.439436+02
 DWS = -.121162+01
```

NOT REPRODUCIBLE

NOT REPRODUCIBLE

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                    ORIGIN AT AIRPLANE C.G.

RUN NO.  L4            NUMERATOR CHARACTERISTICS FOR COLLECTIVE

                THETA PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     THO = -.1390+02
            ROOTS (COMPLEX FORM)
             -.4822-001          .0000
             -.5133+000          .0000

  1/TTH1 = -.482202-01  1/TTH2 = -.513375-00
     D.C. GAIN = -.138640-01, ROOT LOCUS GAIN =  .116200+00

  ATH =  .116200+00  BTH =  .652574-01 CTH =  .287654-02

                X AXIS VELOCITY PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .1044+03
            ROOTS (COMPLEX FORM)
             -.6185+000         -.1308+001
             -.6185+000          .1308+001
             -.3817+000         -.8320-031

  ZUB =  .427473-00  WUB =  .144705+01  1/TUB = -.381749-00
     D.C. GAIN =  .701156+01, ROOT LOCUS GAIN = -.181729+01

  AUB = -.181729+01  BUB = -.294201+01 CUB = -.466360+01
  DUB = -.145268+01

                Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
              .8067+000          .0000
             -.4492+000         -.4383+000
             -.4492+000          .4383+000

  ZWB =  .715728-00  WWB =  .627642-00  1/TWB =  .806784-00
     D.C. GAIN = -.120429+02, ROOT LOCUS GAIN = -.785060+01

  AWB = -.785060+01  BWB = -.719570-00 CWB =  .259787+01
  DWB =  .249508+01
```

```
Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
   PERTURBATIONS ABOUT INITIAL VALUE,
          AZO = 0.0
ROOTS (COMPLEX FORM)
  .1375-001          .1033-023
 -.9241+000         -.4311+000
 -.9241+000          .4311+000
  .1980+000          .3389-033

   WAZ =  .101978+01     ZAZ =  .906216-00
1/TAZ1 =  .137581-01 1/TAZ2 = -.924145-00
    D.C. GAIN =  .107398+00, ROOT LOCUS GAIN = -.785060+01

 AAZ = -.785060+01  BAZ = -.128470+02 CAZ = -.511170+01
 DAZ =  .169008+01  EAZ = -.222510-01


X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
   PERTURBATIONS ABOUT INITIAL VALUE,
          AXO = 0.0
ROOTS (COMPLEX FORM)
 -.1329+000          .8448-016
  .3598+000         -.8436-019
 -.9229+000         -.4272+000
 -.9229+000          .4272+000

   WAX =  .101705+01     ZAX =  .907461-00
1/TAX1 = -.132913-00 1/TAX2 =  .359871-00
    D.C. GAIN = -.433974-00, ROOT LOCUS GAIN = -.181729+01

 AAX = -.181729+01  BAX = -.294201+01 CAX = -.103153+01
 DAX =  .587077-00  EAX =  .899122-01

     HORIZ. VELOCITY PER DELTA COLLECTIVE
     PERTURBATIONS ABOUT INITIAL VALUE,
          SDO =  .101311+03
ROOTS (COMPLEX FORM)
 -.5376+000          .0000
  .4803+001          .0000
 -.6156+001          .0000

1/TSD1 = -.537630-00  1/TSD2 =  .480344+01  1/TSD3 = -.615611+01
   D.C. GAIN =  .935118+01, ROOT LOCUS GAIN =  .121865+00

ASD =  .121865+00  BSD =  .230341-00 CSD = -.351499+01
DSD = -.193741+01
```

```
            RATE OF CLIMB PER DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 HDO = -.250719+02, POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
         -.9240+000          .4309+000
         -.9240+000         -.4309+000
          .2125+000          .7583-033

ZHD =  .906284-00  WHD =  .101964+01  1/THD =  .212682-00
   D.C. GAIN =  .859924+01, ROOT LOCUS GAIN =  .605727+01

AHD =  .605727+01  BHD =  .131776+02 CHD =  .520981+01
DHD = -.178162+01

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 USTABO =  .104367+03
        ROOTS (COMPLEX FORM)
         -.6185+000         -.1308+001
         -.6185+000          .1308+001
         -.3817+000         -.1741-030

ZUS =  .427473-00  WUS =  .144705+01  1/TUS = -.381749-00
   D.C. GAIN =  .701156+01, ROOT LOCUS GAIN = -.181729+01

AUS = -.181729+01  BUS = -.294201+01 CUS = -.466360+01
DUS = -.145268+01


            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
          .2673+000          .3446-015
         -.9519+000         -.3735+000
         -.9519+000          .3735+000

ZWS =  .930893-00  WWS =  .102257+01  1/TWS =  .267373-00
   D.C. GAIN = -.105938+02, ROOT LOCUS GAIN = -.785060+01

AWS = -.785060+01  BWS = -.128470+02 CWS = -.421286+01
DWS =  .219487+01
```

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES.
                RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE,
                     LX =  .1700+02 LY = -.0000    AND LZ = -.0000

RUN NO.  L4          NUMERATOR CHARACTERISTICS FOR COLLECTIVE

                X AXIS VELOCITY PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .9650+02
            ROOTS (COMPLEX FORM)
             -.7474+000          .1051+000
             -.7474+000         -.1051+000
              .4379+001          .5130-030

  ZUB =  .990246-00  WUB =  .754792-00  1/TUB =  .437981+01
     D.C. GAIN =  .105983+02, ROOT LOCUS GAIN =  .880000-00

  AUB =  .880000-00  BUB = -.253876+01 CUB = -.526019+01
  DUB = -.219580+01

                Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .3450+02, POSITIVE DOWN
            ROOTS (COMPLEX FORM)
              .5365+000          .0000
             -.4065+000         -.4297+000
             -.4065+000          .4297+000

  ZWB =  .687192-00  WWB =  .591544-00  1/TWB =  .536503-00
     D.C. GAIN = -.904810+01, ROOT LOCUS GAIN = -.998540+01

  AWB = -.998540+01  BWB = -.276102+01 CWB =  .861314-00
  DWB =  .187462+01

             X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     AXO = 0.0
            ROOTS (COMPLEX FORM)
              .9058-001          .3027+000
              .9058-001         -.3027+000
             -.9258+000          .4384+000
             -.9258+000         -.4384+000

  WAX1 =  .315984-00  ZAX1 = -.286660-00
  WAX2 =  .102445+01  ZAX2 =  .903794-00
     D.C. GAIN = -.445079-00, ROOT LOCUS GAIN =  .880000-00

  AAX =  .880000-00  BAX =  .147014+01 CAX =  .716205-00
  DAX = -.460544-02  EAX =  .922131-01
```

```
Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
   PERTURBATIONS ABOUT INITIAL VALUE,
        AZC = 0.0
ROOTS (COMPLEX FORM)
 -.4808-002          .6482-024
 -.8146+000          .4427+000
 -.8146+000         -.4427+000
  .2113+000         -.6933-032

  WAZ =  .927171-00     ZAZ =  .078614-00
1/TAZ1 = -.480824-02 1/TAZ2 = -.814626-00
   D.C. GAIN = -.420959-01, ROOT LOCUS GAIN = -.998540+01

AAZ = -.998540+01  BAZ = -.142067+02 CAZ = -.521423+01
DAZ =  .178913+01  EAZ =  .872157-02

        VELOCITY PERTURBATIONS PARALLEL TO INITIAL
             FLIGHT PATH, DUE TO DELTA COLLECTIVE
        PERTURBATIONS ABOUT INITIAL VALUE,
             USTARO =  .104367+03
ROOTS (COMPLEX FORM)
  .1543+001          .0000
 -.5874+000          .0000
 -.2626+001          .0000

1/TUS1 =  .154379+01  1/TUS2 = -.587473-00  1/TUS3 = -.262693+01
   D.C. GAIN =  .101193+02, ROOT LOCUS GAIN =  .880000-00

AUS =  .880000-00  BUS =  .147014+01 CUS = -.300881+01
DUS = -.209656+01

        VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
             FLIGHT PATH, DUE TO DELTA COLLECTIVE
        PERTURBATIONS ABOUT INITIAL VALUE,
             WSTARO = 0.0, POSITIVE FOR DOWN
ROOTS (COMPLEX FORM)
 -.8043+000         -.4579+000
 -.8043+000          .4579+000
  .1860+000          .4044-032

ZWS =  .869046-00  WWS =  .925591-00  1/TWS =  .186013-00
   D.C. GAIN = -.768052+01, ROOT LOCUS GAIN = -.998540+01

AWS = -.998540+01  BWS = -.142067+02 CWS = -.556654+01
DWS =  .159128+01
```

ROOTS OF A/C LONGITUDINAL TRANSFER FUNCTIONS

RUN NO. 65

VERTOL YHC-1A HOVER

INPUT DATA

UNITS ARE 1 PER RADIAN
DIMENSIONAL STABILITY DERIVATIVES
(BODY AXES DIFFER BY .0000 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

XU =	-.2540-01	ZU =	.6009-01	MU =	.6560-02
XW =	.5449-01	ZW =	-.3693-00	MW =	-.2850-02
XQ =	.6018-00	ZQ =	-.7151-00	MQ =	-.7320-00
XUD =	-.0000	ZUD =	-.0000	MUD =	-.0000
XWD =	-.0000	ZWD =	-.0000	MWD =	-.0000
XQD =	-.0000	ZQD =	-.0000	MQD =	-.0000
XD =	.1770-00	ZD =	-.4100-02	MD =	.3545-00
XT =	.1205+01	ZT =	-.7430 1	MT =	-.4770-01

U =	.1100+01	UZ =	.0000	GAMA =	.0000
MACH =	-.0000	RHO =	.2380-02	S =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
HT =	-.0000	XI =	-.0000	TDT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7179+05	G =	.3220+02

DIMENSIONAL STABILITY DERIVATIVES, PER RADIAN,
STABILITY AXES

XU =	-.2540-01	ZU =	.6009-01	MU =	.6560-02
XW =	.5449-01	ZW =	-.3693-00	MW =	-.2850-02
XQ =	.6018-00	ZQ =	-.7151-00	MQ =	-.7320-00
XUD =	-.0000	ZUD =	-.0000	MUD =	-.0000
XWD =	-.0000	ZWD =	-.0000	MWD =	-.0000
XQD =	-.0000	ZQD =	-.0000	MQD =	-.0000
XD =	.1770-00	ZD =	-.4100-02	MD =	.3545-00
XT =	.1205+01	ZT =	-.7430+01	MT =	-.4770-01

IN STABILITY AXES, U = .1100+01 AND W = 0.0
ZIY = .7591+05 AND ZIXZ = .1397+05

THE CHARACTERISTICS OF THE LONGITUDINAL DENOMINATOR ARE
ROOTS (COMPLEX FORM)

.9870-001	.4564+000
.9870-001	-.4564+000
-.3500+000	.2741-026
-.9741+000	.5976-026

NOT REPRODUCIBLE

ZSP = -.214058-00 WSP = .461115-00 RAD/SEC
= .733889-01 CYCLES/SEC
1/TP1 = -.350004-00 1/TP2 = -.974107-00

SHORT PERIOD MODE

PERIOD = .13949+02 TIME TO DOUBLE AMP. = .70224+01
TIME TO TEN TIMES AMP. = .23328+02

CYCLES TO DOUBLE AMP. = .50342-00
CYCLES TO TEN TIMES AMP. = .16723+01

COEFFICIENTS

A = .100000+01 B = .112470+01 C = .292175-00
D = .214237-00 E = .724935-01

NOT REPRODUCIBLE

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                    ORIGIN AT AIRPLANE C.G.

RUN NO.  L4          NUMERATOR CHARACTERISTICS FOR CYCLIC

                THETA PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     THO =  .0000
            ROOTS (COMPLEX FORM)
             -.1907-001          .0000
             -.3789+000          .0000

  1/TTH1 = -.190710-01  1/TTH2 = -.378937-00
     D.C. GAIN =  .353393-01, ROOT LOCUS GAIN =  .354500-00

  ATH =  .354500-00  BTH =  .141094-00 CTH =  .256187-02

                X AXIS VELOCITY PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .1100+01
            ROOTS (COMPLEX FORM)
             -.3695+000          .0000
              .7118+001          .0000
             -.9054+001          .0000

  1/TUB1 = -.369575-00  1/TUB2 =  .711820+01  1/TUB3 = -.905407+01
     D.C. GAIN = -.501535+02, ROOT LOCUS GAIN =  .177000-00

  AUB =  .177000-00  BUB =  .408063-00 CUB = -.112806+02
  DUB = -.421590+01

                Z AXIS VELOCITY, W, PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
              .2165+001          .0000
             -.2200+001          .0000
              .3515+002          .0000

  1/TWB1 =  .216599+01  1/TWB2 = -.220013+01  1/TWB3 =  .351506+02
     D.C. GAIN = -.947378+01, ROOT LOCUS GAIN = -.410000-02

  AWB = -.410000-02  BWB =  .143978-00 CWB =  .244587-01
  DWB = -.486787-00
```

NOT REPRODUCIBLE

```
Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE,
AZ0 = 0.0
ROOTS (COMPLEX FORM)
.0000                    .0000
-.2442+000               -.1463+001
-.2442+000                .1463+001
-.5950+002               -.4491-024

WAZ =  .108125+01     ZAZ =  .145250-00
1/TAZ1 =  .000000     1/TAZ2 = -.944201-00
D.C. GAIN =  .000000   , ROOT LOCUS GAIN = -.410000-02

AAZ = -.410000-02  BAZ = -.245072-00 CAZ = -.130745-00
DAZ = -.489605-00  EAZ =  .000000


X AXIS ACCELERATION,AX,PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE,
AX0 = 0.0
ROOTS (COMPLEX FORM)
.1214+000                -.5741+000
.1214+000                 .5741+000
-.2602+000               -.2698-031
-.2288+001                .7272-030

WAX =  .884550-00     ZAX = -.137503-00
1/TAX1 = -.260275-00 1/TAX2 = -.228856+01
D.C. GAIN =  .113792+01, ROOT LOCUS GAIN =  .177000-00

AAX =  .177000-00  BAX =  .404063-00 CAX =  .134113-00
DAX =  .327326-00  EAX =  .524921-01

HORIZ. VELOCITY PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE,
SD0 =  .110000+01
ROOTS (COMPLEX FORM)
-.3695+000               .0000
.7118+001                .0000
-.9054+001               .0000

1/TSD1 = -.369575-00  1/TSD2 =  .711820+01  1/TSD3 = -.905407+01
D.C. GAIN = -.581555+02, ROOT LOCUS GAIN =  .177000-00

ASD =  .177000-00  BSD =  .404063-00 CSD = -.112808+02
DSD = -.421590+01
```

NOT REPRODUCIBLE

```
            RATE OF CLIMB PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                WCO =  .000000   , POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
         -.2442+000          .1663+001
         -.2442+000         -.1663+001
         -.5950+002          .2140-025

ZWO =  .145250-00  WWO =  .168125+01  1/TWO = -.595049+02
   D.C. GAIN =  .951265+01, ROOT LOCUS GAIN =  .410000-02

AWO =  .410000-02  BWO =  .245972-00 CWO =  .130745-00
DWO =  .689605-00

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                USTABO =  .110000+01
        ROOTS (COMPLEX FORM)
         -.3695+000          .0000
          .7118+001          .0000
         -.9054+001          .0000

1/TUS1 = -.369575-00  1/TUS2 =  .711820+01  1/TUS3 = -.905407+01
   D.C. GAIN = -.581555+02, ROOT LOCUS GAIN =  .177000-00

AUS =  .177000-00  BUS =  .404063-00 CUS = -.112800+02
DUS = -.421590+01


            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                FLIGHT PATH, DUE TO DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
         -.2442+000         -.1663+001
         -.2442+000          .1663+001
         -.5950+002         -.2140-025

ZWS =  .145250-00  WWS =  .168125+01  1/TWS = -.595049+02
   D.C. GAIN = -.951265+01, ROOT LOCUS GAIN = -.410000-02

AWS = -.410000-02  BWS = -.245972-00 CWS = -.130745-00
DWS = -.689605-00
```

TRANSFER FUNCTIONS FOR BODY AXES UP -.0000 DEGREES
0.0 ORIGINAL BODY AXES.
RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
TO ORIGIN OF AXES ABL.
LX = .1700+02 LY = -.0000 AND LZ = -.0000

RUN NO. L9 TRANSFER CHARACTERISTICS FOR CYCLIC

X AXIS VELOCITY PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE.
UO = .1100+01

ROOTS (COMPLEX FORM)

-.3699+000	.0000
.7118+001	.0000
-.0094+001	.0000

NOT REPRODUCIBLE

1/TUB1 = -.369979-00 1/TUB2 = .711890+01 1/TUB3 = -.009407+01
D.C. GAIN = -.581955+02, ROOT LOCUS GAIN = .177000-00

AUB = .177000-00 BUB = .401343-00 CUB = -.112000+02
DUB = -.471590+01

Z AXIS VELOCITY, W, PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE.
WO = .0000 , POSITIVE DOWN

ROOTS (COMPLEX FORM)

.1349+000	-.3983+000
.1349+000	.3983+000
-.6437+000	-.5431-031

ZWB = -.320835-00 AWB = .420603-00 1/TWB = -.643751-00
D.C. GAIN = -.947378+01, ROOT LOCUS GAIN = -.603060+01

AWB = -.603060+01 BWB = -.225462+01 CWB = -.190931-01
DWB = -.686787-00

X AXIS ACCELERATION,AX,PER DELTA CYCLIC
PERTURBATIONS ABOUT INITIAL VALUE.
AXO = 0.0

ROOTS (COMPLEX FORM)

.1216+000	-.8761+000
.1216+000	.8761+000
-.2602+000	-.2696-031
-.2288+001	.7272-030

WAX = .884550-00 ZAX = -.137563-00
1/TAX1 = -.260275-00 1/TAX2 = -.228856+01
D.C. GAIN = .113792+01, ROOT LOCUS GAIN = .177000-00

AAX = .177000-00 BAX = .401343-00 CAX = .134113-00
DAX = .327326-00 EAX = .124921-01

```
          Z AXIS ACCELERATION,AZ,FOR DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  AZO = 0.0
        ROOTS (COMPLEX FORM)
          .0000                .0000
          .1099+000            .4019+000
          .1099+000           -.4019+000
         -.6584+000            .1576-031

  WAZ =  .416746-00    ZAZ = -.263813-00
1/TAZ1 =  .000000    1/TAZ2 =  .139843+00
   D.C. GAIN =  .000000    . ROOT LOCUS GAIN = -.603060+01

AAZ = -.603060+01  BAZ = -.264457+01 CAZ = -.174296-00
DAZ = -.689605-00  EAZ =  .000000

             VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                  FLIGHT PATH, DUE TO DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  USTABO =  .117000+01
        ROOTS (COMPLEX FORM)
         -.3695+000            .0000
          .7118+001            .0000
         -.9054+001            .0000

1/TUS1 = -.369575-00  1/TUS2 =  .711820+01  1/TUS3 = -.905407+01
   D.C. GAIN = -.581555+02, ROOT LOCUS GAIN =  .177000-00

AUS =  .177000-00  BUS =  .408043-00 CUS = -.112608+02
DUS = -.421590+01

             VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                  FLIGHT PATH, DUE TO DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
          .1099+000            .4019+000
          .1099+000           -.4019+000
         -.6584+000           -.3045-032

ZWS = -.263813-00  WWS =  .416746-00  1/TWS = -.658411-00
   D.C. GAIN = -.951265+01, ROOT LOCUS GAIN = -.603060+01

AWS = -.603060+01  BWS = -.264457+01 CWS = -.174296-00
DWS = -.689605-00
```

TRANSFER FUNCTIONS FOR STABILITY AXES,
ORIGIN AT AIRPLANE C.G.

RUN NO. L8 EQUATION CHARACTERISTICS FOR COLLECTIVE

THETA PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
T.0 = .0000
ROOTS (COMPLEX FORM)

.2413+000	.0000
-.2637-001	.0000

1/TTH1 = .241324-00 1/TTH2 = -.263742-01
D.C. GAIN = .418703-02, ROOT LOCUS GAIN = -.477000-01

ATH = -.477000-01 BTH = .102531-01 CTH = .303598-03

X AXIS VELOCITY PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
U0 = .1100+01
ROOTS (COMPLEX FORM)

.7005-001	.6260-023
-.4057+000	.1092+001
-.4057+000	-.1092+001

ZUB = .348213-00 WUB = .116530+01 1/TUB = .700536-01
D.C. GAIN = -.156122+01, ROOT LOCUS GAIN = .120500+01

AUB = .120500+01 BUB = .893498-00 CUB = .156779+01
DUB = -.114626+00

Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
W0 = .0000 , POSITIVE DOWN
ROOTS (COMPLEX FORM)

.1042+000	.4432+000
.1042+000	-.4432+000
-.9587+000	-.3235-031

ZWB = -.229025-00 WWB = .455381-00 1/TWB = -.958713-00
D.C. GAIN = -.203764+02, ROOT LOCUS GAIN = -.743000+01

AWB = -.743000+01 BWB = -.557343+01 CWB = -.549557-01
DWB = -.147716+01

NOT REPRODUCIBLE

Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
PERTURBATION, ABOUT INITIAL VALUE,
AZ0 = 0.0
ROOTS (COMPLEX FORM)

.3[illegible]0[illegible]	.[illegible]
.1[illegible]4[illegible]+0[illegible]	-.444[illegible]+000
.1[illegible]4[illegible]+0[illegible]	.444[illegible]+000
-.[illegible]527+000	.12[illegible]-029

AAZ = .45[illegible]-00 ZAZ = -.22[illegible]-00
1/TAZ1 = .000000 1/TAZ2 = .104[illegible]+00
D.C. GAIN = .000000 , ROOT LOCUS GAIN = -.743000+01

AAZ = -.743100+01 BAZ = -.552096+01 CAZ = -.462341-01
DAZ = -.147749+01 EAZ = .000000

X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
PERTURBATION, ABOUT INITIAL VALUE,
AX0 = 0.0
ROOTS (COMPLEX FORM)

.1096+000	.4284+000
.1096+000	-.4284+000
-.4530-001	-.5777-033
-.9154+000	-.7703-031

WAX = .442296-00 ZAX = -.247675-00
1/TAX1 = -.453004-01 1/TAX2 = -.915460-00
D.C. GAIN = .134451-00, ROOT LOCUS GAIN = .120500+01

AAX = .120500+01 BAX = .893498-00 CAX = .318507-01
DAX = .215522-00 EAX = .977585-02

HORIZ. VELOCITY PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
S00 = .110[illegible]+01
ROOTS (COMPLEX FORM)

.7005-001	.6145-023
-.4057+000	-.1092+001
-.4057+000	.1092+001

ZSD = .348213-00 WS = .116530+01 1/TSD = .700536-01
D.C. GAIN = -.158122+01, ROOT LOCUS GAIN = .120500+01

ASD = .120500+01 BSD = .893498-00 CSD = .156779+01
DSD = -.114628+00

NOT REPRODUCIBLE

```
            RATE OF CLIMB PER DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WD0 =  .000000   , POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
          .1048+000          .4446+000
          .1048+000         -.4446+000
         -.9527+000         -.4992-030

ZWD = -.229510-00  WWD =  .456851-00  1/TWD = -.952767-00
   D.C. GAIN =  .203810+02, ROOT LOCUS GAIN =  .743000+01

AWD =  .743000+01  BWD =  .552096+01 CWD =  .662341-01
DWD =  .147749+01

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 USTABO =  .110000+01
        ROOTS (COMPLEX FORM)
          .7005-001          .6165-023
         -.4057+000         -.1092+001
         -.4057+000          .1092+001

ZUS =  .348213-00  WUS =  .116530+01  1/TUS =  .700536-01
   D.C. GAIN = -.158122+01, ROOT LOCUS GAIN =  .120500+01

AUS =  .120500+01  BUS =  .893498-00 CUS =  .156779+01
DUS = -.114628+00

            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
          .1048+000         -.4446+000
          .1048+000          .4446+000
         -.9527+000          .4992-030

ZWS = -.229510-00  WWS =  .456851-00  1/TWS = -.952767-00
   D.C. GAIN = -.203810+02, ROOT LOCUS GAIN = -.743000+01

AWS = -.743000+01  BWS = -.552096+01 CWS = -.662341-01
DWS = -.147749+01
```

[illegible] UP -.0000 [illegible]

[illegible] AXES.

[illegible] / [illegible] BODY AIRPLANE C.G

TO [illegible] OF AXES ABC.

LV = .17[illegible] LV = -.[illegible] AND LZ = -.0000

RUN NO. [illegible] [illegible] CHARACTERISTICS FOR COLLECTIVE

Z AXIS VELOCITY [illegible] DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
WO = .11[illegible]

ROOTS (COMPLEX FORM)

.7[illegible]-001	.4[illegible]-023
-.4[illegible]+000	-.[illegible]+00[illegible]
-.4[illegible]+000	.1[illegible]+00[illegible]

ZW = .74[illegible]-00 [illegible] = .11[illegible]+01 1/TZ = .703536+01
D.C. GAIN = -.158127+01, ROOT LOCUS GAIN = .190500+01

AIW = .120500+01 [illegible] = .693496-00 CUR = .156770+01
DUR = -.114[illegible]+00

Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
WO = .0000 , POSITIVE DOWN

ROOTS (COMPLEX FORM)

.9523-001	-.4491+000
.9523-001	.4491+000
-.1058+001	-.1331-029

ZWB = -.207450-00 TWB = .456093-00 1/TWB = -.105883+01
D.C. GAIN = -.203764+02, ROOT LOCUS GAIN = -.661910+01

AWB = -.661910+01 BWB = -.574774+01 CWB = -.601169-01
DWB = -.147716+01

X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
AXO = 0.0

ROOTS (COMPLEX FORM)

.1096+000	.4284+000
.1096+000	-.4284+000
-.4530-001	-.5777-033
-.9154+000	-.7703-031

WAX = .442296-00 ZAX = -.247875-00
1/TAX1 = -.453004-01 1/TAX2 = -.915460-00
D.C. GAIN = .134851-00, ROOT LOCUS GAIN = .120500+01

AAX = .120500+01 BAX = .693496-00 CAX = .318507-01
DAX = .215522-00 EAX = .977585-02

NOT REPRODUCIBLE

NOT REPRODUCIBLE

Z AXIS ACCELERATION, AZ, DUE TO DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
AZ0 = 0.0

ROOTS (COMPLEX FORM)

.0000	.0000
.9573-001	.4505+000
.9573-001	-.4505+000
-.1051+001	-.0171-030

WAZ = .400694-00 ZAZ = -.207832-00
1/TAZ1 = .000000 1/TAZ2 = .957389-01
D.C. GAIN = .000000 , ROOT LOCUS GAIN = -.661910+01

AAZ = -.661910+01 BAZ = -.569527+01 CAZ = -.713953-01
DAZ = -.147749+01 EAZ = .000000

VELOCITY PERTURBATIONS PARALLEL TO INITIAL
FLIGHT PATH, DUE TO DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
USTABO = .112000+01

ROOTS (COMPLEX FORM)

.7005-001	.4145-023
-.4057+000	-.1092+001
-.4057+000	.1092+001

ZUS = .348213-00 WUS = .116530+01 1/TUS = .700934-01
D.C. GAIN = -.156122+01, ROOT LOCUS GAIN = .120500+01

AUS = .120500+01 BUS = .493498-00 CUS = .156779+01
DUS = -.114628+00

VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
FLIGHT PATH, DUE TO DELTA COLLECTIVE
PERTURBATIONS ABOUT INITIAL VALUE,
WSTABO = 0.0, POSITIVE FOR DOWN

ROOTS (COMPLEX FORM)

.9573-001	.4505+000
.9573-001	-.4505+000
-.1051+001	.3582-030

ZWS = -.207832-00 WWS = .400694-00 1/TWS = -.105191+01
D.C. GAIN = -.203810+02, ROOT LOCUS GAIN = -.661910+01

AWS = -.661910+01 BWS = -.569527+01 CWS = -.713953-01
DWS = -.147749+01

ROOTS OF A/C LONGITUDINAL TRANSFER FUNCTIONS

RUN NO. L4 .

VERTOL YHC-1A VERTICAL DESCENT AT 1500 FT/MIN

INPUT DATA

UNITS ARE 1 PER RADIAN
DIMENSIONAL STABILITY DERIVATIVES
(BODY AXES DIFFER BY .8748+02 DEGREES, POSITIVE
FOR NOSE UP, FROM STABILITY AXES)

XU =	.1140-01	ZU =	-.1344-00	MU =	.1308-01
XW =	.4370-01	ZW =	-.2475-00	MW =	.3680-02
XQ =	.1026+01	ZQ =	-.7900-00	MQ =	-.5824-00
XUD =	-.0000	ZUD =	-.0000	MUD =	-.0000
XWD =	-.0000	ZWD =	-.0000	MWD =	-.0000
XQD =	-.0000	ZQD =	-.0000	MQD =	-.0000
XD =	.1460-00	ZD =	.4100-02	MD =	.3436-00
XT =	.1139+01	ZT =	-.7453+01	MT =	-.5510-01

U =	.1100+01	UZ =	.7500+02	GAMA =	-.0000+02
MACH =	-.0000	RHO =	.7300-02	R =	-.0000
MAC =	-.0000	IXZ =	.7114+04	IY =	.7591+05
MT =	-.0000	XI =	-.0000	TOT =	-.0000
LX =	.1700+02	LY =	-.0000	LZ =	-.0000
CL =	-.0000	CD =	-.0000	W =	.1340+05
IX =	.9203+04	IZ =	.7170+05	G =	.3270+02

DIMENSIONAL STABILITY DERIVATIVES, PER RADIAN,
STABILITY AXES

XU =	-.2909-00	ZU =	-.4700-01	MU =	.4291-02
XW =	.1211+00	ZW =	.1481-01	MW =	-.1291-01
XQ =	-.7441-00	ZQ =	-.1360+01	MQ =	-.5824-00
XUD =	.0000	ZUD =	.0000	MUD =	.0000
XWD =	.0000	ZWD =	.0000	MWD =	.0000
XQD =	.0000	ZQD =	.0000	MQD =	.0000
XD =	.1339-01	ZD =	-.1656-00	MD =	.3436-00
XT =	-.7306+01	ZT =	-.1466+01	MT =	-.5510-01

IN STABILITY AXES, U = .2539+02 AND G = 0.0
ZIY = .7591+05 AND ZIXZ = .9835+04

THE CHARACTERISTICS OF THE LONGITUDINAL DENOMINATOR ARE
ROOTS (COMPLEX FORM)

.1087+000	.7002+000
.1087+000	-.7002+000
-.2520+000	-.7443-025
-.8239+000	-.7482-025

ZSP = -.153482-00 WSP = .704663-00 RAD/SEC
= .112787+00 CYCLES/SEC
1/TP1 = -.252087-00 1/TP2 = -.623947-00

SHORT PERIOD MODE

PERIOD = .89726+01 TIME TO DOUBLE AMP. = .63728+01
TIME TO TEN TIMES AMP. = .21170+02

CYCLES TO DOUBLE AMP. = .71025-00
CYCLES TO TEN TIMES AMP. = .23594+01

COEFFICIENTS

A = .100000+01 B = .458500-00 C = .475836-00
D = .495205-00 E = .104311+00

NOT REPRODUCIBLE

```
                TRANSFER FUNCTIONS FOR STABILITY AND
                    CONTROL AT 11 DEG A.O.A.

RUN NO.  1A          SUMMARY CHARACTERISTICS FOR CYCLIC

                THETA PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     THO = -.5700+02
            ROOTS (COMPLEX FORM)
             -.1567-001          .0000
             -.2666+000          .0000

  1/TTW1 = -.156781-01  1/TTW2 = -.266666-00
     D.C. GAIN =  .137730-01, ROOT LOCUS GAIN =  .343600-00

  ATW =  .343600-00  BTW =  .671417-01 CTW =  .143726-02

                X AXIS VELOCITY PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .2502+02
            ROOTS (COMPLEX FORM)
             -.1045+001          .0000
              .6675+001          .0000
              .1439+002          .0000

  1/TUB1 = -.104561+01  1/TUB2 =  .667579+01  1/TUB3 =  .143933+02
     D.C. GAIN =  .124979+02, ROOT LOCUS GAIN =  .133910-01

  AUB =  .133910-01  BUB = -.267135-00 CUB =  .391402-00
  DUB =  .134539+01

                Z AXIS VELOCITY, W, PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
             -.2906+000          .0000
             -.1326+001          .0000
              .5047+002          .0000

  1/TWB1 = -.290608-00  1/TWB2 = -.132610+01  1/TWB3 =  .504707+02
     D.C. GAIN =  .308730+02, ROOT LOCUS GAIN = -.165571-00

  AWB = -.165571-00  BWB =  .404883+01 CWB =  .134442+02
  DWB =  .322039+01
```

NOT REPRODUCIBLE

```
          Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                  AZO = 0.0
        ROOTS (COMPLEX FORM)
          .2415+000          .3044+000
          .2415+000         -.3044+000
         -.6320+000          .1034-027
         -.2928+001          .1406-026

   WAZ =  .308627-00     ZAZ = -.421670-00
1/TAZ1 = -.632024-00 1/TAZ2 = -.292829+01
    D.C. GAIN = -.443678-00, ROOT LOCUS GAIN = -.165571-00

 AAZ = -.165571-00  BAZ = -.509403-00 CAZ = -.466006-01
 DAZ =  .590356-01  EAZ = -.462805-01

          X AXIS ACCELERATION,AX,PER DELTA CYCLIC
            PERTURBATIONS ABOUT INITIAL VALUE,
                  AXO = 0.0
        ROOTS (COMPLEX FORM)
          .4765-009          .0000
         -.1045+001          .0000
          .6675+001          .0000
          .1439+002          .0000

 1/TAX1 =  .476548-09  1/TAX2 = -.104561+01
 1/TAX3 =  .667579+01  1/TAX4 =  .143933+02
    D.C. GAIN = -.614646-08, ROOT LOCUS GAIN =  .133910-01

 AAX =  .133910-01  BAX = -.268135-00 CAX =  .991692-00
 DAX =  .134539+01  EAX = -.641143-09

             HORIZ. VELOCITY PER DELTA CYCLIC
             PERTURBATIONS ABOUT INITIAL VALUE,
                  SDO = -.346471-06
        ROOTS (COMPLEX FORM)
         -.2856+000          .0000
          .6928+001          .0000
         -.9719+001          .0000

 1/TSD1 = -.285616-00  1/TSD2 =  .692811+01  1/TSD3 = -.971961+01
    D.C. GAIN = -.305282+02, ROOT LOCUS GAIN =  .165571-00

 ASD =  .165571-00  BSD =  .509403-00 CSD = -.110173+02
 DSD = -.318442+01
```

```
          RATE OF CLIMB PER DELTA CYCLIC
          PERTURBATIONS ABOUT INITIAL VALUE,
               HDO = -.250242+02, POSITIVE FOR CLIMB
       ROOTS (COMPLEX FORM)
        -.1045+001          .0000
         .6675+001          .0000
         .1439+002          .0000

1/THD1 = -.104561+01  1/THD2 =  .667579+01  1/THD3 =  .143933+02
   D.C. GAIN = -.128979+02, ROOT LOCUS GAIN = -.133911-01

AHD = -.133911-01  BHD =  .268135-00 CHD = -.991692-00
DHD = -.134539+01

          VELOCITY PERTURBATIONS PARALLEL TO INITIAL
               FLIGHT PATH, DUE TO DELTA CYCLIC
          PERTURBATIONS ABOUT INITIAL VALUE,
               USTABO =  .250242+02
       ROOTS (COMPLEX FORM)
        -.1045+001          .0000
         .6675+001          .0000
         .1439+002          .0000

1/TUS1 = -.104561+01  1/TUS2 =  .667579+01  1/TUS3 =  .143933+02
   D.C. GAIN =  .128979+02, ROOT LOCUS GAIN =  .133910-01

AUS =  .133910-01  BUS = -.268135-00 CUS =  .991692-00
DUS =  .134539+01

          VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
               FLIGHT PATH, DUE TO DELTA CYCLIC
          PERTURBATIONS ABOUT INITIAL VALUE,
               WSTABO = 0.0, POSITIVE FOR DOWN
       ROOTS (COMPLEX FORM)
        -.2856+000          .0000
         .6928+001          .0000
        -.9719+001          .0000

1/TWS1 = -.285616-00  1/TWS2 =  .692811+01  1/TWS3 = -.971961+01
   D.C. GAIN =  .305282+02, ROOT LOCUS GAIN = -.165571-00

AWS = -.165571-00  BWS = -.509483-00 CWS =  .110173+02
DWS =  .318442+01
```

```
                TRANSFER FUNCTIONS FOR BODY AXES OF -.0000     DEGREES
                     FROM ORIGINAL BODY AXES.
                RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE,
                     LX =  .1700+02 LY = -.0000     AND LZ = -.0000

RUN NO.  L6            NUMERATOR CHARACTERISTICS FOR CYCLIC

                X AXIS VELOCITY PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     U0 =  .1100+01
            ROOTS (COMPLEX FORM)
             -.2853+000          .0000
             -.1323+001          .0000
              .5036+002          .0000

  1/TUB1 = -.285375-00  1/TUB2 = -.132377+01  1/TUB3 =  .503609+02
     D.C. GAIN = -.302762+02, ROOT LOCUS GAIN =  .166000-00

  AUB =  .166000-00  BUB = -.809280+01 CUB = -.133896+02
  DUB = -.315814+01

                Z AXIS VELOCITY, W, PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     W0 =  .2500+02, POSITIVE DOWN
            ROOTS (COMPLEX FORM)
              .6785+000          .0000
             -.4731+000         -.3890+000
             -.4731+000          .3890+000

  ZWB =  .772427-00  AWB =  .412552-00  1/TAW =  .675551-00
     D.C. GAIN =  .142425+02, ROOT LOCUS GAIN = -.583510+01

  AWB = -.583510+01  BWB = -.194236+01 CWB =  .155736+01
  DWB =  .148565+01

                X AXIS ACCELERATION,AX,PER DELTA CYCLIC
                PERTURBATIONS ABOUT INITIAL VALUE,
                     AX0 = 0.0
            ROOTS (COMPLEX FORM)
              .1829+000          .3752+000
              .1829+000         -.3752+000
             -.5733+000         -.4640-026
             -.2787+001         -.1021-024

    WAX =  .417444-00     ZAX = -.438174-00
 1/TAX1 = -.573367-00 1/TAX2 = -.278764+01
     D.C. GAIN =  .443249-00, ROOT LOCUS GAIN =  .166000-00

  AAX =  .166000-00  BAX =  .497284-00 CAX =  .901480-01
  DAX =  .161409-03  EAX =  .462357-01
```

NOT REPRODUCIBLE

```
Z AXIS ACCELERATION,AZ,PER DELTA CYCLIC
   PERTURBATIONS ABOUT INITIAL VALUE,
        AZO = 0.0
ROOTS (COMPLEX FORM)
  .1509-002          .8405-023
  .5951+000          .9975-041
 -.4645+000         -.4151+000
 -.4645+000          .4151+000


   WAZ =  .623072-00     ZAZ =  .745627-00
1/TAZ1 =  .150903-02 1/TAZ2 =  .595125-00
   D.C. GAIN = -.195030-01, ROOT LOCUS GAIN = -.583510+01

AAZ = -.583510+01  BAZ = -.194032+01 CAZ =  .964251-00
DAZ =  .134668+01  EAZ = -.203437-02

        VELOCITY PERTURBATIONS PARALLEL TO INITIAL
             FLIGHT PATH, DUE TO DELTA CYCLIC
        PERTURBATIONS ABOUT INITIAL VALUE,
             USTABO =  .250242+02
ROOTS (COMPLEX FORM)
 -.2815+000          .0000
  .6928+001          .0000
 -.9642+001          .0000

1/TUS1 = -.281536-00  1/TUS2 =  .692855+01  1/TUS3 = -.964222+01
   D.C. GAIN = -.299317+02, ROOT LOCUS GAIN =  .166000-00

AUS =  .166000-00  BUS =  .497204-00 CUS = -.109631+02
DUS = -.312220+01

        VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
             FLIGHT PATH, DUE TO DELTA CYCLIC
        PERTURBATIONS ABOUT INITIAL VALUE,
             WSTABO = 0.0, POSITIVE FOR DOWN
ROOTS (COMPLEX FORM)
  .6505+000          .0000
 -.4915+000         -.3864+000
 -.4915+000          .3864+000

ZWS =  .786137-00  WWS =  .625260-00  1/TWS =  .650555-00
   D.C. GAIN =  .142274+02, ROOT LOCUS GAIN = -.583510+01

AWS = -.583510+01  BWS = -.194032+01 CWS =  .145059+01
DWS =  .148407+01
```

```
                TRANSFER FUNCTIONS FOR STABILITY AXES,
                    ORIGIN AT AIRPLANE C.G.

RUN NO.  L6            NUMERATOR CHARACTERISTICS FOR COLLECTIVE

                THETA PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     THO = -.9000+02
            ROOTS (COMPLEX FORM)
             -.1369-001          .0000
             -.4897+000          .0000

  1/TTH1 = -.136979-01  1/TTH2 = -.489716-00
     D.C. GAIN = -.354340-02, ROOT LOCUS GAIN = -.551000-01

  ATH = -.551000-01  BTH = -.277381-01 CTH = -.369615-03

                X AXIS VELOCITY PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     UO =  .2502+02
            ROOTS (COMPLEX FORM)
              .1205+000          .7232+000
              .1205+000         -.7232+000
             -.8270+000         -.3235-030

  ZUB = -.164361-00  WUB =  .733195-00  1/TUB = -.827069-00
     D.C. GAIN = -.315233+02, ROOT LOCUS GAIN = -.739571+01

  AUB = -.739571+01  BUB = -.433427+01 CUB = -.250151+01
  DUB = -.328822+01

                Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     WO =  .0000    , POSITIVE DOWN
            ROOTS (COMPLEX FORM)
             -.3814+000         -.1138+001
             -.3814+000          .1138+001
             -.7236+000          .1343-026

  ZWB = ..317760-00  WWB =  .120047+01  1/TWB = -.723610-00
     D.C. GAIN = -.146540+02, ROOT LOCUS GAIN = -.146581+01

  AWB = -.146581+01  BWB = -.217898+01 CWB = -.292164+01
  DWB = -.152857+01
```

```
          Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                  AZO = 0.0
         ROOTS (COMPLEX FORM)
           .1274+000          -.7158+000
           .1274+000           .7158+000
           .1874-001          -.5546-031
          -.8194+000          -.5854-031

   WAZ =  .727064-00     ZAZ = -.175231-00
1/TAZ1 =  .187445-01 1/TAZ2 = -.819424-00
    D.C. GAIN =  .114097+00, ROOT LOCUS GAIN = -.146581+01

 AAZ = -.146581+01  BAZ = -.800146-00 CAZ = -.453292-00
 DAZ = -.626153-00  EAZ =  .119016-01
 .


          X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                  AXO = 0.0
         ROOTS (COMPLEX FORM)
           .1205+000           .7232+000
           .1205+000          -.7232+000
           .5014-010           .9783-031
          -.8270+000           .2804-030

   WAX =  .733195-00     ZAX = -.164361-00
1/TAX1 =  .501420-10 1/TAX2 = -.827069-00
    D.C. GAIN =  .158064-08, ROOT LOCUS GAIN = -.739571+01

 AAX = -.739571+01  BAX = -.433427+01 CAX = -.250151+01
 DAX = -.328822+01  EAX =  .164878-09

             HORIZ. VELOCITY PER DELTA COLLECTIVE
             PERTURBATIONS ABOUT INITIAL VALUE,
                  SDO = -.346671-06
         ROOTS (COMPLEX FORM)
           .5320-001           .1259+001
           .5320-001          -.1259+001
          -.6522+000           .2247-031

 ZSD = -.422058-01  WSD =  .126057+01  1/TSD = -.652278-00
    D.C. GAIN =  .145653+02, ROOT LOCUS GAIN =  .146581+01

 ASD =  .146581+01  BSD =  .800146-00 CSD =  .222751+01
 DSD =  .151932+01
```

```
            RATE OF CLIMB PER DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 HDO = -.250242+02, POSITIVE FOR CLIMB
        ROOTS (COMPLEX FORM)
          .1205+000          .7232+000
          .1205+000         -.7232+000
         -.8270+000         -.9244-032

ZHD = -.164361-00  WHD =  .733195-00  1/THD = -.827069-00
   D.C. GAIN =  .315233+02, ROOT LOCUS GAIN =  .739571+01

AHD =  .739571+01  BHD =  .433427+01 CHD =  .250151+01
DHD =  .328822+01

            VELOCITY PERTURBATIONS PARALLEL TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 USTABO =  .250242+02
        ROOTS (COMPLEX FORM)
          .1205+000         -.7232+000
          .1205+000          .7232+000
         -.8270+000          .9725-031

ZUS = -.164361-00  WUS =  .733195-00  1/TUS = -.827069-00
   D.C. GAIN = -.315233+02, ROOT LOCUS GAIN = -.739571+01

AUS = -.739571+01  BUS = -.433427+01 CUS = -.250151+01
DUS = -.328822+01


            VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
                 FLIGHT PATH, DUE TO DELTA COLLECTIVE
            PERTURBATIONS ABOUT INITIAL VALUE,
                 WSTABO = 0.0, POSITIVE FOR DOWN
        ROOTS (COMPLEX FORM)
          .5320-001         -.1259+001
          .5320-001          .1259+001
         -.6522+000         -.3081-032

ZWS = -.422058-01  WWS =  .126057+01  1/TWS = -.652278-00
   D.C. GAIN = -.145653+02, ROOT LOCUS GAIN = -.146581+01

AWS = -.146581+01  BWS = -.800146-00 CWS = -.222751+01
DWS = -.151932+01
```

```
                TRANSFER FUNCTIONS FOR BODY AXES UP -.0000    DEGREES
                     FROM ORIGINAL BODY AXES.
                RESPECTIVE X, Y, AND Z DISTANCES FROM AIRPLANE C.G
                     TO ORIGIN OF AXES ARE,
                     LX =  .1700+02 LY = -.0000    AND LZ = -.0000

RUN NO.  L6          NUMERATOR CHARACTERISTICS FOR COLLECTIVE

                X AXIS VELOCITY PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     U0 =  .1100+01
           ROOTS (COMPLEX FORM)
            -.5220+000          .1209+001
            -.5220+000         -.1209+001
            -.6993+000          .2744-031

  ZUB =  .396325-00  WUB =  .131727+01  1/TUB = -.699345-00
     D.C. GAIN =  .132541+02, ROOT LOCUS GAIN =  .113930+01

  AUB =  .113930+01  BUB =  .198635+01 CUB =  .280885+01
  DUB =  .138255+01

                Z AXIS VELOCITY, W, PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     W0 =  .2500+02, POSITIVE DOWN
           ROOTS (COMPLEX FORM)
             .1205+000         -.7695+000
             .1205+000          .7695+000
            -.8479+000          .9244-031

  ZWB = -.154768-00  WWB =  .778907-00  1/TWB = -.847935-00
     D.C. GAIN = -.321369+02, ROOT LOCUS GAIN = -.651630+01

  AWB = -.651630+01  BWB = -.395432+01 CWB = -.262124+01
  DWB = -.339223+01

            X AXIS ACCELERATION,AX,PER DELTA COLLECTIVE
                PERTURBATIONS ABOUT INITIAL VALUE,
                     AX0 = 0.0
           ROOTS (COMPLEX FORM)
             .1293+000         -.7135+000
             .1293+000          .7135+000
             .242B-001          .2080-031
            -.8173+000          .4005-031

    MAX =  .725194-00     ZAX = -.178313-00
 1/TAX1 =  .242801-01 1/TAX2 = -.817309-00
     D.C. GAIN = -.113947+00, ROOT LOCUS GAIN =  .113930+01

  AAX =  .113930+01  BAX =  .404844-00 CAX =  .342894-00
  DAX =  .481006-00  EAX = -.111901-01
```

```
Z AXIS ACCELERATION,AZ,PER DELTA COLLECTIVE
   PERTURBATIONS ABOUT INITIAL VALUE,
         AZO = 0.0
ROOTS (COMPLEX FORM)
  .1255+000          .7436+000
  .1255+000         -.7436+000
  .1579-003          .2214-031
 -.8488+000          .8320-031


  WAZ =  .773902-00     ZAZ = -.162283-00
1/TAZ1 =  .157915-03 1/TAZ2 = -.846874-00
   D.C. GAIN =  .501544-02, ROOT LOCUS GAIN = -.651630+01

AAZ = -.651630+01  BAZ = -.389371+01 CAZ = -.251273+01
DAZ = -.331257+01  EAZ =  .523165-03

      VELOCITY PERTURBATIONS PARALLEL TO INITIAL
           FLIGHT PATH, DUE TO DELTA COLLECTIVE
      PERTURBATIONS ABOUT INITIAL VALUE,
           USTABO =  .250242+02
ROOTS (COMPLEX FORM)
  .4731-001          .1383+001
  .4731-001         -.1383+001
 -.6290+000         -.5176-030

ZUS = -.341782-01  WUS =  .136430+01  1/TUS = -.629031-00
   D.C. GAIN =  .131655+02, ROOT LOCUS GAIN =  .113930+01

AUS =  .113930+01  BUS =  .608848-00 CUS =  .211540+01
DUS =  .137331+01

      VELOCITY PERTURBATIONS PERPENDICULAR TO INITIAL
           FLIGHT PATH, DUE TO DELTA COLLECTIVE
      PERTURBATIONS ABOUT INITIAL VALUE,
           WSTABO = 0.0, POSITIVE FOR DOWN
ROOTS (COMPLEX FORM)
  .1242+000         -.7697+000
  .1242+000          .7697+000
 -.8461+000         -.1741-030

ZWS = -.159418-00  WWS =  .773691-00  1/TWS = -.846127-00
   D.C. GAIN = -.321330+02, ROOT LOCUS GAIN = -.651630+01

AWS = -.651630+01  BWS = -.389371+01 CWS = -.259072+01
DWS = -.335183+01
```

VI. DERIVATIVES AND TRANSFER FUNCTIONS FOR SIKORSKY S-58

INTRODUCTION

Derivatives, eigenvectors, residues, and transfer functions were calculated for the S-58 in the flight conditions shown by the following tables. Note that V_{TAS} is the total speed, not the horizontal component.

TABLE I	S-58 FLIGHT CONDITIONS; SPEED AND DESCENT RATE				
V_{TAS} Knots	0	20	40	60	100
Rate of	0	0	0	0	0
Descent	-7.5	-7.5	-7.5	-7.5	-7.5
fps	-15.0	-15.0	-15.0	-15.0	-15.0
	-22.5	-22.5	-22.5	-22.5	-22.5

At low speeds the maximum descent rate corresponds roughly to the predicted boundary of the vortex-ring state.

In terms of descent angle, the flight conditions are as follows:

TABLE II	S-58 FLIGHT CONDITIONS; SPEED AND DESCENT ANGLE				
V_{TAS} Knots	0	20	40	60	100
Descent	0	0	0	0	0
Angle	-90	-12.8	-6.35	-4.12	-2.54
γ	-90	-26.4	-12.8	-8.5	-5.10
Degrees	-90	-41.8	-19.4	-12.8	-7.65

Because of space considerations, it was impracticable to present the results of the calculations for all the above flight conditions. Therefore, this part presents

(1) Derivatives for all the above flight conditions

(2) Numerators of the transfer functions relating u, v, w, p, q, and r to longitudinal and lateral cyclic pitch, main rotor collective pitch, and tail rotor collective for speeds of 0, 20, 40, 50, and 100 knots in level flight and 22.5 fps descent.

(3) Eigenvalues (transfer function denominator roots) for the above flight conditions. Those not listed here are included in Chapter VI, Table XV, which tabulates the eigenvalues for all the flight conditions.

(4) Derivatives and eigenvalues for 22.5 fps rate of descent at $\gamma = -18.5$ degrees and $\gamma = -90$ degrees calculated with static tip loss factor (i.e., no cyclic variation) to provide a basis for comparing the effect of dynamic tip losses on the derivatives.

Residues and Eigenvectors

In addition to derivatives, residues and eigenvectors were also calculated and are quoted in the main text of the report where appropriate. For space reasons these are not presented here; however, if required, they can be generated from the transfer functions. The residue corresponding to an eigenvalue located at $s = a + jb$ is obtained by substituting $s = a + jb$ in the factored transfer direction with the factor corresponding to the eigenvalue removed. The eigenvectors are obtained by taking the ratio of the required numerators evaluated at the appropriate denominator root, as with the ϕ/β commonly used as a handling qualities parameter.

Explanation of the Print-Out Format

The print-out is as self-explanatory as possible; however, the following items require some comment.

Stability Derivative Matrices

The stability derivatives given in the print-out are in units of lb-ft and lb, per unit perturbation quantity. Note that this differs from equations of motion cited in the main text, where derivatives are quoted in terms of linear or angular acceleration per unit perturbation. To convert the print-out derivatives to this form, simply divide by the mass or the appropriate inertia. I_x, I_y, I_z are the divisors for L, M, and N derivatives. Both the derivatives and the inertias must be in a consistent axis system. The inertia tensor quoted on the print-out is in stability axes, as are the stability derivatives. The inertia tensor is defined as

$$\begin{bmatrix} I_x & -I_{xy} & -I_{xz} \\ -I_{yx} & I_y & -I_{yz} \\ -I_{zx} & -I_{zy} & I_z \end{bmatrix}$$

The S-58 controls are denoted as follows*:

C(1)	= θ_o	=	main rotor collective pitch, radians
C(2)	= B_{1s}	=	longitudinal cyclic pitch, radians
C(3)	= A_{1s}	=	lateral cyclic pitch, radians
C(4)	= θ_{oTR}	=	tail rotor collective pitch, radians

The trimmed iteration column vector contains the trimmed values of C(1), C(2), C(3), C(4), Θ, and Φ (in that order), where Θ and Φ are referred to overall vehicle axes and are in radians. The print-out also lists Θ and Φ referred to stability axes, in radians. Because of the somewhat arbitrary definition of stability axes as having their x-z plane in the x-z plane of the overall vehicle coordinates, this Φ is not exactly zero; however, it is generally negligibly small. The trimmed bank angle of the helicopter is typically about one degree.

Eigenvalues (Denominator Characteristic Roots)

Frequency is measured in radians per second. Very small eigenvalues are usually spurious (due to computer round-off errors) and should be set equal to zero. It is essential to check the dimensions of all transfer functions to avoid the inadvertent omission of small genuine eigenvalues. For example, transfer functions relating velocity response to control deflections should have <u>one</u> zero less than the number of poles; for positional response the difference should be two.

---

* For the AH-56 (in Part VII), the symbols C(1), C(2), C(3), C(4) are defined differently (see Part VII).

Transfer Function Numerators

The print-out shows the transfer function numerators for all controls. The response quantities are denoted as follows:

u	v	w	p	q	r
X(1)	X(2)	X(3)	X(4)	X(5)	X(6)

Note that stability axes are used. Thus, for 90-degree descent, u is directed vertically downward and w is horizontal, for zero pitch perturbation.

Due to an oversight, the print-out shows minus the correct sign on the root-locus gain*. The root-locus gain is defined as the lead coefficient, A_n, where the transfer function is written as

$$\frac{A\,s^n + A_{n-1}\,s^{n-1} + A_{n-2}\,s^{n-2} + \ldots\ldots + A_o}{s^r + B_{r-1}\,s^{r-1} + \ldots\ldots\ldots\ldots\ldots\ldots + B_o}$$

The Bode gain, also called d.c. gain, is defined as A_o/B_o provided neither of these terms is zero. If either A_o or B_o is zero the Bode gain is defined as the ration of the lowest order nonzero denominator coefficient. This definition of Bode gain is not foolproof for automatic computation, and occasionally round-off errors will cause a spurious Bode gain to be printed out. The sign of this gain may be either correct or incorrect, but the magnitude is usually grossly inaccurate. This situation occurs when the magnitude of the smallest numerator root is less than 10^{-7} times that of the largest numerator root.

Because of the incorrect sign on the root-locus gain, the sign on the d.c. gain is also incorrect, apart from the exceptional cases noted above.

---

* This error has been corrected on all transfer functions, eigenvectors, and residues quoted in the main text.

SIKORSKY S-58 HELICOPTER JUNE 2 1970 MOSTAB-8 DERIVATIVES
CASE 1 SPEED= 67.8 FT/SEC. H-DOT=-22.5FT/SEC. GAMMA=-18.5 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.4925+02	-.5256-00	-.6242+02	-.6339+03	.1288+04	.4189+03
Y	.3017-00	-.2306+02	-.1639-00	-.1123+04	-.6719+03	.8167+03
Z	-.1121+03	-.9895-00	-.1822+03	.1751+03	-.1944+03	.5880+03
L	-.6526+02	-.2782+02	-.1060+03	-.1784+05	-.8276+04	.2989+04
M	.9627+02	.7798+01	.2134+02	.9048+04	-.2087+05	-.2891+04
N	-.2312+03	.3074+03	-.3318+03	.1322+04	.4489+04	-.1491+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.5381-02	-.5514-03	-.1557-01	-.2257+02	-.8242+01	.7875+01
Y	.1063-01	.6085-01	.3036-01	.8006+01	-.2577+02	-.4963+01
Z	.1756-02	-.1788-02	.5286-02	.1029+02	.3173+01	-.3583+01
L	.3875-00	-.3925-00	.1100+01	.2354+04	-.3600+03	-.8063+03
M	-.6775-02	-.2524-01	.3290-02	.3625+03	.2649+04	-.1262+03
N	-.1502-00	-.1996+01	-.4229-00	-.8457+03	.1169+03	.3681+03

	C(1)	C(2)	C(3)	C(4)
X	-.3149+05	-.6276+03	.1566+05	-.1295+02
Y	.2363+03	.1210+05	.6529+03	.3755+04
Z	-.8256+05	.2134+03	.8377+04	-.1489+02
L	.2294+05	.1687+06	.1532+05	-.2447+05
M	.5441+05	.8936+04	-.1818+06	-.6870+03
N	.3946+05	-.6045+05	.2018+05	-.1234+06

THE INERTIA TENSOR

.8127+04	-.1996-06	.5778+04
-.1996-06	.2750+05	.5953-07
.5778+04	.5953-07	.2086+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.6325+02	-.6985-09	.2443+02	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

				θ	ϕ
.1779-00	-.5203-02	.3423-01	.1035-01	.3031-01	-.8211-03

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.3383-00 PHI -.8700-03
AIRCRAFT INERTIAL SPEED= .6780+02

DENOMINATOR CHARACTERISTIC
ROOTS

REAL PART	IMAGINARY PART
-.1381-07	.0000
-.5567+01	.0000
-.1041+00	.0000
-.1198+01	.0000
-.6160-00	.0000
.1135-01	.2982-00
.1135-01	-.2982-00
-.2833-00	.9242-00
-.2833-00	-.9242-00
.0000	.0000
.0000	.0000
.0000	.0000

NUMERATORS
(NOTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
LARGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

X(1)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .8561+02

BODE GAIN = -.6420+03

ROOTS

REAL PART	IMAGINARY PART
-.7150-01	.0000
-.5659+01	.0000
-.5685-00	.9923-00
-.5685-00	-.9923-00
.1830-01	.9556-00
.1830-01	-.9556-00
-.5521-00	.0000
-.4657-08	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.5038-00

BODE GAIN = .2245+03

ROOTS

REAL PART	IMAGINARY PART
.3942-01	.0000
.1776+03	.0000
.1702-01	.3954-00
.1702-01	-.3954-00
-.1026+02	.0000
-.2819+01	.0000
-.5005-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .2239+03

BODE GAIN = -.1998-04

ROOTS

REAL PART	IMAGINARY PART
-.2255-05	.0000
-.5633+01	.0000
-.3662-00	.9546-00
-.3662-00	-.9546-00
-.3484-00	.1043+00
-.3484-00	-.1043+00
.3269-00	.0000
-.5532-02	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.2487+01

BODE GAIN = .6183+01

ROOTS

REAL PART	IMAGINARY PART
-.9505-07	.0000
-.2544-06	.0000
-.2284-00	.2808+01
-.2284-00	-.2808+01
.8054-01	.4316-00
.8054-01	-.4316-00
-.7144-00	.0000
-.4358-00	.0000
-.1858-00	.0000
.2142-07	.0000

X(5)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.2220+01

BODE GAIN = -.1529-01

ROOTS

REAL PART	IMAGINARY PART
.1932-01	.0000
-.4915-01	.2038-01
-.4915-01	-.2038-01
-.6037+01	.0000
-.2276-00	.1084+01
-.2276-00	-.1084+01
-.6051-00	.0000
.0000	.0000
-.3260-07	.1578-07
-.3260-07	-.1578-07

X(6)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.1140+01

BODE GAIN = .1758+02

ROOTS

REAL PART	IMAGINARY PART
.1263-00	.3742-00
.1263-00	-.3742-00
-.1192+00	.4574-00
-.1192+00	-.4574-00
-.1356+02	.0000
-.2373+01	.0000
-.4894-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .5302+01

BODE GAIN = -.4270+03

ROOTS

REAL PART	IMAGINARY PART
.1864-06	.0000
-.2275+02	.0000
-.1563-00	.2796+01
-.1563-00	-.2796+01
-.3144-00	.8686-00
-.3144-00	-.8686-00
-.3986-00	.0000
-.4726-01	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.3414+02

BODE GAIN = .1807+04

ROOTS

REAL PART	IMAGINARY PART
.5157-01	.2764-00
.5157-01	-.2764-00
-.2277-00	.0000
-.3725+02	.0000
-.2244+01	.0000
-.5274-00	.9874-00
-.5274-00	-.9874-00
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.2217+01

BODE GAIN = .3746+03

ROOTS

REAL PART	IMAGINARY PART
-.6777-01	.0000
-.3103-00	.8769-00
-.3103-00	-.8769-00
-.1318-00	.3548-00
-.1318-00	-.3548-00
-.1831+02	.1952+02
-.1831+02	-.1952+02
-.2171-07	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.5149+02

BODE GAIN = -.4481-05

ROOTS

REAL PART	IMAGINARY PART
-.1694-00	.0000
-.2903-00	.8203-00
-.2903-00	-.8203-00
.4259-01	.3684-00
.4259-01	-.3684-00
-.9578-00	.0000
-.4678-00	.0000
.0000	.0000
-.3920-06	.0000
.1131-07	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.1210+01

BODE GAIN = -.2827-01

ROOTS

REAL PART	IMAGINARY PART
.2809-01	.0000
-.4449-01	.3423-01
-.4449-01	-.3423-01
-.1911+02	.0000
-.3210-00	.8708-00
-.3210-00	-.8708-00
-.5710-00	.0000
-.3843-07	.0000
-.1372-07	.0000
.0000	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .1959+02

BODE GAIN = .3249+02

ROOTS

REAL PART	IMAGINARY PART
.1923-01	.3361-00
.1923-01	-.3361-00
-.3155-00	.0000
-.1714+01	.0000
-.4108-00	.1044+01
-.4108-00	-.1044+01
.7658-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.4245+02

BODE GAIN = .2150+04

ROOTS

REAL PART	IMAGINARY PART
-.1963-07	.0000
-.3964-00	.0000
-.1121+00	.0000
-.3401-00	.9543-00
-.3401-00	-.9543-00
-.5625+01	.0000
-.1261-00	.2648+01
-.1261-00	-.2648+01
.0000	.0000
.0000	.0000

X(2)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2355+01

BODE GAIN = .2110-02

ROOTS

REAL PART	IMAGINARY PART
.9006-05	.0000
-.4484+01	.1071+02
-.4484+01	-.1071+02
-.4279+01	.0000
-.4459-01	.8325-01
-.4459-01	-.8325-01
.6421-00	.5253-00
.6421-00	-.5253-00
.0000	.0000
.0000	.0000

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2276+02

BODE GAIN = -.1291+04

ROOTS

REAL PART	IMAGINARY PART
.4535-06	.0000
.2112+02	.0000
-.1091+00	.0000
-.3337-00	.9500-00
-.3337-00	-.9500-00
-.5620+01	.0000
-.1376-00	.3671-00
-.1376-00	-.3671-00
.0000	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.3230+01

BODE GAIN = .5684-00

ROOTS

REAL PART	IMAGINARY PART
.2519-01	.5968-01
.2519-01	-.5968-01
-.7464+01	.0000
-.1551-00	.1213+01
-.1551-00	-.1213+01
-.7470-00	.0000
-.1792-00	.0000
-.2597-07	.9256-07
-.2597-07	-.9256-07
.0000	.0000

X(5)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .7268+01

BODE GAIN = -.1405-02

ROOTS

REAL PART	IMAGINARY PART
-.2171-02	.0000
-.5627+01	.0000
-.3369-00	.9611-00
-.3369-00	-.9611-00
-.5711-00	.0000
-.1130+00	.0000
-.8417-02	.0000
-.1173-06	.0000
.2603-07	.0000
.0000	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .1018+00

BODE GAIN = -.7468-05

ROOTS

REAL PART	IMAGINARY PART
.2769-01	.6149-01
.2769-01	-.6149-01
-.3457+02	.0000
-.3273+01	.0000
.3248+01	.0000
-.9412-01	.5737-00
-.9412-01	-.5737-00
-.4623-05	.0000
.2268-07	.0000
.0000	.0000

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .4488-00

BODE GAIN = .3671+02

ROOTS

REAL PART	IMAGINARY PART
-.2531-01	.0000
-.3425+02	.0000
-.6944-00	.2499+01
-.6944-00	-.2499+01
-.1155+01	.0000
.1052+01	.0000
-.4108-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1038+02

BODE GAIN = .4669+02

ROOTS

REAL PART	IMAGINARY PART
-.1299-01	.0000
-.4711+02	.0000
-.4433+01	.0000
-.1190+01	.0000
.1311-01	.3204-00
.1311-01	-.3204-00
-.4826-00	.0000
.1084-08	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1479-00

BODE GAIN = -.4835+02

ROOTS

REAL PART	IMAGINARY PART
-.4320-07	.0000
-.1329-00	.3652-00
-.1329-00	-.3652-00
-.5338-01	.0000
.1664+02	.1750+02
.1664+02	-.1750+02
.2147+01	.0000
-.1153+01	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.4158+01

BODE GAIN = -.2471+01

ROOTS

REAL PART	IMAGINARY PART
-.5431-08	.0000
.3279+01	.0000
.4074-01	.3361-00
.4074-01	-.3361-00
-.2021-00	.0000
-.1187+01	.0000
-.7070-00	.0000
-.3318-00	.0000
.8489-11	.0000
.0000	.0000

X(5)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.7041-01

BODE GAIN = .6111-02

ROOTS

REAL PART	IMAGINARY PART
-.3779-01	.4095-01
-.3779-01	-.4095-01
.3623-01	.0000
-.3134+02	.0000
-.1160+01	.0000
.1241+01	.0000
-.5769-00	.0000
-.7697-08	.0000
.1494-06	.0000
.2144-07	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .7366+01

BODE GAIN = -.7024+01

ROOTS

REAL PART	IMAGINARY PART
.6284-08	.0000
-.1192-07	.0000
-.3956+01	.0000
-.1190+01	.0000
-.4618-00	.0000
-.7622-01	.3780-00
-.7622-01	-.3780-00
.7429-01	.3153-00
.7429-01	-.3153-00
.0000	.0000

SIKORSKY S-58 HELICOPTER JUNE 2 1970 MOSTAB-B DERIVATIVES
CASE 2 SPEED= 22.5 FT/SEC. H-DOT=-22.5FT/SEC. GAMMA=-90.0 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.6726+02	.2947+01	.1568+01	.9084+03	.7328+01	-.6476+02
Y	.5866-00	-.1380+02	-.5472-00	.2969+03	-.6312+03	.9857+03
Z	-.1261-00	.5348-00	-.6521+01	.2877+02	-.9526+03	-.7332+03
L	-.1509+03	.2375+03	.1777+01	-.8832+04	-.4622+04	.1538+04
M	-.7498+01	.2401+02	-.1168+03	.2832+03	-.1770+05	-.1082+05
N	-.7610+01	.1292+03	.1556+02	-.1516+04	.1025+05	-.1630+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.1696-02	-.3994-02	.1834-02	.8935-01	.1012+00	.3574-01
Y	-.3587-02	.6660-01	-.3854-04	-.1750+01	-.1869+02	-.1013+02
Z	-.4236-02	-.7059-03	.7147-04	-.3568-00	.9810+01	-.1860+02
L	.7146-01	-.2208+01	-.8791-03	.7833+02	-.9969+02	.2206+02
M	-.1982-00	-.1083+00	-.8144-03	-.7198+02	.2670+04	-.3252+03
N	.3937-00	-.2911-00	-.5499-02	.1428+02	.3264+03	.2677+04

	C(1)	C(2)	C(3)	C(4)
X	-.8788+05	-.2871+03	-.1932+03	-.1488+03
Y	-.3506+04	.1239+05	.5760+03	.4083+04
Z	-.2857+02	.5843+03	-.1239+05	-.3081+02
L	.1607+06	-.1350+04	.5600+04	-.1354+06
M	.7028+04	.1894+04	-.1858+06	-.6765+04
N	.1345+05	-.1857+06	-.1758+04	-.1840+05

THE INERTIA TENSOR

.2307+05	-.1236+03	-.6522+03
-.1236+03	.2750+05	-.1819+02
-.6522+03	-.1819+02	.5920+04

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
-.6541-00	-.6271-00	.2246+02	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2465-00	-.1236-01	.3884-02	.1507-00	.3797-01	-.2790-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.1571+01 PHI -.6553-01
AIRCRAFT INERTIAL SPEED= .2250+02

DENOMINATOR CHARACTERISTIC
ROOTS

REAL PART	IMAGINARY PART
-.2450-00	.1291-00
-.2450-00	-.1291-00
.5427-01	.4002-00
.5427-01	-.4002-00
-.1789-00	.4199-00
-.1789-00	-.4199-00
-.4681+01	.0000
-.1051+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000
.0000	.0000

NUMERATORS
(NOTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
LARGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

X(1)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .2385+03

BODE GAIN = -.7656+03

ROOTS

REAL PART	IMAGINARY PART
-.1809-00	.4346-00
-.1809-00	-.4346-00
.5372-01	.4034-00
.5372-01	-.4034-00
-.4685+01	.0000
-.1053+01	.0000
-.2273-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .9713+01

BODE GAIN = .2748+03

ROOTS

REAL PART	IMAGINARY PART
-.5428-07	.0000
-.1510+02	.0000
-.1342+01	.0000
-.7540-00	.0000
-.4017-00	.0000
.1652-01	.4606-00
.1652-01	-.4606-00
.2781-00	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .3589-00

BODE GAIN = .2591+03

ROOTS

REAL PART	IMAGINARY PART
-.1070+00	.3242-00
-.1070+00	-.3242-00
-.3937-00	.0000
-.1674+02	.0000
-.1902+01	.1227+01
-.1902+01	-.1227+01
.2352+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.7155+01

BODE GAIN = .3872+02

ROOTS

REAL PART	IMAGINARY PART
.5476-07	.8103-07
.5476-07	-.8103-07
-.4622+01	.0000
-.1084+01	.0000
-.4082-00	.0000
-.1221+00	.4430-00
-.1221+00	-.4430-00
.7377-01	.3938-00
.7377-01	-.3938-00
.0000	.0000

X(5)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.2304-00

BODE GAIN = -.4377-03

ROOTS

REAL PART	IMAGINARY PART
.5648-02	.0000
-.9453-02	.0000
.1586+01	.2732+01
.1586+01	-.2732+01
-.1049+00	.3242-00
-.1049+00	-.3242-00
-.3934-00	.0000
.7685-10	.0000
.2601-08	.0000
.6519-08	.0000

X(6)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.5614+01

BODE GAIN = .5180-08

ROOTS

REAL PART	IMAGINARY PART
-.1496-01	.0000
-.3924-00	.0000
.5630-01	.0000
.2548-00	.0000
-.8370-00	.0000
.1430-01	.4646-00
.1430-01	-.4646-00
.0000	.0000
.7766-06	.0000
-.5339-07	.0000

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .7852-00

BODE GAIN = .6293+03

ROOTS

REAL PART	IMAGINARY PART
.3985-01	.4217-00
.3985-01	-.4217-00
-.6388-00	.0000
-.1615+01	.0000
.5232+01	.0000
-.7628-00	.3166+01
-.7628-00	-.3166+01
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.3518+02

BODE GAIN = .1889+04

ROOTS

REAL PART	IMAGINARY PART
-.2847-00	.7775-01
-.2847-00	-.7775-01
-.3577+02	.0000
-.1479+01	.0000
-.8115-00	.0000
.4660-01	.4265-00
.4660-01	-.4265-00
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.4512+01

BODE GAIN = .4605+03

ROOTS

REAL PART	IMAGINARY PART
-.2279-01	.2976-00
-.2279-01	-.2976-00
-.2379-00	.0000
-.3419-00	.0000
-.2653+02	.0000
-.2452+01	.8873-00
-.2452+01	-.8873-00
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .1749+01

BODE GAIN = .3999+02

ROOTS

REAL PART	IMAGINARY PART
-.1771-00	.0000
.4078-01	.4254-00
.4078-01	-.4254-00
-.6585-00	.0000
-.2357+01	.7716-00
-.2357+01	-.7716-00
.2236+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.7840-00

BODE GAIN = -.4521-03

ROOTS

REAL PART	IMAGINARY PART
.4673-02	.0000
-.6712-02	.0000
-.3243+02	.0000
-.2032-01	.2977-00
-.2032-01	-.2977-00
-.3429-00	.0000
-.2379-00	.0000
-.2336-07	.0000
.0000	.0000
-.1327-07	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .5754+02

BODE GAIN = .6889-02

ROOTS

REAL PART	IMAGINARY PART
.9608-02	.0000
-.1212-01	.0000
-.2892-00	.6263-01
-.2892-00	-.6263-01
-.8182-00	.0000
.4663-01	.4263-00
.4663-01	-.4263-00
.4249-08	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .5265-00

BODE GAIN = .6502+02

ROOTS

REAL PART	IMAGINARY PART
.1577-01	.1846-00
.1577-01	-.1846-00
-.5610+01	.0000
-.2103+01	.0000
.2883+01	.0000
-.3298-00	.1116+01
-.3298-00	-.1116+01
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1977+01

BODE GAIN = .2799+03

ROOTS

REAL PART	IMAGINARY PART
-.1497-01	.2199-00
-.1497-01	-.2199-00
-.3006-00	.6803-01
-.3006-00	-.6803-01
-.1197+02	.1095+02
-.1197+02	-.1095+02
-.1494+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .3375+02

BODE GAIN = -.1521+04

ROOTS

REAL PART	IMAGINARY PART
-.1323-00	.4662-00
-.1323-00	-.4662-00
-.2325-00	.1278-00
-.2325-00	-.1278-00
-.4936+01	.0000
-.2544+01	.7798-00
-.2544+01	-.7798-00
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1976-00

BODE GAIN = .6745+01

ROOTS

REAL PART	IMAGINARY PART
-.8090-02	.2137-00
-.8090-02	-.2137-00
-.1895-00	.0000
-.4989+01	.2401+01
-.4989+01	-.2401+01
-.3723-00	.1228+01
-.3723-00	-.1228+01
-.2235-07	.0000
.2359-07	.0000
.0000	.0000

X(5)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .7466+01

BODE GAIN = -.7625-04

ROOTS

REAL PART	IMAGINARY PART
.4849-03	.0000
-.4910+01	.0000
-.1313-00	.4664-00
-.1313-00	-.4664-00
-.2325-00	.1276-00
-.2325-00	-.1276-00
.3329-02	.0000
-.2946-07	.0000
-.1239-07	.0000
-.3353-07	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .1295+01

BODE GAIN = .1162-02

ROOTS

REAL PART	IMAGINARY PART
.4661-07	.1031-06
.4661-07	-.1031-06
-.1850+02	.0000
-.3082-00	.4230-01
-.3082-00	-.4230-01
-.1349-01	.2206-00
-.1349-01	-.2206-00
-.1370-01	.0000
.9595-02	.0000
.1090-08	.0000

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .4061-00

BODE GAIN = -.1736+03

ROOTS

REAL PART	IMAGINARY PART
.7681-01	.3892-00
.7681-01	-.3892-00
-.1093+00	.4198-00
-.1093+00	-.4198-00
-.3386+02	.0000
-.5034+01	.0000
-.1085+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1131+02

BODE GAIN = -.5773+01

ROOTS

REAL PART	IMAGINARY PART
.1454-01	.0000
-.1586+02	.0000
-.1359+01	.0000
-.7772-00	.0000
.7051-02	.4364-00
.7051-02	-.4364-00
-.1410-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.2677-00

BODE GAIN = -.7818+02

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.1726-00	.0000
-.3103+02	.0000
-.2091+01	.1214+01
-.2091+01	-.1214+01
.1099+01	.0000
-.1300-00	.3031-00
-.1300-00	-.3031-00
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .6094+01

BODE GAIN = -.1254+02

ROOTS

REAL PART	IMAGINARY PART
-.9701-10	.0000
-.4599+01	.0000
-.1090+01	.0000
-.1138+00	.4168-00
-.1138+00	-.4168-00
.7282-01	.3858-00
.7282-01	-.3858-00
-.1829-00	.0000
.2114-09	.0000
.0000	.0000

X(5)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .1993-00

BODE GAIN = .1417-03

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
.5552-02	.0000
-.1036-01	.0000
.5719+01	.0000
.1493+01	.0000
-.1278-00	.3028-00
-.1278-00	-.3028-00
-.1719-00	.0000
.1287-09	.0000
-.3496-08	.0000
.5355-08	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .6948+01

BODE GAIN = -.2160-02

ROOTS

REAL PART	IMAGINARY PART
-.1080-07	.0000
.4419-07	.0000
-.1163+00	.0000
-.7312-01	.0000
.4619-01	.2740-01
.4619-01	-.2740-01
-.8429-00	.0000
.5710-02	.4389-00
.5710-02	-.4389-00
.0000	.0000

SIKORSKY S-58 HELICOPTER JUNE 24 1970 MOSTAB-8 DERIVATIVES
CASE 5 SPEED=1.0 FT/SEC, W-DOT=0.0 FT/SEC, GAMMA=0.0 DEG.
GROSS WEIGHT= 11867.LB, SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.7329+01	-.7171-00	.1614-00	-.7610+03	.8364+03	-.2630+01
Y	.7641-00	-.1298+02	-.1400+01	-.8581+03	-.7567+03	.2038+03
Z	-.3677+01	-.1792+01	-.1011+03	.2943+01	-.6169+01	.9798+03
L	.1926+02	-.1352+03	-.1717+02	-.1525+05	-.1133+05	.1156+04
M	.1054+03	.2013+02	-.1295+02	.1151+05	-.1664+05	.4533+02
N	-.4105+01	.1777+03	-.3322+02	-.2067+04	-.1932+04	-.7577+04

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.6425-04	-.4581-04	.4123-02	-.1599+02	-.1030+02	.1042+00
Y	-.1739-04	.7285-01	-.1523-02	.1063+02	-.1601+02	-.2479+01
Z	.3426-04	.7810-03	.7218-03	.1783-00	-.1556-01	.2711-01
L	.2428-02	.3249-00	-.4801-00	.2688+04	-.3048+03	-.2622+02
M	-.1890-01	-.3788-01	-.2231-00	.3045+03	.2684+04	.3266-00
N	-.7773-03	-.2418+01	.3312-02	-.1414+02	-.3594+02	.8218+02

	C(1)	C(2)	C(3)	C(4)
X	.5180+01	-.5467+03	.1265+05	-.1583+01
Y	-.1402+04	.1265+05	.5434+03	.4466+04
Z	-.8702+05	.1182+02	-.1055+03	-.5180+01
L	-.1801+05	.1906+06	-.1037+04	.1996+05
M	.3423+04	-.9456+03	-.1908+06	-.2369+04
N	.1982+06	-.1769+04	.6473+03	-.1483+06

THE INERTIA TENSOR

.5921+04	.0000	.6649+03
.0000	.2750+05	.0000
.6649+03	.0000	.2306+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.9993-00	-.0000	.3870-01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2679-00 -.1532-01 .5162-02 .1933-00 .3869-01 -.3656-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= .8074-05 PHI -.3653-01
AIRCRAFT INERTIAL SPEED= .1000+01

DENOMINATOR CHARACTERISTIC
ROOTS

REAL PART	IMAGINARY PART
-.8794-01	.4909-00
-.8794-01	-.4909-00
.9304-01	.3667-00
.9304-01	-.3667-00
-.2664-00	.7518-01
-.2664-00	-.7518-01
-.4491+01	.0000
-.1139+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000
.0000	.0000

NUMERATORS
(NOTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
LARGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

X(1)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.3350-00

BODE GAIN = -.3728+03

ROOTS

REAL PART	IMAGINARY PART
-.2690-00	.0000
-.9626-01	.3918-00
-.9626-01	-.3918-00
-.4734+02	.0000
-.4874-00	.1887+01
-.4874-00	-.1887+01
.1972+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .4080+01

BODE GAIN = .2939+03

ROOTS

REAL PART	IMAGINARY PART
.2959-07	.0000
-.7789-00	.8048+01
-.7789-00	-.8048+01
.2947-00	.0000
.5744-01	.4418-00
.5744-01	-.4418-00
-.8825-00	.0000
-.2977-00	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .2361+03

BODE GAIN = -.5065+03

ROOTS

REAL PART	IMAGINARY PART
-.1592-00	.0000
-.4475+01	.0000
-.1152+01	.0000
-.8737-01	.4955-00
-.8737-01	-.4955-00
.9108-01	.3685-00
.9108-01	-.3685-00
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .7432+01

BODE GAIN = .3361-10

ROOTS

REAL PART	IMAGINARY PART
.3522-03	.0000
-.8606-00	.0000
-.2868-00	.0000
-.8181-01	.0000
.6308-01	.4400-00
.6308-01	-.4400-00
.3863-00	.0000
-.1099-09	.0000
-.1162-06	.0000
.3145-07	.0000

X(5)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.4899-01

BODE GAIN = -.1309+01

ROOTS

REAL PART	IMAGINARY PART
-.3290-00	.9881-01
-.3290-00	-.9881-01
-.5670-01	.3959-00
-.5670-01	-.3959-00
.5145+02	.0000
.8216-00	.0000
.4672-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(6)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.8846+01

BODE GAIN = .3581+02

ROOTS

REAL PART	IMAGINARY PART
.1103+00	.3589-00
.1103+00	-.3589-00
-.5175-01	.4825-00
-.5175-01	-.4825-00
-.4419+01	.0000
-.1167+01	.0000
-.3299-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .4075+01

BODE GAIN = -.5259+03

ROOTS

REAL PART	IMAGINARY PART
.6783-02	.3015-00
.6783-02	-.3015-00
-.2596-00	.0000
-.3575-00	.0000
-.3213+02	.0000
-.8231-01	.2575+01
-.8231-01	-.2575+01
-.3847-18	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.3602+02

BODE GAIN = .1750+04

ROOTS

REAL PART	IMAGINARY PART
-.3009-00	.5704-01
-.3009-00	-.5704-01
-.3561-00	.7275+01
-.3561-00	-.7275+01
-.8690-00	.0000
.8706-01	.3862-00
.8706-01	-.3862-00
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.6067-01

BODE GAIN = .3748+03

ROOTS

REAL PART	IMAGINARY PART
.7953-01	.3791-00
.7953-01	-.3791-00
-.7309-01	.7600-00
-.7309-01	-.7600-00
.3037+02	.2112+02
.3037+02	-.2112+02
-.7198-00	.0000
.3776-07	.0000
.2502-07	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.5928+02

BODE GAIN = -.3216-03

ROOTS

REAL PART	IMAGINARY PART
.2298-03	.0000
-.8684-00	.0000
-.2926-00	.6134-01
-.2926-00	-.6134-01
.8719-01	.3861-00
.8719-01	-.3861-00
-.2708-01	.0000
.3725-08	.0000
.0000	.0000
.0000	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.6893-00

BODE GAIN = -.1455+01

ROOTS

REAL PART	IMAGINARY PART
-.1113-07	.0000
-.3966+02	.0000
-.2840-00	.0000
.2141-00	.0000
.3260-01	.3253-00
.3260-01	-.3253-00
-.3036-00	.1485-00
-.3036-00	-.1485-00
.0000	.0000
.0000	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .1834+01

BODE GAIN = .3981+02

ROOTS

REAL PART	IMAGINARY PART
-.2775-00	.0000
-.2178+01	.1490+01
-.2178+01	-.1490+01
-.7926-00	.0000
.1267+01	.0000
.8381-01	.3859-00
.8381-01	-.3859-00
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.3452+02

BODE GAIN = .1709+04

ROOTS

REAL PART	IMAGINARY PART
-.2581-00	.7612-01
-.2581-00	-.7612-01
-.2382-01	.5243-00
-.2382-01	-.5243-00
-.4841+01	.0000
-.8148-01	.2673+01
-.8148-01	-.2673+01
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1820+01

BODE GAIN = .3128+03

ROOTS

REAL PART	IMAGINARY PART
-.2100-02	.2272-00
-.2100-02	-.2272-00
-.3061-00	.6243-01
-.3061-00	-.6243-01
-.1490+02	.0000
.4742-00	.5632+01
.4742-00	-.5632+01
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .2857-00

BODE GAIN = -.4740+01

ROOTS

REAL PART	IMAGINARY PART
-.1844-01	.0000
-.2791+02	.0000
-.5790+01	.0000
-.1245+00	.6730-00
-.1245+00	-.6730-00
.3651-00	.1800-00
.3651-00	-.1800-00
.5217-07	.0000
-.5004-08	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.3979-00

BODE GAIN = -.5314-04

ROOTS

REAL PART	IMAGINARY PART
-.2487-06	.0000
-.6755+02	.0000
.2013-03	.0000
-.2846-01	.0000
-.2969-00	.6537-01
-.2969-00	-.6537-01
-.1584-02	.2282-00
-.1584-02	-.2282-00
-.1569-07	.0000
.9847-09	.0000

X(5)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .7684+01

BODE GAIN = -.2404-00

ROOTS

REAL PART	IMAGINARY PART
.7222-02	.6258-01
.7222-02	-.6258-01
-.4835+01	.0000
-.1369-01	.5274-00
-.1369-01	-.5274-00
-.2755-00	.7610-01
-.2755-00	-.7610-01
-.3725-08	.0000
.0000	.0000
.0000	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2824-01

BODE GAIN = .6578+01

ROOTS

REAL PART	IMAGINARY PART
.3865-02	.2092-00
.3865-02	-.2092-00
-.2900-00	.0000
-.8167-00	.4950+01
-.8167-00	-.4950+01
.1947-00	.3183+01
.1947-00	-.3183+01
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .3360-00

BODE GAIN = .1293+03

ROOTS

REAL PART	IMAGINARY PART
-.4378-08	.0000
-.4803+02	.0000
-.1979-00	.1961+01
-.1979-00	-.1961+01
-.1420-00	.3380-00
-.1420-00	-.3380-00
.9923-00	.0000
-.2155-00	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1238+02

BODE GAIN = -.4005+02

ROOTS

REAL PART	IMAGINARY PART
.5486-01	.0000
-.1921+01	.4448+01
-.1921+01	-.4448+01
-.8922-00	.0000
.4867-01	.3989-00
.4867-01	-.3989-00
-.2430-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .1084-01

BODE GAIN = -.1972+03

ROOTS

REAL PART	IMAGINARY PART
.1047+00	.3687-00
.1047+00	-.3687-00
-.6777-01	.4699-00
-.6777-01	-.4699-00
-.1641+04	.0000
-.3546+01	.0000
-.1317+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.7603+01

BODE GAIN = .1608-03

ROOTS

REAL PART	IMAGINARY PART
.2356-03	.0000
-.8916-00	.0000
-.1922-00	.8883-02
-.1922-00	-.8883-02
.5431-01	.4035-00
.5431-01	-.4035-00
.2288-00	.0000
.0000	.0000
-.5413-08	.1487-07
-.5413-08	-.1487-07

X(5)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .2274-02

BODE GAIN = .7274-00

ROOTS

REAL PART	IMAGINARY PART
.8562-08	.0000
.1330+04	.0000
-.3396-00	.3418-01
-.3396-00	-.3418-01
-.7395-01	.3599-00
-.7395-01	-.3599-00
.3469-00	.3049-00
.3469-00	-.3049-00
.0000	.0000
.0000	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .6680+01

BODE GAIN = -.1990+02

ROOTS

REAL PART	IMAGINARY PART
-.5501-01	.4575-00
-.5501-01	-.4575-00
.1071+00	.3571-00
.1071+00	-.3571-00
-.4399+01	.0000
-.1167+01	.0000
-.2743-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

SIKORSKY S-58 HELICOPTER MAY 1970 MOSTAB-R DERIVATIVES,
CASE 6 SPEED= 33.8 FT/SEC, W DOT= 0.0 FT/SEC. GAMMA= 0.0 DEG,
GROSS WEIGHT= 11867 LB. SEA LEVEL DYNAMIC TIP LOSSES (YES),

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.9653+01	-.5826-00	-.5984-00	-.7493+03	.9164+03	-.1715+02
Y	.2270+01	-.1828+02	-.1675+01	-.9567+03	-.7509+03	.2915+03
Z	-.7055+02	-.2531+01	-.1499+03	-.6169+02	.4241+03	.8815+03
L	.1999+02	-.1389+03	-.1578+02	-.1597+05	-.1096+05	.1331+04
M	.1106+03	.1869+02	.2567+02	.1116+05	-.1703+05	.1615+03
N	-.1277+03	.2049+03	-.8977+02	-.1703+04	-.1522+02	-.1044+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.7226-04	-.3355-03	-.6426-02	-.1800+02	-.1003+02	.5891-01
Y	-.8464-04	.6699-01	.3188-01	.1041+02	-.1792+02	-.2258+01
Z	.1516-04	-.7854-03	.9308-03	.2851+01	.1253+01	.3971-01
L	-.8726-03	.3079-00	.4293-00	.2682+04	-.3189+03	-.1594+02
M	-.5760-02	-.5286-01	-.1234+00	.3203+03	.2678+04	.1679+01
N	.4573-03	-.2223+01	-.1181-01	-.2651+02	-.3607+02	.7608+02

	C(1)	C(2)	C(3)	C(4)
X	-.1307+04	-.5650+03	.1248+05	-.413[illegible] 02
Y	-.8976+03	.1257+05	.6130+03	.411[illegible] 04
Z	-.8384+05	.6648+02	.5002+04	-.4427+02
L	-.8364+04	.1887+06	.1246+04	.1894+05
M	.2752+05	.9329+03	-.1889+06	-.3018+04
N	.1699+06	-.1541+04	.3708+04	-.1365+06

THE INERTIA TENSOR

.5916+04	-.3141-06	.6027+03
-.3141-06	.2750+05	.8771-08
.6027+03	.8771-08	.2307+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.3378+02	-.4919-09	.1186+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2506-00	-.1570-01	.2278-01	.1559-00	.3507-01	-.2919-01

DENOMINATOR CHARACTERISTIC
ROOTS

REAL PART	IMAGINARY PART
-.3852-00	.0000
-.1970-00	.0000
.6132-01	.3335-00
.6132-01	-.3335-00
-.1461-00	.7300-00
-.1461-00	-.7300-00
-.4759+01	.0000
-.1155+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000
.0000	.0000

NUMERATORS
(NOTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
LARGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

X(1)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .3367+01

BODE GAIN = -.4035+03

ROOTS

REAL PART	IMAGINARY PART
-.1237+00	.0000
.3491-00	.3839+01
.3491-00	-.3839+01
-.2247-00	.1124+01
-.2247-00	-.1124+01
-.3377+01	.0000
-.3904-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .2670+01

BODE GAIN = .2346+03

ROOTS

REAL PART	IMAGINARY PART
.5465-01	.0000
-.8838+02	.0000
-.5492+01	.0000
-.1283+01	.0000
.4066-01	.3934-00
.4066-01	-.3934-00
-.4388-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .2275+03

BODE GAIN = -.2136+03

ROOTS

REAL PART	IMAGINARY PART
-.1829-07	.0000
-.4693+01	.0000
-.1559-00	.0000
.5818-01	.2728-00
.5818-01	-.2728-00
-.1810-00	.6676-00
-.1810-00	-.6676-00
-.9168-00	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .4154+01

BODE GAIN = .2816-03

ROOTS

REAL PART	IMAGINARY PART
-.1357-06	.0000
-.1878+01	.0000
-.7030-00	.0000
-.4967-00	.0000
-.9780-05	.0000
.1555+01	.0000
.7645-01	.4180-00
.7645-01	-.4180-00
-.5658-07	.0000
.1034-07	.0000

X(5)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.1057+01

BODE GAIN = -.8069-00

ROOTS

REAL PART	IMAGINARY PART
-.2380-07	.0000
-.4107-00	.0000
-.1142+00	.1780-00
-.1142+00	-.1780-00
.1721-00	.0000
-.3502+01	.0000
-.1595-00	.1345+01
-.1595-00	-.1345+01
.0000	.0000
.0000	.0000

X(6)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.7501+01

BODE GAIN = .2765+02

ROOTS

REAL PART	IMAGINARY PART
.1188+00	.3761-00
.1188+00	-.3761-00
-.7664-01	.4873-00
-.7664-01	-.4873-00
-.4722+01	.0000
-.1199+01	.0000
-.4575-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .4417+01

BODE GAIN = -.6044+03

ROOTS

REAL PART	IMAGINARY PART
-.1454-00	.0000
-.2899+02	.0000
-.7044-01	.2564+01
-.7044-01	-.2564+01
-.1753-00	.5601-00
-.1753-00	-.5601-00
-.3807-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.3574+02

BODE GAIN = .1640+04

ROOTS

REAL PART	IMAGINARY PART
.1004+00	.3309-00
.1004+00	-.3309-00
-.3055-00	.0000
-.7135-00	.2888-00
-.7135-00	-.2888-00
-.1032+01	.7438+01
-.1032+01	-.7438+01
.1259-07	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR.

ROOT LOCUS GAIN= -.6361-00

BODE GAIN = .4643+03

ROOTS

REAL PART	IMAGINARY PART
-.1453-00	.5796-00
-.1453-00	-.5796-00
.1124-02	.3972-00
.1124-02	-.3972-00
-.1254+02	.3738+02
-.1254+02	-.3738+02
-.2217-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.5859+02

BODE GAIN = .3610-03

ROOTS

REAL PART	IMAGINARY PART
-.9517-05	.0000
-.3317-00	.0000
.1043+00	.3837-00
.1043+00	-.3837-00
-.2566-00	.5274-00
-.2566-00	-.5274-00
-.9544-00	.0000
.0000	.0000
-.1258-07	.0000
.5472-08	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.7935-00

BODE GAIN = -.1034+01

ROOTS

REAL PART	IMAGINARY PART
-.1464-00	.1915-00
-.1464-00	-.1915-00
-.3587-00	.0000
.1557-00	.0000
-.3346+02	.0000
-.1941-00	.5305-00
-.1941-00	-.5305-00
.0000	.0000
.5986-07	.0000
.1790-07	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .1679+01

BODE GAIN = .3544+02

ROOTS

REAL PART	IMAGINARY PART
.6148-01	.3714-00
.6148-01	-.3714-00
-.3248-00	.0000
-.2052+01	.0000
-.1529+01	.1222+01
-.1529+01	-.1222+01
.1556+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.3402+02

BODE GAIN = .1937+04

ROOTS

REAL PART	IMAGINARY PART
-.2030-00	.0000
-.3789-00	.0000
-.1281-00	.7291-00
-.1281-00	-.7291-00
-.5025+01	.0000
-.6042-01	.2674+01
-.6042-01	-.2674+01
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2069+01

BODE GAIN = .2780+03

ROOTS

REAL PART	IMAGINARY PART
-.1152+00	.8097-01
-.1152+00	-.8097-01
-.2568-00	.5922-00
-.2568-00	-.5922-00
-.1089+02	.0000
.5034-00	.6287+01
.5034-00	-.6287+01
-.2655-07	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1356+02

BODE GAIN = -.9398+03

ROOTS

REAL PART	IMAGINARY PART
-.1940-00	.0000
.9752-02	.4241-00
.9752-02	-.4241-00
-.1278-00	.7299-00
-.1278-00	-.7299-00
.1922+02	.0000
-.5004+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1109+01

BODE GAIN = .1017+02

ROOTS

REAL PART	IMAGINARY PART
.1904-09	.0000
-.2855-06	.0000
-.2369+02	.0000
-.1745-00	.6772-00
-.1745-00	-.6772-00
.0000	.0000
-.6513-00	.0000
.2182-00	.0000
-.1481-00	.0000
.3391-08	.0000

X(5)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .7596+01

BODE GAIN = .2862-00

ROOTS

REAL PART	IMAGINARY PART
-.7623-01	.0000
-.5018+01	.0000
-.1254-00	.7279-00
-.1254-00	-.7279-00
-.3053-00	.0000
-.2668-00	.0000
.5894-01	.0000
.1035-06	.0000
.1594-08	.0000
-.8382-08	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1424-00

BODE GAIN = -.9807+01

ROOTS

REAL PART	IMAGINARY PART
-.1439-00	.0000
-.3842+01	.0000
-.3534-00	.9086-00
-.3534-00	-.9086-00
.1987+01	.1714+01
.1987+01	-.1714+01
.5069-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .4558-00

BODE GAIN = .1365+03

ROOTS

REAL PART	IMAGINARY PART
-.1122+00	.0000
-.3347+02	.0000
-.1431-00	.1991+01
-.1431-00	-.1991+01
.1534+01	.0000
-.9065-00	.0000
-.3827-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1130+02

BODE GAIN = .1477+02

ROOTS

REAL PART	IMAGINARY PART
-.5684-02	.0000
-.1344+02	.0000
-.7817+01	.0000
-.1130+01	.0000
.4894-01	.3674-00
.4894-01	-.3674-00
-.3717-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .6650-01

BODE GAIN = -.1416+03

ROOTS

REAL PART	IMAGINARY PART
.1454-07	.0000
-.2655+03	.0000
.7620-00	.2440+01
.7620-00	-.2440+01
.1260-01	.4003-00
.1260-01	-.4003-00
-.8290-00	.0000
-.2454-00	.0000
.0000	.0000
.0000	.0000

X(4)-T(·C(4) NUMERATOR

ROOT LOCUS GAIN= -.7033+01

BODE GAIN = -.1349-03

ROOTS

REAL PART	IMAGINARY PART
-.9690-05	.0000
-.9714-00	.6906-01
-.9714-00	-.6906-01
-.3633-00	.0000
.9662-00	.0000
.7641-01	.3902-00
.7641-01	-.3902-00
.0000	.0000
-.1146-07	.0000
-.2328-08	.0000

X(5)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .3127-01

BODE GAIN = .3863-00

ROOTS

REAL PART	IMAGINARY PART
-.3746-00	.0000
-.1124+00	.1916-00
-.1124+00	-.1916-00
.2157-00	.0000
.7840+02	.0000
.1111+01	.0000
-.9462-00	.0000
-.3446-07	.0000
.2772-07	.0000
.3492-08	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .6130+01

BODE GAIN = -.1324+02

ROOTS

REAL PART	IMAGINARY PART
.1111+00	.3541-00
.1111+00	-.3541-00
-.7323-01	.4545-00
-.7323-01	-.4545-00
-.4674+01	.0000
-.1146+01	.0000
+.3674-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

SIKORSKY S-58 HELICOPTER MAY 1970 MOSTAR-8 DERIVATIVES.
CASE 7 SPEED= 67.8 FT/SEC. W DOT= 0.0 FT/SEC. GAMMA= 0.0 DEG.
GROSS WEIGHT= 11867 LB. SEA LEVEL DYNAMIC TIP LOSSES (YES).

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.9986+01	-.4244-00	-.6870-00	-.7366+03	.1051+04	-.3324+02
Y	.2261+01	-.2937+02	-.1726+01	-.1084+04	-.7344+03	.4295+03
Z	-.3922+02	-.3219+01	-.2118+03	-.3417+03	.2546+03	.8688+03
L	.2237+02	-.1504+03	-.5571+01	-.1685+05	-.1056+05	.1765+04
M	.1352+03	.1650+02	.8154+02	.1067+05	-.1750+05	.3047+03
N	-.1256+03	.2866+03	-.2045+03	-.1142+04	.1152+04	-.1498+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	.9746-04	-.4060-03	-.1670-01	-.2063+02	-.9707+01	-.3737-01
Y	-.2991-03	.6383-01	.5621-01	.1013+02	-.2025+02	-.2117+01
Z	.9672-03	-.9664-03	.3627-02	.1625+01	.3937-01	.4469-01
L	-.9870-02	.3021-00	.1288+01	.2675+04	-.3359+03	-.2507+01
M	-.1093-02	-.4268-01	-.1018+00	.3411+03	.2670+04	.2725+01
N	-.2894-04	-.2120+01	-.4404-01	-.3589+02	-.3490+02	.7288+02

	C(1)	C(2)	C(3)	C(4)
X	-.2592+04	-.5930+03	.1239+05	-.5879+02
Y	-.4622+03	.1250+05	.6935+03	.3948+04
Z	-.9203+05	.1118+02	.1452+05	-.5963+02
L	.5813+03	.1869+06	.3205+04	.1888+05
M	.4620+05	.3194+04	-.1872+06	-.2735+04
N	.1247+06	-.1226+04	.1460+05	-.1310+06

THE INERTIA TENSOR

.5911+04	.1571-06	.5171+03
.1571-06	.2750+05	-.3762-08
.5171+03	-.3762-08	.2307+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.6777+02	.4933-09	.2040+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2309-00	-.1498-01	.4196-01	.9860-01	.3009-01	-.2046-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= .3966-05 PHI -.2045-01
AIRCRAFT INERTIAL SPEED= .6780+02

DENOMINATOR CHARACTERISTIC
ROOTS

REAL PART	IMAGINARY PART
-.1410-00	.0000
-.5078+01	.0000
-.4792-00	.0000
.8464-01	.3743-00
.8464-01	-.3743-00
-.2395-00	.9853-00
-.2395-00	-.9853-00
-.1332+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000
.0000	.0000

NUMERATORS
(NOTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
LARGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

X(1)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .7016+01

BODE GAIN = -.2900+03

ROOTS

REAL PART	IMAGINARY PART
.8364-07	.0000
-.4668-00	.0000
-.7766-01	.0000
-.1802-00	.1249+01
-.1802-00	-.1249+01
-.1109+00	.3091+01
-.1109+00	-.3091+01
-.5173+01	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .1452+01

BODE GAIN = .2246+03

ROOTS

REAL PART	IMAGINARY PART
.4377-01	.0000
-.2495+03	.0000
-.5016+01	.0000
-.1884+01	.0000
.9908-01	.4442-00
.9908-01	-.4442-00
-.5004-00	.0000
.6978-08	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .2497+03

BODE GAIN = -.3062+03

ROOTS

REAL PART	IMAGINARY PART
-.1290-00	.0000
-.5090+01	.0000
-.4103-00	.9951-00
-.4103-00	-.9951-00
-.5485-00	.0000
.1942-00	.4068-00
.1942-00	-.4068-00
.0000	.0000
.9388-08	.0000
.0000	.0000

X(4)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .9859-00

BODE GAIN = -.6850-04

ROOTS

REAL PART	IMAGINARY PART
-.3728-07	.1830-07
-.3728-07	-.1830-07
.1702-05	.0000
-.6349+01	.0000
-.1043+01	.0000
-.5121-00	.0000
.3342+01	.0000
.1561-00	.4741-00
.1561-00	-.4741-00
.1630-07	.0000

X(5)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.1849+01

BODE GAIN = -.3928-00

ROOTS

REAL PART	IMAGINARY PART
-.8877-01	.1334-00
-.8877-01	-.1334-00
.1288-00	.0000
-.5158+01	.0000
-.1642-00	.1339+01
-.1642-00	-.1339+01
-.4731-00	.0000
.2837-06	.0000
-.8527-07	.0000
.0000	.0000

X(6)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.5444+01

BODE GAIN = .1920+02

ROOTS

REAL PART	IMAGINARY PART
-.7701-01	.5296-00
-.7701-01	-.5296-00
.1727-00	.4036-00
.1727-00	-.4036-00
-.5085+01	.0000
-.1719+01	.0000
-.5054-00	.0000
.1863-08	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .4874+01

BODE GAIN = -.5097+03

ROOTS

REAL PART	IMAGINARY PART
-.1185-06	.0000
-.2568+02	.0000
-.4723-01	.2517+01
-.4723-01	-.2517+01
-.3076-00	.9004-00
-.3076-00	-.9004-00
-.5643-00	.0000
-.8700-01	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.3547+02

BODE GAIN = .1574+04

ROOTS

REAL PART	IMAGINARY PART
.1358-00	.3281-00
.1358-00	-.3281-00
-.3148-00	.0000
-.1521+01	.7349+01
-.1521+01	-.7349+01
-.8918-00	.7597-00
-.8918-00	-.7597-00
-.1863-08	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.2854-00

BODE GAIN = .2005+03

ROOTS

REAL PART	IMAGINARY PART
.3304-01	.2312-00
.3304-01	-.2312-00
-.1611-00	.0000
-.1182+02	.7753+02
-.1182+02	-.7753+02
-.3020-00	.8987-00
-.3020-00	-.8987-00
.2465-06	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.5790+02

BODE GAIN = -.1124-03

ROOTS

REAL PART	IMAGINARY PART
.5002-09	.3186-07
.5002-09	-.3186-07
.1662-05	.0000
-.3495-00	.8906-00
-.3495-00	-.8906-00
.1560-00	.4125-00
.1560-00	-.4125-00
-.1228+01	.0000
-.3694-00	.0000
-.6985-09	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.9238-00

BODE GAIN = -.6447-00

ROOTS

REAL PART	IMAGINARY PART
-.1057+00	.1369-00
-.1057+00	-.1369-00
.1244+00	.0000
-.5239-00	.0000
-.2768+02	.0000
-.3207-00	.8896-00
-.3207-00	-.8896-00
.2980-07	.0000
-.1490-07	.0000
.0000	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .1450+01

BODE GAIN = .3152+02

ROOTS

REAL PART	IMAGINARY PART
.1065+00	.4212-00
.1065+00	-.4212-00
-.3561-00	.0000
-.2907+01	.0000
-.9841-00	.1801+01
-.9841-00	-.1801+01
.1827+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.3372+02

BODE GAIN = .1531+04

ROOTS

REAL PART	IMAGINARY PART
-.1410-00	.0000
-.5665-00	.0000
-.2690-01	.2642+01
-.2690-01	-.2642+01
-.5272+01	.0000
-.2547-00	.1002+01
-.2547-00	-.1002+01
-.1892-06	.0000
.1119-14	.0000
.0000	.0000

X(2)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2344+01

BODE GAIN = .1957+03

ROOTS

REAL PART	IMAGINARY PART
-.9318-01	.0000
-.1409-00	.0000
.6072+01	.3053+01
.6072+01	-.3053+01
-.6735+01	.0000
.2415-00	.1164+01
.2415-00	-.1164+01
.1107-08	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.3941+02

BODE GAIN = -.2374+03

ROOTS

REAL PART	IMAGINARY PART
.6160-02	.2071-00
.6160-02	-.2071-00
-.1410-00	.0000
.1228+02	.0000
-.5247+01	.0000
-.2570-00	.1001+01
-.2570-00	-.1001+01
-.1346-07	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1689+01

BODE GAIN = .1774-04

ROOTS

REAL PART	IMAGINARY PART
-.7666-08	.0000
.6923-06	.0000
.1768-05	.0000
-.1521+02	.0000
-.1543-00	.1052+01
-.1543-00	-.1052+01
-.1020+01	.0000
.1661-00	.0000
-.1409-00	.0000
.4730-09	.0000

X(5)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .7516+01

BODE GAIN = .9952-01

ROOTS

REAL PART	IMAGINARY PART
-.2852-07	.0000
-.5263+01	.0000
-.2570-00	.1005+01
-.2570-00	-.1005+01
.3821-01	.0000
-.5292-00	.0000
-.1410-00	.0000
-.5673-01	.0000
.4140-09	.0000
.0000	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.6051-00

BODE GAIN = -.7263-04

ROOTS

REAL PART	IMAGINARY PART
.1493-04	.0000
-.1409-00	.0000
.2242-00	.0000
-.1299-00	.7120-00
-.1299-00	-.7120-00
-.4808+01	.0000
.2592-00	.2631+01
.2592-00	-.2631+01
.0000	.0000
.0000	.0000

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .5378-00

BODE GAIN = .9187+02

ROOTS

REAL PART	IMAGINARY PART
-.2370-06	.0000
-.2715+02	.0000
-.1245+00	.2064+01
-.1245+00	-.2064+01
-.5612-00	.0000
.1808+01	.0000
-.1373+01	.0000
-.7301-01	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1094+02

BODE GAIN = .3372+02

ROOTS

REAL PART	IMAGINARY PART
-.1099-01	.0000
-.3352+02	.0000
-.5957+01	.0000
-.1336+01	.0000
.9648-01	.4035-00
.9648-01	-.4035-00
-.4224-00	.0000
.4582-08	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .1327-00

BODE GAIN = -.5106+02

ROOTS

REAL PART	IMAGINARY PART
-.1639-00	.0000
.3417-01	.2437-00
.3417-01	-.2437-00
-.1721+03	.0000
.2077+01	.2645+01
.2077+01	-.2645+01
-.1378+01	.0000
.1285-07	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.6778+01

BODE GAIN = .2911-04

ROOTS

REAL PART	IMAGINARY PART
.8641-08	.0000
-.1385+01	.0000
-.1263+01	.0000
-.3911-00	.0000
.1696-05	.0000
.1308+01	.0000
.1382-00	.4204-00
.1382-00	-.4204-00
.1222-08	.0000
-.4657-09	.0000

X(5)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .1850-01

BODE GAIN = .1669-00

ROOTS

REAL PART	IMAGINARY PART
-.9676-01	.1432-00
-.9676-01	-.1432-00
.1490-00	.0000
.1167+03	.0000
-.1370+01	.0000
.1695+01	.0000
-.5172-00	.0000
.6243-08	.0000
.5545-07	.0000
-.2152-07	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .5860+01

BODE GAIN = -.3484-04

ROOTS

REAL PART	IMAGINARY PART
.4269-05	.0000
-.4987+01	.0000
-.1335+01	.0000
-.4057-00	.0000
-.6255-01	.4762-00
-.6255-01	-.4762-00
.1443-00	.3657-00
.1443-00	-.3657-00
.0000	.0000
.0000	.0000

SIKORSKY S-58 HELICOPTER MAY 1970 MOSTAB-8 DERIVATIVES.
CASE A SPEED=101.5 FT/SEC. W DOT= 0.0 FT/SEC. GAMMA= 0.0 DEG.
GROSS WEIGHT= 11867 LB. SEA LEVEL DYNAMIC TIP LOSSES (YES).

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.1249+02	-.3012-00	-.4394-00	-.7255+03	.1046+04	-.6673+02
Y	.1444+01	-.3218+02	-.1778+01	-.1134+04	-.7198+03	.5373+03
Z	-.1533+02	-.3945+01	-.2424+03	-.6134+03	-.5466+01	.9029+03
L	.1947+02	-.1687+03	.8489+01	-.1705+05	-.1042+05	.2183+04
M	.9787+02	.1748+02	.7847+02	.1070+05	-.2049+05	.5196+03
N	-.8180+02	.3442+03	-.2694+03	-.9529+03	.2112+04	-.1891+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	.4836-03	-.6262-03	-.2565-01	-.2165+02	-.9534+01	-.3242-00
Y	-.1300-02	.7098-01	.7713-01	.1018+02	-.2078+02	-.2230+01
Z	.2447-04	-.1198-02	.2337-02	.1320+01	-.5680-00	.5738-01
L	-.4056-01	.3693-00	.2024+01	.2675+04	-.3382+03	.3105+02
M	.4540-02	-.5106-01	-.4486-01	.3502+03	.2668+04	.7282+01
N	.1701-02	-.2348+01	-.7291-01	-.2982+02	-.4108+02	.8065+02

	C(1)	C(2)	C(3)	C(4)
X	-.2780+04	-.6033+03	.1211+05	-.8205+02
Y	-.2753+03	.1249+05	.7568+03	.4423+04
Z	-.1018+06	-.3711+01	.2459+05	-.8168+02
L	.6759+04	.1865+06	.2405+04	.2313+05
M	.8653+05	.3824+04	-.1931+06	-.3024+04
N	.9416+05	.4834+03	.2795+05	-.1465+06

THE INERTIA TENSOR

.5900+04	.7858-07	.2870+03
.7858-07	.2750+05	-.1044-08
.2870+03	-.1044-08	.2308+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.1015+03	.3693-09	.1695+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2280-00 -.1659-01 .5978-01 .7602-01 .1649-01 -.1744-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.5416-05 PHI -.1744-01
AIRCRAFT INERTIAL SPEED= .1015+03

DENOMINATOR CHARACTERISTIC
ROOTS

REAL PART	IMAGINARY PART
-.1177+00	.0000
-.5154+01	.0000
-.5767-00	.0000
.5800-01	.3235-00
.5800-01	-.3235-00
-.3234-00	.1228+01
-.3234-00	-.1228+01
-.1421+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000
.0000	.0000

NUMERATORS
(NOTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
LARGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

X(1)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .7691+01

BODE GAIN = -.7995+03

ROOTS

REAL PART	IMAGINARY PART
-.8357-01	.0000
-.2940-00	.1382+01
-.2940-00	-.1382+01
-.6186-00	.0000
.1874-00	.3872+01
.1874-00	-.3872+01
-.5803+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .9931-00

BODE GAIN = .1511+03

ROOTS

REAL PART	IMAGINARY PART
.2508-01	.0000
-.4199+03	.0000
-.4331+01	.0000
-.3165+01	.0000
.1507-00	.4387+00
.1507-00	-.4387+00
-.4237-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .2762+03

BODE GAIN = -.3138+03

ROOTS

REAL PART	IMAGINARY PART
-.3064-07	.0000
-.5279+01	.0000
-.4711-00	.1347+01
-.4711-00	-.1347+01
-.3225-00	.0000
.4133-00	.3032-00
.4133-00	-.3032-00
-.1080+00	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.1232+01

BODE GAIN = -.4134-10

ROOTS

REAL PART	IMAGINARY PART
-.4890-06	.0000
-.1724-05	.0000
.2857-00	.4531-00
.2857-00	-.4531-00
-.3939-00	.0000
.2860+01	.3743+01
.2860+01	-.3743+01
-.1373+01	.0000
-.9211-08	.0000
.7244-08	.0000

X(5)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.3504+01

BODE GAIN = -.2725-00

ROOTS

REAL PART	IMAGINARY PART
.6697-01	.0000
-.8296-01	.8260-01
-.8296-01	-.8260-01
-.5564+01	.0000
-.2860-00	.1458+01
-.2860-00	-.1458+01
-.5970-00	.0000
-.1490-07	.0000
.4657-09	.0000
.0000	.0000

X(6)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.4072+01

BODE GAIN = .1563+02

ROOTS

REAL PART	IMAGINARY PART
-.1010+00	.5656-00
-.1010+00	-.5656-00
.2347-00	.3613-00
.2347-00	-.3613-00
-.5185+01	.0000
-.2582+01	.0000
-.4047-00	.0000
.2328-09	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .5057+01

BODE GAIN = -.6255+03

ROOTS

REAL PART	IMAGINARY PART
-.6422-01	.0000
-.2442+02	.0000
-.9987-01	.2525+01
-.9987-01	-.2525+01
-.4033-00	.1202+01
-.4033-00	-.1202+01
-.6652-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.3544+02

BODE GAIN = .1414+04

ROOTS

REAL PART	IMAGINARY PART
.1073+00	.2599-00
.1073+00	-.2599-00
-.2894-00	.0000
-.1230+01	.7355+01
-.1230+01	-.7355+01
-.1016+01	.1297+01
-.1016+01	-.1297+01
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.1952-00

BODE GAIN = .1176+03

ROOTS

REAL PART	IMAGINARY PART
-.7512-07	.0000
-.3116-00	.1146+03
-.3116-00	-.1146+03
-.4045-00	.1196+01
-.4045-00	-.1196+01
.2858-01	.1304-00
.2858-01	-.1304-00
-.1397-00	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.5779+02

BODE GAIN = .1446-03

ROOTS

REAL PART	IMAGINARY PART
.2897-07	.0000
-.1683-05	.0000
-.4366-00	.1204+01
-.4366-00	-.1204+01
.1356-00	.3628-00
.1356-00	-.3628-00
-.1402+01	.0000
-.3733-00	.0000
.0000	.0000
.1892-07	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.9687-00

BODE GAIN = -.4664-00

ROOTS

REAL PART	IMAGINARY PART
-.8396-01	.1017+00
-.8396-01	-.1017+00
.9073-01	.0000
-.2658+02	.0000
-.4158-00	.1196+01
-.4158-00	-.1196+01
-.6188-00	.0000
.1490-07	.0000
.0000	.0000
-.1211-07	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .7805-00

BODE GAIN = .2674+02

ROOTS

REAL PART	IMAGINARY PART
.9240-01	.3805-00
.9240-01	-.3805-00
-.3534-00	.0000
-.4338+01	.0000
-.6692-00	.2349+01
-.6692-00	-.2349+01
.2115+01	.0000
-.2910-09	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.3297+02

BODE GAIN = .1994+04

ROOTS

REAL PART	IMAGINARY PART
-.1180+00	.0000
-.6628-00	.0000
-.3455-00	.1263+01
-.3455-00	-.1263+01
-.5359+01	.0000
-.6703-01	.2698+01
-.6703-01	-.2698+01
-.7270-09	.0000
.7724-15	.0000
.0000	.0000

X(2)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2539+01

BODE GAIN = .8754-03

ROOTS

REAL PART	IMAGINARY PART
.4345-05	.0000
.4109+02	.0000
-.1015+00	.1559-01
-.1015+00	-.1559-01
.5100-00	.0000
-.5950+01	.0000
.2124-00	.2275+01
.2124-00	-.2275+01
.0000	.0000
.0000	.0000

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.6674+02

BODE GAIN = -.2236-03

ROOTS

REAL PART	IMAGINARY PART
.5800-05	.0000
.1082+02	.0000
-.5328+01	.0000
-.3530-00	.1265+01
-.3530-00	-.1265+01
-.1174+00	.0000
-.3684-02	.6535-01
-.3684-02	-.6535-01
.0000	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1505+01

BODE GAIN = .8858+01

ROOTS

REAL PART	IMAGINARY PART
-.8741-08	.0000
-.1751+02	.0000
-.1212+00	.1378+01
-.1212+00	-.1378+01
.9839-01	.0000
.0000	.0000
-.1365+01	.0000
-.1132+00	.0000
.0000	.0000
.9313-09	.0000

X(5)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .7755+01

BODE GAIN = .5104-01

ROOTS

REAL PART	IMAGINARY PART
.1246-06	.0000
-.5347+01	.0000
-.3511-00	.1270+01
-.3511-00	-.1270+01
.1881-01	.0000
-.6192-00	.0000
-.1191+00	.0000
-.4420-01	.0000
.8149-09	.0000
.0000	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1208+01

BODE GAIN = -.2927+01

ROOTS

REAL PART	IMAGINARY PART
-.1131+00	.0000
.1157+00	.0000
-.1036+00	.6676-00
-.1036+00	-.6676-00
-.5111+01	.0000
-.5670-01	.2620+01
-.5670-01	-.2620+01
-.8731-09	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .6682-00

BODE GAIN = .1086+03

ROOTS

REAL PART	IMAGINARY PART
-.5284-01	.0000
-.2415+02	.0000
-.6658-00	.0000
-.1748+01	.0000
-.1217+00	.2129+01
-.1217+00	-.2129+01
.2083+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1226+02

BODE GAIN = .5318+02

ROOTS

REAL PART	IMAGINARY PART
-.1489-01	.0000
-.5105+02	.0000
-.5723+01	.0000
-.1474+01	.0000
.7771-01	.3529-00
.7771-01	-.3529-00
-.4486-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .1951-00

BODE GAIN = -.3321+02

ROOTS

REAL PART	IMAGINARY PART
.3101-01	.1475-00
.3101-01	-.1475-00
-.1402-00	.0000
-.1674+03	.0000
.2899+01	.2683+01
.2899+01	-.2683+01
-.1770+01	.0000
-.7105-09	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.7689+01

BODE GAIN = -.3664-04

ROOTS

REAL PART	IMAGINARY PART
.3235-07	.0000
-.1723-05	.0000
-.1800+01	.0000
-.1406+01	.0000
-.3991-00	.0000
.1589+01	.0000
.1187+00	.3674-00
.1187+00	-.3674-00
-.3725-08	.0000
.2034-07	.0000

X(5)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .1527-01

BODE GAIN = .1179+00

ROOTS

REAL PART	IMAGINARY PART
-.8004-01	.1072+00
-.8004-01	-.1072+00
.1059+00	.0000
.1591+03	.0000
-.1739+01	.0000
.2066+01	.0000
-.6171-00	.0000
.1317-06	.0000
-.9321-07	.0000
-.6054-08	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .6477+01

BODE GAIN = -.6763+01

ROOTS

REAL PART	IMAGINARY PART
.2535-06	.0000
-.5130+01	.0000
-.1469+01	.0000
.1294-00	.3286-00
.1294-00	-.3286-00
-.7424-01	.4718-00
-.7424-01	-.4718-00
-.4214-00	.0000
.1325-08	.0000
.0000	.0000

SIKORSKY S-58 HELICOPTER MAY 1970 MOSTAB-B DERIVATIVES.
CASE 9 SPEED=169.0 FT/SEC. H DOT= 0.0 FT/SEC. GAMMA= 0.0 DEG.
GROSS WEIGHT= 11867 LB. SEA LEVEL DYNAMIC TIP LOSSES (YES).

STABILITY DERIVATIVE MATRICES=

	U	V	W	P	Q	R
X	-.1729+02	.3597-01	.7499+01	-.6832+03	.1006+04	-.1682+03
Y	.1190+01	-.4503+02	-.2607+01	-.1118+04	-.7150+03	.6895+03
Z	.1200+02	-.6626+01	-.2688+03	-.1165+04	-.2439+03	.9793+03
L	.2015+02	-.2198+03	.3378+02	-.1628+05	-.1094+05	.3327+04
M	.9225+02	.2524+02	.1341+03	.1131+05	-.2240+05	.1177+04
N	-.5519+02	.3985+03	-.2798+03	-.8584+03	.3950+04	-.2552+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	.3071-02	-.8937-03	-.3611-01	-.2094+02	-.9335+01	-.1227+01
Y	-.8327-02	.7960-01	.1272-00	.1088+02	-.1883+02	-.2069+01
Z	-.2012-02	-.3356-02	-.5924-03	.2245+01	-.1070+01	.2045-00
L	-.2171-00	.5319-00	.3393+01	.2686+04	-.3158+03	.1472+03
M	.2152-03	-.7881-01	-.7919-01	.3461+03	.2673+04	.2356+02
N	.2211-02	-.2631+01	-.5294-01	.3381+02	-.7172+02	.9394+02

	C(1)	C(2)	C(3)	C(4)
X	-.1394+04	-.5944+03	.1053+05	-.1879+03
Y	-.3873+03	.1270+05	.9958+03	.5160+04
Z	-.1175+06	.5889+02	.4507+05	-.1766+03
L	.1512+05	.1891+06	-.4551+04	.3483+05
M	.1515+06	.2071+04	-.2106+06	-.5120+04
N	.7386+05	.7394+04	.4638+05	-.1696+06

THE INERTIA TENSOR

.5909+04	-.1571-06	-.4925+03
-.1571-06	.2750+05	-.3583-08
-.4925+03	-.3583-08	.2307+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.1689+03	-.1230-08	-.4843+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2554-00 -.2562-01 .1017+00 .8465-01 -.2845-01 -.2196-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= .9009-05 PHI -.2195-01
AIRCRAFT INERTIAL SPEED= .1690+03

DENOMINATOR CHARACTERISTIC
ROOTS

REAL PART	IMAGINARY PART
-.1172+00	.0000
-.4959+01	.0000
-.4663-00	.0000
.1208+00	.3307-00
.1208+00	-.3307-00
-.4592-00	.1626+01
-.4592-00	-.1626+01
-.1824+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000
.0000	.0000

NUMERATORS
(NOTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
LARGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

X(1)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .4060+01

BODE GAIN = -.1218+04

ROOTS

REAL PART	IMAGINARY PART
-.8996-01	.0000
.4824-00	.6319+01
.4824-00	-.6319+01
-.3815-00	.1696+01
-.3815-00	-.1696+01
-.6636+01	.0000
-.7240-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .1365+01

BODE GAIN = .7657+02

ROOTS

REAL PART	IMAGINARY PART
.1292-01	.0000
-.4215+03	.0000
-.4061+01	.1844+01
-.4061+01	-.1844+01
.4464-00	.3247-00
.4464-00	-.3247-00
-.2974-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .3188+03

BODE GAIN = -.4511+03

ROOTS

REAL PART	IMAGINARY PART
-.1045+00	.0000
-.5315+01	.0000
-.5170-00	.1828+01
-.5170-00	-.1828+01
.2393+01	.0000
-.2351-00	.0000
.2195-00	.0000
.4955-07	.0000
.5796-18	.0000
.0000	.0000

X(4)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.4404+01

BODE GAIN = -.9313-04

ROOTS

REAL PART	IMAGINARY PART
.1930-06	.0000
.1534-05	.0000
.1040+01	.3272+01
.1040+01	-.3272+01
.1058+01	.0000
-.1906+01	.0000
.3594-00	.0000
-.2820-00	.0000
-.2359-07	.0000
.0000	.0000

X(5)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.6168+01

BODE GAIN = -.2553-00

ROOTS

REAL PART	IMAGINARY PART
-.1167-06	.0000
-.5585+01	.0000
-.4027-00	.1842+01
-.4027-00	-.1842+01
.4909-01	.0000
-.6028-00	.0000
-.8644-01	.6963-01
-.8644-01	-.6963-01
.0000	.0000
.0000	.0000

X(6)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.3297+01

BODE GAIN = .1163+02

ROOTS

REAL PART	IMAGINARY PART
-.2846-00	.0000
.4969-00	.8754-01
.4969-00	-.8754-01
-.7279-01	.6437-00
-.7279-01	-.6437-00
-.4340+01	.1204+01
-.4340+01	-.1204+01
.9895-09	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .4989+01

BODE GAIN = -.6845+03

ROOTS

REAL PART	IMAGINARY PART
-.7560-08	.0000
-.2400+02	.0000
-.7677-01	.2380+01
-.7677-01	-.2380+01
-.5339-00	.1689+01
-.5339-00	-.1689+01
-.8815-00	.0000
-.6372-01	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.3615+02

BODE GAIN = .1105+04

ROOTS

REAL PART	IMAGINARY PART
.3914+01	.6642+01
.3914+01	-.6642+01
-.1390+01	.1860+01
-.1390+01	-.1860+01
.1312-00	.2152-00
.1312-00	-.2152-00
-.2623-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.5167-00

BODE GAIN = .1335+02

ROOTS

REAL PART	IMAGINARY PART
.2754-01	.0000
.3931-01	.0000
.2795+02	.8883+02
.2795+02	-.8883+02
-.5537-00	.1665+01
-.5537-00	-.1665+01
-.1564-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.5892+02

BODE GAIN = -.1695-03

ROOTS

REAL PART	IMAGINARY PART
-.3114-00	.0000
.2343-00	.3279-00
.2343-00	-.3279-00
-.5771-00	.1689+01
-.5771-00	-.1689+01
-.1858+01	.0000
-.1901-08	.0000
.1681-05	.0000
.3749-07	.0000
-.2328-08	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.9063-00

BODE GAIN = -.4131-00

ROOTS

REAL PART	IMAGINARY PART
.7698-01	.0000
-.8584-01	.9541-01
-.8584-01	-.9541-01
-.3027+02	.0000
-.5607-00	.1669+01
-.5607-00	-.1669+01
-.6697-00	.0000
.0000	.0000
.2142-07	.0000
.0000	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.1665+01

BODE GAIN = .1881+02

ROOTS

REAL PART	IMAGINARY PART
-.3053-00	.0000
.2237-00	.4128-00
.2237-00	-.4128-00
.1106+01	.1306+01
.1106+01	-.1306+01
-.2112+01	.2360+01
-.2112+01	-.2360+01
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2877+02

BODE GAIN = .1939+04

ROOTS

REAL PART	IMAGINARY PART
-.1828-08	.0000
-.8461-00	.0000
-.1155+00	.0000
-.4431-00	.1668+01
-.4431-00	-.1668+01
-.5292+01	.0000
-.2544-01	.2767+01
-.2544-01	-.2767+01
.0000	.0000
.0000	.0000

X(2)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.3165+01

BODE GAIN = .1511+03

ROOTS

REAL PART	IMAGINARY PART
-.5791-01	.0000
.1009+03	.0000
.2668-00	.0000
-.1513-00	.0000
-.5761+01	.0000
-.8983-01	.2477+01
-.8983-01	-.2477+01
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1223+03

BODE GAIN = .2413+03

ROOTS

REAL PART	IMAGINARY PART
-.1134+00	.0000
-.1500-00	.0000
.1197+00	.0000
.1061+02	.0000
-.5226+01	.0000
-.4676-00	.1684+01
-.4676-00	-.1684+01
.0000	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .4804-01

BODE GAIN = .1342+02

ROOTS

REAL PART	IMAGINARY PART
.2545-08	.0000
.1711-05	.0000
.1153-04	.0000
.5972+03	.0000
-.1135+00	.1825+01
-.1135+00	-.1825+01
-.1939+01	.0000
-.1363-00	.0000
.9260-01	.0000
.6980-09	.0000

X(5)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .8482+01

BODE GAIN = .5825-01

ROOTS

REAL PART	IMAGINARY PART
.1686-01	.0000
-.6132-01	.0000
-.1089+00	.0000
-.5254+01	.0000
-.4619-00	.1688+01
-.4619-00	-.1688+01
-.6628-00	.0000
-.2922-07	.0000
.8615-08	.0000
.0000	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2043+01

BODE GAIN = -.2653+01

ROOTS

REAL PART	IMAGINARY PART
.1014+00	.0000
-.1365-00	.0000
-.9434-01	.6738-00
-.9434-01	-.6738-00
-.5305+01	.0000
-.1436-00	.2580+01
-.1436-00	-.2580+01
-.2898-07	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .1018+01

BODE GAIN = .1569+03

ROOTS

REAL PART	IMAGINARY PART
.9598-08	.0000
-.1852+02	.0000
-.2508+01	.0000
-.8947-00	.0000
-.5659-01	.0000
-.1911-01	.2008+01
-.1911-01	-.2008+01
.2836+01	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1433+02

BODE GAIN = .8056+02

ROOTS

REAL PART	IMAGINARY PART
-.2141-01	.0000
-.8197+02	.0000
-.5482+01	.0000
-.1945+01	.0000
.1679-00	.3476-00
.1679-00	-.3476-00
-.3526-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .425R-00

BODE GAIN = -.1576+02

ROOTS

REAL PART	IMAGINARY PART
.3589-01	.6049-01
.3589-01	-.6049-01
-.1595+03	.0000
-.1539-00	.0000
.3223+01	.3230+01
.3223+01	-.3230+01
-.2560+01	.0000
-.2731-08	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.9394+01

BODE GAIN = .4987-04

ROOTS

REAL PART	IMAGINARY PART
-.3214-00	.0000
.2240-00	.3385-00
.2240-00	-.3385-00
-.2616+01	.0000
.2095+01	.0000
-.1851+01	.0000
.1727-05	.0000
.2306-07	.0000
.1397-08	.0000
.0000	.0000

X(5)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .8212-01

BODE GAIN = .1215+00

ROOTS

REAL PART	IMAGINARY PART
.8576-01	.0000
-.8415-01	.9926-01
-.8415-01	-.9926-01
.3171+02	.0000
.3307+01	.0000
-.2537+01	.0000
-.6701-00	.0000
.1196-07	.0000
.1493-06	.0000
-.4925-07	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .7168+01

BODE GAIN = -.5535+01

ROOTS

REAL PART	IMAGINARY PART
-.4954-07	.0000
-.5161+01	.0000
-.1937+01	.0000
-.6352-01	.5417-00
-.6352-01	-.5417-00
.2058-00	.3091-00
.2058-00	-.3091-00
-.3294-00	.0000
.0000	.0000
.0000	.0000

SIKORSKY S-56 HELICOPTER JUNE 2 1970 MOSTAB-B DERIVATIVES
CASE 10 SPEED= 7.5 FT/SEC, --DOT=-7.5 FT/SEC, GAMMA=-90. DEG,
GROSS WEIGHT= 11667.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

		V	P	R	Q	R
X	-.[illegible]+02	-.256[illegible]+01	.[illegible]-00	.9437+[illegible]	.2929+02	-.4375+02
Y	-.2[illegible]+01	-.13[illegible]+02	-.[illegible]-00	.2679+03	-.7062+03	.9041+03
Z	-.1[illegible]-00	.6533-00	-.6952+01	.3168+02	-.8795+03	-.7508+03
L	-.[illegible]+02	.1[illegible]+03	.338[illegible]+01	-.7691+[illegible]	-.2676+04	.2172+04
M	-.15[illegible]+02	.2513+02	-.1062+03	.3426+03	-.1706+05	-.1121+05
N	.4[illegible]+01	.1321+03	.1[illegible]+02	-.1509+[illegible]4	.1090+05	-.1563+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.[illegible]274-03	-.256[illegible]-02	.2663-04	.9614-01	.4144-00	.2767-00
Y	-.4[illegible]1-02	.7119-01	-.[illegible]652-06	-.1[illegible]+01	-.1706+02	-.1044+02
Z	-.42[illegible]-02	-.5[illegible]19-03	-.1324-03	-.4296-00	.1011+02	-.1696+02
L	.9[illegible]1-01	-.2364+01	.7334-03	.8451+02	-.1190+03	.2385+02
M	-.1[illegible]7-00	-.1[illegible]+00	-.1081-02	-.8591+02	.2676+04	-.3117+03
N	.[illegible]4-[illegible]	-.3[illegible]-[illegible]	.[illegible]705-03	.1446+[illegible]2	.3133+03	.2684+04

	C(1)	C(2)	C(3)	C(4)
X	-.[illegible]73+05	-.43[illegible]+03	-.2116+03	-.1615+[illegible]3
Y	-.4166+04	.12[illegible]+[illegible]	.5497+03	.4364+[illegible]4
Z	-.4[illegible]3+02	.5[illegible]03+03	-.1256+05	-.1275+[illegible]2
L	.1[illegible]41+[illegible]	-.15[illegible]+[illegible]4	.4[illegible]3+[illegible]4	-.1448+[illegible]6
M	.[illegible]+04	.6[illegible]+[illegible]2	-.1[illegible]+06	-.7460+[illegible]4
N	.1[illegible]39+05	-.1[illegible]+[illegible]	-.5126+01	-.1[illegible]+[illegible]5

THE INERTIA TENSOR-

.2[illegible]7+05	-.1475+03	-.6573+03
-.1475+03	.2750+05	-.2187+02
-.6573+03	-.2187+02	.5920+04

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
-.2[illegible]9-[illegible]	-.249[illegible]-[illegible]	.7490+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2[illegible]-[illegible]	-.141[illegible]-[illegible]	.41[illegible]-02	.1736-[illegible]	.3827-01	-.3129-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.1571+01 PHI .3150-01
AIRCRAFT INERTIAL SPEED= .7500+01

NOT REPRODUCIBLE

SIKORSKY S-58 HELICOPTER JUNE 2 1970 MOSTAB-B DERIVATIVES
CASE 11 SPEED= 33.8 FT/SEC. W-DOT=-7.5 FT/SEC. GAMMA=-12.8 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.3511+02	-.9162-00	-.2571+02	-.6646+03	.1067+04	.3212+03
Y	.1944+01	-.1753+02	-.6884-00	-.9328+03	-.7106+03	.4991+03
Z	-.1126+03	-.1727+01	-.1195+03	.3276+03	.2729+03	.7444+03
L	-.2523+02	-.8516+02	-.3617+02	-.1618+05	-.1041+05	.2645+04
M	.1126+03	.1674+02	.1690+01	.1060+05	-.1744+05	-.2266+04
N	-.1707+03	.2227+03	-.1061+03	.4919+02	.1619+04	-.1029+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.1551-02	-.2718-03	-.5821-02	-.1754+02	-.9152+01	.4065+01
Y	.6252-02	.6384-01	.2767-01	.9427+01	-.1933+02	-.4366+01
Z	.5576-04	-.6821-03	.3701-02	.8078+01	.3907+01	-.1822+01
L	.9235-01	-.1826-00	.4344-00	.2538+04	-.3282+03	-.5783+03
M	-.2434-01	-.4956-01	-.1071+00	.3235+03	.2672+04	-.7235+02
N	-.1953-01	-.2134+01	-.1080+00	-.5876+03	.4438+02	.2104+03

	C(1)	C(2)	C(3)	C(4)
X	-.1933+05	-.5511+03	.1295+05	-.3487+02
Y	-.7030+03	.1245+05	.6115+03	.3927+04
Z	-.7911+05	.2024+03	.1194+04	-.3916+02
L	.2788+05	.1815+06	.3339+04	-.1136+05
M	.2606+05	.2404+04	-.1866+06	-.2906+04
N	.1495+06	-.4254+05	.3312+04	-.1311+06

THE INERTIA TENSOR

.2027+04	-.2256-05	.4264+04
-.2256-05	.2750+05	.4700-06
.4264+04	.4700-06	.2196+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.3267+02	-.3725-00	.8674+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2341-00	-.1357-01	.2205-01	.1349-00	.3569-01	-.2435-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.2237-00 PHI -.2496-01
AIRCRAFT INERTIAL SPEED= .3390+02

SIKORSKY S-58 HELICOPTER JUNE 2 1970 MOSTAR-B DERIVATIVES
CASE 12 SPEED= 67.8 FT/SEC. W-DOT=-7.5 FT/SEC. GAMMA=-6.35 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.1302+02	-.6054-00	-.2374+02	-.7389+03	.1109+04	.1364+03
Y	.1506+01	-.2472-02	-.1107+01	-.1113+04	-.7065+03	.5480+03
Z	-.6591+02	-.2446+01	-.2082+03	-.1509+03	.8840+02	.8109+03
L	.1929+01	-.1103+03	-.2469+02	-.1739+05	-.9923+04	.2017+04
M	.1033+03	.1396+02	.3498+02	.1029+05	-.1968+05	-.8601+03
N	-.1536+03	.2984+03	-.2623+03	-.4786+03	.2095+04	-.1478+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.1745-02	-.2948-03	-.1674-01	-.2202+02	-.9336+01	.2419+01
Y	.5286-02	.6205-01	.4842-01	.9534+01	-.2210+02	-.3140+01
Z	.4490-03	-.6885-03	.3924-02	.4331+01	.1176+01	-.4466-00
L	.1367-00	.6527-01	.1283+01	.2631+04	-.3509+03	-.2892+03
M	-.1192-02	-.3325-01	-.7717-01	.3540+03	.2663+04	-.3734+02
N	-.1937-01	-.2078+01	-.1870-00	-.3236+03	.1312+02	.1074+03

	C(1)	C(2)	C(3)	C(4)
X	-.1231+05	-.6127+03	.1370+05	-.4237+02
Y	-.2148+03	.1235+05	.6775+03	.3834+04
Z	-.5976+05	.5792+02	.1276+05	-.4467+02
L	.1428+05	.1829+06	.6700+04	.4032+04
M	.5554+05	.5141+04	-.1665+06	-.2198+04
N	.9569+05	-.2166+05	.1769+05	-.1294+06

THE INERTIA TENSOR

.6233+04	-.1460-05	.2404+04
-.1460-05	.2750+05	.1651-06
.2404+04	.1651-06	.2275+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.6712+02	-.4657-08	.9576+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2134-00	-.1183-01	.4058-01	.6954-01	.3086-01	-.1384-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.1108+00 PHI -.1392-01
AIRCRAFT INERTIAL SPEED= .6780+02

SIKORSKY S-58 HELICOPTER JUNE 2 1970 MOSTAR-8 DERIVATIVES
CASE 13 SPEED= 101.5 FT/SEC. W-DOT=-7.5 FT/SEC. GAMMA=-4.12 DEG.
GROSS WEIGHT= 11067.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.1438+02	-.4719-00	-.1746+02	-.7491+03	.1138+04	.5302+02
Y	.8879-00	-.3144+02	-.1183+01	-.1173+04	-.6965+03	.6126+03
Z	-.3301+02	-.3064+01	-.2427+03	-.4833+03	-.8725+02	.8663+03
L	.9407+01	-.1351+03	-.6971+01	-.1759+05	-.9760+04	.2038+04
M	.9515+02	.1404+02	.7749+02	.1030+05	-.2111+05	-.2456+03
N	-.9801+02	.3505+03	-.3414+03	-.7313+03	.3090+04	-.1659+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.1542-02	-.4345-03	-.2613-01	-.2332+02	-.9259+01	.1341+01
Y	.3598-02	.7042-01	.6426-01	.9675+01	-.2260+02	-.2937+01
Z	.4587-03	-.7492-03	.5366-02	.3077+01	.1590-00	-.1492-00
L	.1067+00	.1909-00	.1970+01	.2653+04	-.3534+03	-.1570+03
M	.6443-02	-.2860-01	.4218-01	.3639+03	.2661+04	-.1956+02
N	-.1215-01	-.2354+01	-.2164-00	-.2251+03	-.4623+01	.9430+02

	C(1)	C(2)	C(3)	C(4)
X	-.1034+05	-.6261+03	.1376+05	-.5646+02
Y	-.1653+02	.1232+05	.7162+03	.4397+04
Z	-.2012+06	.9463+01	.2370+05	-.5813+02
L	.1454+05	.1829+06	.6117+04	.1229+05
M	.8777+05	.5764+04	-.1906+06	-.2272+04
N	.6011+05	-.1290+05	.3449+05	-.1469+06

THE INERTIA TENSOR

.6033+04	-.1970-06	.1533+04
-.1970-06	.2750+05	.1407-07
.1533+04	.1407-07	.2295+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.1011+03	-.9313-09	.9086+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2095-00	-.1302-01	.5566-01	.4959-01	.1566-01	-.1053-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.7395-01 PHI -.1056-01
AIRCRAFT INERTIAL SPEED= .1015+03

SIKORSKY S-58 HELICOPTER JUNE 2 1970 MOSTAB-B DERIVATIVES
CASE 14 SPEED= 169.0 FT/SEC. W-DOT=-7.5 FT/SEC. GAMMA=-2.54 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.1629+02	-.2429-00	-.3911+01	-.7248+03	.1086+04	-.8736+02
Y	.3714-02	-.4421+02	-.2055+01	-.1158+04	-.6941+03	.7246+03
Z	.1177+01	-.5541+01	-.2711+03	-.1077+04	-.2937+03	.9552+03
L	.1471+02	-.1931+03	.2406+02	-.1674+05	-.1027+05	.2842+04
M	.8806+02	.2112+02	.1414+03	.1100+05	-.2298+05	.6725+03
N	-.5756+02	.4002+03	-.3624+03	-.1079+04	.4947+04	-.2511+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	.1138-02	-.6884-03	-.3746-01	-.2268+02	-.9159+01	-.3806-00
Y	-.2439-02	.7991-01	.1053+00	.1049+02	-.2052+02	-.2537+01
Z	-.3155-02	-.2774-02	.1534-03	.3295+01	-.5875-00	.1088+00
L	-.6949-01	.4217-00	.3250+01	.2681+04	-.3310+03	.3599+02
M	-.6351-02	-.6576-01	.5316-01	.3600+03	.2667+04	.8495+01
N	.6270-02	-.2647+01	-.2001-00	-.8954+02	-.4892+02	.9564+02

	C(1)	C(2)	C(3)	C(4)
X	-.6672+04	-.6096+03	.1239+05	-.1405+03
Y	-.1242+03	.1246+05	.9969+03	.5153+04
Z	-.1177+06	.1950+02	.4493+05	-.1346+03
L	.2134+05	.1254+06	-.1657+04	.2745+05
M	.1545+06	.3955+04	-.2087+06	-.4133+04
N	.3371+05	-.7253+03	.6004+05	-.1707+04

HE INERTIA TENSOR

.3498+04	-.2381-06	.2431+03
-.2381-06	.2753+05	.2479-06
.2431+03	.2679-08	.2309+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.1690+03	-.1863-06	.2390+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2343-02 -.2154-01 .9473-01 .6170-01 -.3026-01 -.1495-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.4440-01 PHI -.1496-01
AIRCRAFT INERTIAL SPEED= .1690+03

SIKORSKY S-58 HELICOPTER JUNE 5 1970 MOSTAR-R DERIVATIVES
CASE 15 SPEED= 15. FT/SEC. W-DOT= 15.FT/SEC. GAMMA=-90. DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TLP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.7757+02	.6684-01	.1208+01	.9232+03	.1934+02	-.5464+02
Y	-.8915-00	-.1332+02	-.5951-00	.2783+03	-.6660+03	.9469+03
Z	-.1432-00	.5891-00	-.6721+01	.3044+02	-.9183+03	-.7415+03
L	-.1206+03	.2097+03	.2510+01	-.8141+04	-.3714+04	.1858+04
M	-.1017+02	.2426+02	-.1123+03	.3151+03	-.1739+05	-.1101+05
N	-.1884+01	.1299+03	.1669+02	-.1492+04	.1056+05	-.1598+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	.6526-03	-.1447-02	-.3174-04	.9589-01	.2879-00	.1532-00
Y	-.4589-02	.6889-01	.9294-04	-.1804+01	-.1792+02	-.1028+02
Z	-.4304-02	-.5982-03	.1249-03	-.3887-00	.9955+01	-.1783+02
L	.7422-01	-.2287+01	.4600-03	.8139+02	-.1086+03	.2295+02
M	-.1898-00	-.1165+00	-.3673-02	-.7838+02	.2673+04	-.3188+03
N	.4346-00	-.2935-00	-.5704-02	.1419+02	.3202+03	.2680+04

	C(1)	C(2)	C(3)	C(4)
X	-.8727+05	-.3843+03	-.2007+03	-.1554+03
Y	-.3007+04	.1246+05	.5636+03	.4235+04
Z	-.3419+02	.5728+03	-.1247+05	-.2295+02
L	.1718+06	-.1455+04	.6149+04	-.1405+06
M	.7994+04	.1033+04	-.1872+06	-.7130+04
N	.1491+05	-.1872+06	-.9393+03	-.1907+05

THE INERTIA TENSOR

.2307+05	-.1347+03	-.6532+03
-.1347+03	.2750+05	-.1985+02
-.6532+03	-.1985+02	.5920+04

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
-.5703-00	-.4556-00	.1498+02	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2526-00 -.1322-01 .3935-02 .1655-00 .3863-01 -.3040-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.1571+01 PHI -.1769-01
AIRCRAFT INERTIAL SPEED= .1500+02

NOT REPRODUCIBLE

SIKORSKY S-58 HELICOPTER JUNE 5 197 MOSTAR-B DERIVATIVES
CASE 16 SPEED= 33.8 FT/SEC. H-DOT= 15.FT/SEC. GAMMA=-26.4 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TLP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.7761+02	-.9424-00	-.2984+02	-.4092+03	.1184+04	.5650+03
Y	.1843+01	-.1662+02	-.1841-00	-.8417+03	-.6737+03	.7139+03
Z	-.1379+03	-.8841-00	-.6790+02	.6488+03	.6688+02	.4436+03
L	-.9697+02	-.2818+02	-.4889+02	-.1538+05	-.9755+04	.4139+04
M	.1030+03	.1516+02	-.2628+02	.9534+04	-.1777+05	-.4587+04
N	-.2237+03	.2297+03	-.8077+02	.1885+04	.3146+04	-.1105+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.1804-02	.1172-03	-.4313-02	-.1406+02	-.7474+01	.7055+01
Y	.1102-01	.6109-01	.2185-01	.8003+01	-.2045+02	-.6287+01
Z	.2553-02	.9420-04	.3463-02	.1291+02	.6520+01	-.6420+01
L	.1687-00	-.6503-00	.3383-00	.2141+04	-.3141+03	-.1045+04
M	-.6583-01	-.4236-01	-.1203+00	.3056+03	.2668+04	-.1506+03
N	-.9192-01	-.1941+01	-.1741-00	-.1050+04	.1293+03	.5996+03

	C(1)	C(2)	C(3)	C(4)
X	-.3603+05	-.4837+03	.1204+05	-.3116+02
Y	-.5613+03	.1235+05	.6066+03	.3753+04
Z	-.7005+05	.3677+03	-.3323+04	-.3506+02
L	.5787+05	.1648+06	.4514+04	-.3996+05
M	.2336+05	.3583+04	-.1849+06	-.2734+04
N	.1269+06	-.8325+05	.1184+04	-.1192+06

THE INERTIA TENSOR

.9797+04	-.1951-05	.7202+04
-.1951-05	.2750+05	.7937-06
.7202+04	.7937-06	.1919+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.2972+02	-.3725-08	.1610+02	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2281-00 -.1171-01 .2062-01 .1169+00 .3664-01 -.2058-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.4597-00 PHI -.2295-01
AIRCRAFT INERTIAL SPEED= .3380+02

SIKORSKY S-58 HELICOPTER JUNE 5 1970 MOSTAR-B DERIVATIVES
CASE 17 SPEED= 67.8 FT/SEC. H-DOT= 15.FT/SEC. GAMMA=-12.8 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TLP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.3071+02	-.6409-00	-.4431+02	-.7037+03	.1207+04	.2903+03
Y	.9134+00	-.2396+02	-.5853-00	-.1127+04	-.6851+03	.6770+03
Z	-.9019+02	-.1695+01	-.1979+03	.2244+02	-.4051+02	.7170+03
L	-.2605+02	-.6948+02	-.4376+02	-.1774+05	-.9181+04	.2439+04
M	.1001+03	.1090+02	.3054+02	.9721+04	-.2027+05	-.1919+04
N	-.1888+03	.3062+03	-.3062+03	.3540+03	.3236+04	-.1475+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.4058-02	-.2069-03	-.1619-01	-.2270+02	-.8842+01	.5099+01
Y	.8829-02	.6102-01	.3936-01	.8825+01	-.2394+02	-.4082+01
Z	-.4975-03	-.4060-03	.5470-02	.7257+01	.2227+01	-.1612+01
L	.2748-00	-.1603-00	.1210+01	.2524+04	-.3592+03	-.5597+03
M	-.2960-02	-.2222-01	-.3282-01	.3613+03	.2656+04	-.8018+02
N	-.7296-01	-.2036+01	-.3165-00	-.5971+03	.6346+02	.2059+03

	C(1)	C(2)	C(3)	C(4)
X	-.2207+05	-.6264+03	.1484+05	-.2729+02
Y	.1598+02	.1222+05	.6637+03	.3764+04
Z	-.8686+05	.1249+03	.1075+05	-.2991+02
L	.2153+05	.1768+06	.1082+05	-.1015+05
M	.5525+05	.7046+04	-.1840+06	-.1501+04
N	.6707+05	-.4128+05	.1964+05	-.1257+06

THE INERTIA TENSOR

.6977+04	-.5638-06	.4175+04
-.5638-06	.2750+05	.1147-06
.4175+04	.1147-06	.2201+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.6563+02	-.1863-08	.1701+02	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.1957-00 -.8557-02 .3762-01 .3991-01 .3045-01 -.7277-02

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.2231-00 PHI -.7459-02
AIRCRAFT INERTIAL SPEED= .6780+02

SIKORSKY S-58 HELICOPTER JUNE 5 1970 MOSTAR-B DERIVATIVES
CASE 18 SPEED=101.5 FT/SEC. H-DOT= 15.FT/SEC. GAMMA=-8.5 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TLP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.1894+02	-.5110-00	-.3446+02	-.7546+03	.1223+04	.1640+03
Y	.4087-00	-.3064+02	-.5893-00	-.1205+04	-.6762+03	.6965+03
Z	-.5062+02	-.2176+01	-.2394+03	-.3592+03	-.1840+03	.8107+03
L	-.3186+01	-.1015+03	-.3669+02	-.1809+05	-.9026+04	.2028+04
M	.9293+02	.1046+02	.7622+02	.9853+04	-.2174+05	-.9473+03
N	-.1237+03	.3542+03	-.4092+03	-.3648+03	.4058+04	-.1832+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.3339-02	.6984-05	-.2626-01	-.2469+02	-.8939+01	.3243+01
Y	.0622-02	.7035-01	.5107-01	.9117+01	-.2444+02	-.3598+01
Z	.8872-03	.5309-03	.6417-02	.5086+01	.8272-00	-.6537-00
L	.2437-00	.2662-01	.1884+01	.2603+04	-.3653+03	-.3415+03
M	.8969-02	-.2349-01	.1048+00	.3751+03	.2654+04	-.4859+02
N	-.4528-01	-.2357+01	-.3542-00	-.4162+03	.3019+02	.1369+03

	C(1)	C(2)	C(3)	C(4)
X	-.1799+05	-.6491+03	.1536+05	-.3188+02
Y	.2374+03	.1216+05	.6751+03	.4389+04
Z	-.1002+06	.4513+02	.2255+05	-.3432+02
L	.1732+05	.1786+06	.1082+05	.1421+04
M	.8871+05	.7737+04	-.1883+06	-.1367+04
N	.2571+05	-.2593+05	.4089+05	-.1471+06

THE INERTIA TENSOR

.6349+04	-.2911-06	.2758+04
-.2911-06	.2750+05	.3795-07
.2758+04	.3795-07	.2263+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.1002+03	-.1397-08	.1650+02	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.1907-00 -.9319-02 .5124-01 .2315-01 .1495-01 -.3688-02

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.1483-00 PHI -.3728-02
AIRCRAFT INERTIAL SPEED= .1015+03

NOT REPRODUCIBLE

SIKORSKY S-58 HELICOPTER JUNE 5 1970 MOSTAR-B DERIVATIVES
CASE 19 SPEED=169.0 FT/SEC. H-DOT= 15.FT/SEC. GAMMA=-5.1 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TLP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.1631+02	-.4208-00	-.1560+02	-.7592+03	.1164+04	-.1054+02
Y	.4603-00	-.4339+02	-.1464+01	-.1197+04	-.6740+03	.7645+03
Z	-.1003+02	-.4491+01	-.2725+03	-.9910+03	-.3539+03	.9219+03
L	.9622+01	-.1666+03	.1726+02	-.1723+05	-.9556+04	.2441+04
M	.8439+02	.1674+02	.1489+03	.1067+05	-.2357+05	.2114+03
N	-.6724+02	.4022+03	-.4462+03	-.1194+04	.5890+04	-.2471+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.2896-03	-.1648-03	-.3785-01	-.2430+02	-.8976+01	.6177-00
Y	.1679-02	.7963-01	.8237-01	.1008+02	-.2222+02	-.2904+01
Z	-.3196-02	-.4296-02	.9833-03	.4575+01	-.1658-00	-.8313-01
L	.6977-01	.3047-00	.3090+01	.2666+04	-.3449+03	-.7508+02
M	-.3125-02	-.4868-01	.1722-00	.3729+03	.2661+04	-.7880+01
N	-.5912-02	-.2663+01	-.3345-00	-.2117+03	-.2474+02	.9810+02

	C(1)	C(2)	C(3)	C(4)
X	-.1202+05	-.6304+03	.1429+05	-.9449+02
Y	.1446+03	.1224+05	.8192+03	.5150+04
Z	-.1177+06	.4920+01	.4463+05	-.9269+02
L	.2413+05	.1816+06	.1936+04	.2001+05
M	.1575+06	.5832+04	-.2071+06	-.2983+04
N	-.7077+04	-.8620+04	.7387+05	-.1715+06

THE INERTIA TENSOR

.5951+04	-.3563-06	.9812+03
-.3563-06	.2750+05	.1622-07
.9812+03	.1622-07	.2303+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.1687+03	-.2794-08	.9660+01	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2168-00 -.1730-01 .8740-01 .3904-01 -.3168-01 -.8025-02

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.0888-01 PHI -.8053-02
AIRCRAFT INERTIAL SPEED= .1690+03

NOT REPRODUCIBLE

SIKORSKY S-58 HELICOPTER JUNE 2 1970 MOSTAB-B DERIVATIVES
CASE 2[illegible] SPEED =33.8 FT/SEC. W-DOT=-22.5 FT/SEC. GAMMA=-41.75 DEG.
GROSS WEIGHT= 11067.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

		V	W	P	Q	R
X	-.1226+03	-.5366-00	.3864+01	.1423+02	.1213+04	.6296+03
Y	.1[illegible]7+01	-.1530+02	.3261-00	-.6552+03	-.6434+03	.9105+03
Z	-.1273+03	.1027-01	-.3703+01	.6285+03	-.2257+03	.4890-00
L	-.1740+03	.2940+02	-.2053+02	-.1320+05	-.8975+04	.5174+04
M	.9328+02	.1449+02	-.5762+02	.7844+04	-.1795+05	-.6883+04
N	-.2150+03	.2184+03	-.1553+02	.3225+04	.4792+04	-.1267+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.1776-02	-.2[illegible]-03	-.1253-02	-.7345+01	-.4612+01	.6649+01
Y	.1315-01	.5751-01	.1473-01	.5988+01	-.2099+02	-.8084+01
Z	.2541-02	-.6449-03	.3781-02	.1521+02	.9056+01	-.1367+02
L	.1547-00	-.1119+01	.1740-00	.1495+04	-.2689+03	-.1295+04
M	-.1[illegible]02+00	-.4199-01	-.1035+00	.2576+03	.2666+04	-.2299+03
N	-.1432-00	-.1553+01	-.1636-00	-.1293+04	.2143+03	.1242+04

	C(1)	C(2)	C(3)	C(4)
X	-.5210+05	-.3193+05	.8963+04	-.3114+02
Y	-.5174+03	.1223+05	.5950+03	.3662+04
Z	-.5[illegible]7+05	.5513+03	-.8276+04	-.3322+02
L	.4631+05	.1550+06	.3394+04	-.6859+05
M	.1931+05	.4197+04	-.1639+06	-.2663+04
N	.1732+06	-.1232+06	-.2117+04	-.1017+06

NOT REPRODUCIBLE

THE INERTIA TENSOR

.1417+05	-.2939-05	.8590+04
-.2939-05	.2750+05	.1594-05
.8590+04	.1594-05	.1482+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.2435+02	-.7451-0[illegible]	.2344+02	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.2357-00	-.1[illegible]-01	.1027-01	.1073+00	.3785-01	-.1692-01

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.7283-00 PHI -.2534-01
AIRCRAFT INERTIAL SPEED= .3380+02

DENOMINATOR CHARACTERISTIC
ROOTS

REAL PART	IMAGINARY PART
-.2844-07	.0000
-.4931+01	.0000
-.3120-00	.0000
-.1806-00	.0000
.3541-01	.3395-00
.3541-01	-.3395-00
-.1956-00	.6463-00
-.1956-00	-.6463-00
-.1071+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

NOT REPRODUCIBLE

NUMERATORS
(NOTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
LARGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

X(1)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .1413+03

BODE GAIN = -.3114+03

ROOTS

REAL PART	IMAGINARY PART
-.1298-00	.0000
-.4931+01	.0000
-.2268-00	.3675-00
-.2268-00	-.3675-00
-.2950-01	.5854-00
-.2950-01	-.5854-00
-.8615-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .1362+01

BODE GAIN = .2813+03

ROOTS

REAL PART	IMAGINARY PART
.7133-01	.0000
-.1254+03	.0000
-.4139+01	.0000
-.1165+01	.0000
-.2903-01	.3750-00
-.2903-01	-.3750-00
-.4602-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

NOT REPRODUCIBLE

X(3)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .1544+03

BODE GAIN = .1310+03

ROOTS

REAL PART	IMAGINARY PART
.2431-06	.0000
-.4963+01	.0000
-.2085-00	.0000
-.8017-01	.0000
.3199-00	.0000
-.2210-00	.6902-00
-.2210-00	-.6902-00
-.9720-00	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN = -.1967+01

BODE GAIN = .2066+02

ROOTS

REAL PART	IMAGINARY PART
-.5503-07	.0000
-.9056+01	.0000
-.1270+01	.0000
-.2051-00	.3702-00
-.2051-00	-.3702-00
.3817-01	.3960-00
.3817-01	-.3960-00
-.4689-00	.0000
.0000	.0000
.0000	.0000

X(5)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN = -.7420-00

BODE GAIN = -.5867-00

ROOTS

NOT REPRODUCIBLE

REAL PART	IMAGINARY PART
-.1082+00	.1587-00
-.1082+00	-.1587-00
-.3808-00	.0000
.1715-00	.0000
-.3964+01	.0000
-.1549-00	.1140+01
-.1549-00	-.1140+01
.0000	.0000
.0000	.0000
.0000	.0000

X(6)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN = -.6134+01

BODE GAIN = .2515+0[illegible]

ROOTS

REAL PART	IMAGINARY PART
.2219-37	.0000
-.3777+01	.0000
-.1032+11	.0000
-.4844-10	.0000
-.1070+00	.4356-06
-.1070+00	-.4356-06
.8671-01	.3905-00
.8871-01	-.3905-00
.0000	.0000
.0000	.0000

NOT REPRODUCIBLE

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN = .2400+01

BODE GAIN = .1230+03

ROOTS

REAL PART	IMAGINARY PART
.7674-[illegible]	.0000
-.1433-00	.0000
-.2723+02	.0000
.3271-00	.2609+01
.3271-00	-.2609+01
-.1421-00	.4785-00
-.1421-00	-.4785-00
-.3725-06	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN = -.3479+02

BODE GAIN = .1801+04

ROOTS

REAL PART	IMAGINARY PART
-.1859-00	.0000
-.3659+02	.0000
-.1561+01	.0000
-.6393-00	.4236-00
-.6393-00	-.4236-00
.6318-01	.3582-00
.6318-01	-.3582-00
-.1162-06	.0000
-.1329-07	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR

NOT REPRODUCIBLE

ROOT LOCUS GAIN= -.4658+01

BODE GAIN = .9534+03

ROOTS

REAL PART	IMAGINARY PART
.1088-05	.0000
-.1866+02	.0000
-.1013+02	.0000
-.3920-00	.5160-00
-.3920-00	-.5160-00
-.1766-00	.4446-00
-.1766-00	-.4446-00
-.1800-00	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.4107+02

BODE GAIN = .2059+02

ROOTS

REAL PART	IMAGINARY PART
-.1886-00	.0000
.7727-03	.3615-00
.7727-03	-.3615-00
-.7673-00	.2724-00
-.7673-00	-.2724-00
.1470-00	.6844-00
.1470-00	-.6844-00
.0000	.0000
.0000	.0000
.0000	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.9560-00

BODE GAIN = -.5848-00

ROOTS

REAL PART	IMAGINARY PART
-.1925-00	.0000
.1577-00	.0000
-.1710-00	.1774-00
-.1710-00	-.1774-00
-.2580+02	.0000
-.1782-00	.4511-00
-.1782-00	-.4511-00
-.7451-08	.0000
.0000	.0000
.9313-09	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .3896+02

BODE GAIN = .2800-05

ROOTS

REAL PART	IMAGINARY PART
.1213-06	.0000
-.1689-00	.0000
.2572-01	.3658-00
.2572-01	-.3658-00
-.4380-00	.6865-00
-.4380-00	-.6865-00
-.1017+01	.0000
.5499-00	.0000
-.1101-07	.0000
.0000	.0000

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2436+02

BODE GAIN = .5503+02

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.1536-01	.0000
-.1396-00	.0000
-.1897-00	.6401-00
-.1897-00	-.6401-00
-.5128+01	.0000
.1224+00	.2710+01
.1224+00	-.2710+01
.4351-08	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(5) NUMERATOR

ROOT LOCUS GAIN= -.2000+01

BODE GAIN = .3006+05

ROOTS

REAL PART	IMAGINARY PART
.3013-01	.1001+00
.3013-01	-.1001+00
-.1493+02	.4879+01
-.1493+02	-.4879+01
-.1663+01	.0000
-.2322-00	.6776-00
-.2322-00	-.6776-00
.0000	.0000
.0000	.0000
.0000	.0000

NOT REPRODUCIBLE

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .2253+02

BODE GAIN = -.2930+04

ROOTS

REAL PART	IMAGINARY PART
-.1857-00	.0000
-.1139+02	.0000
-.5110+01	.0000
-.1910-00	.6391-00
-.1910-00	-.6391-00
-.4254-00	.5007-00
-.4254-00	-.5007-00
.3560-07	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1473+01

BODE GAIN = .8751+01

ROOTS

REAL PART	IMAGINARY PART
.2659-07	.0000
-.1176+02	.0000
-.1714-00	.5877-00
-.1714-00	-.5877-00
-.4639-00	.5629-00
-.4639-00	-.5629-00
.3000-00	.0000
.1349-00	.0000
.0000	.0000
.0000	.0000

X(5)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .7377+01

BODE GAIN = -.2485-00

ROOTS

NOT REPRODUCIBLE

REAL PART	IMAGINARY PART
.2083-01	.4811-01
.2083-01	-.4811-01
-.5134+01	.0000
-.1905-00	.6388-00
-.1905-00	-.6388-00
-.2573-00	.1401-00
-.2573-00	-.1401-00
-.2249-08	.0000
.1923-07	.0000
.0000	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .1344+01

BODE GAIN = -.3272-04

ROOTS

REAL PART	IMAGINARY PART
-.3336-05	.0000
-.1173+02	.0000
.1253-00	.0000
.2987-00	.2823-00
.2987-00	-.2823-00
-.1928-00	.6742-00
-.1928-00	-.6742-00
-.9544-00	.0000
-.8648-08	.0000
-.5392-07	.0000

NOT REPRODUCIBLE

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .2523-00

BODE GAIN = -.4762+02

ROOTS

REAL PART	IMAGINARY PART
.1367-00	.0000
-.5611+02	.0000
-.1194+01	.1925+01
-.1194+01	-.1925+01
-.6226-00	.0000
.5704-00	.0000
-.2158-00	.0000
.2550-08	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN = -.1014+02

BODE GAIN = .8511+01

ROOTS

REAL PART	IMAGINARY PART
-.1237-06	.0000
-.2754+02	.0000
-.3076+01	.0000
-.1046+01	.0000
-.4177-02	.0000
-.1483-02	.3643-00
-.1483-02	-.3643-00
-.2730-00	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.2552-00

BODE GAIN = -.2078+03

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.1164-06	.0000
-.2965+01	.1048+02
-.2965+01	-.1048+02
-.5568-00	.5135-00
-.5568-00	-.5135-00
.2200+01	.0000
-.5049-00	.0000
-.1719-00	.0000
.1397-08	.0000
.0000	.0000

X(4)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.9962-00

BODE GAIN = -.7774+01

ROOTS

REAL PART	IMAGINARY PART
-.1916-00	.3439-00
-.1916-00	-.3439-00
-.2697-00	.0000
.5300-01	.3804-00
.5300-01	-.3804-00
.1957+02	.0000
-.1033+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

X(5)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .2165-01

BODE GAIN = .2206-00

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.1031-07	.6713-07
-.1031-07	-.6713-07
.9085+02	.0000
.9743-00	.0000
.2066-00	.0000
-.1156+00	.1671-00
-.1156+00	-.1671-00
-.7827-00	.0000
-.2757-00	.0000
.0000	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN = .8217+01

BODE GAIN = -.8713+01

ROOTS

REAL PART	IMAGINARY PART
-.9262-01	.4113-00
-.9262-01	-.4113-00
.9222-01	.3626-00
.9222-01	-.3626-00
-.2335+01	.0000
-.1055+01	.0000
-.2687-00	.0000
.7451-08	.0000
-.1141-07	.0000
.0000	.0000

NOT REPRODUCIBLE

SIKORSKY S-58 HELICOPTER JUNE 2 1970 MOSTAB-B DERIVATIVES
CASE 21 SPEED=101.5 FT/SEC. W-DOT=-22.5 FT/SEC. GAMMA=-12.8 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.2626+02	-.4165-00	-.5114+02	-.7438+03	.1299+04	.2640+03
Y	.2766-01	-.2978+02	-.5542-02	-.1232+04	-.6592+03	.7886+03
Z	-.6785+02	-.1293+01	-.2339+03	-.2434+03	-.2959+03	.7378+03
L	-.2070+02	-.6782+02	-.7415+02	-.1851+05	-.8210+04	.2141+04
M	.9119+02	.6785+01	.7465+02	.9367+04	-.2237+05	-.1587+04
N	-.1593+03	.3550+03	-.4702+03	.1352+03	.5020+04	-.1813+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.5296-02	.1640-03	-.2605-01	-.2569+02	-.8575+01	.5342+01
Y	.7918-02	.7049-01	.3795-01	.8506+01	-.2627+02	-.4212+01
Z	.1331-02	.9378-03	.6556-02	.7296+01	.1438+01	-.1519+01
L	.3594-00	-.1579-00	.1745+01	.2524+04	-.3735+03	-.5191+03
M	.3504-01	.3720-02	.1877-00	.3840+03	.2647+04	-.7985+02
N	-.9509-01	-.2355+01	-.4719-00	-.5997+03	.6916+02	.2061+03

	C(1)	C(2)	C(3)	C(4)
X	-.2543+05	-.6672+03	.1686+05	-.7878+01
Y	.4635+03	.1202+05	.6346+03	.4349+04
Z	-.9861+05	.1043+03	.2115+05	-.9832+01
L	.1505+05	.1736+06	.1648+05	-.9622+04
M	.8939+05	.9690+04	-.1862+06	-.3154+03
N	-.8535+04	-.3864+05	.4631+05	-.1471+06

NOT REPRODUCIBLE

THE INERTIA TENSOR

.6851+04	.3789-06	-.3939+04
.3789-06	.2750+05	-.7229-07
.3939+04	-.7229-07	.2213+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.9864+02	.1863-08	.2393+02	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TE-

.1717-00	-.5523-02	.4446-01	-.3109-02	.1446-01	.3086-02

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.2235-00 PHI .3164-02
AIRCRAFT INERTIAL SPEED= .1015+03

.NOMINATOR CHARACTERISTIC
OTS

REAL PART	IMAGINARY PART
.1481-07	.0000
-.5592+01	.0000
-.8941-01	.0000
-.5796-00	.0000
.1913-01	.2922-00
.1913-01	-.2922-00
-.3670-00	.1154+01
-.3670-00	-.1154+01
-.1424+01	.0000
.0000	.0000
.0000	.0000
.0000	.0000

NOT REPRODUCIBLE

IMERATORS
OTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
.RGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

1)-TO-C(1) NUMERATOR

OT LOCUS GAIN= .6939+02

DE GAIN = -.9967+03

OTS

REAL PART	IMAGINARY PART
-.6607-01	.0000
-.5815+01	.0000
-.5723-00	.1368+01
-.5723-00	-.1368+01
-.7247-01	.1307+01
-.7247-01	-.1307+01
-.5150-00	.0000
.0000	.0000
.0000	.0000
.0000	.0000

2)-TO-C(1) NUMERATOR

OT LOCUS GAIN= -.1164+01

DE GAIN = .1835+03

OTS

REAL PART	IMAGINARY PART
.1721-07	.0000
-.1014+03	.0000
-.4257+01	.0000
-.3216-00	.0000
.3054-01	.0000
.7149+01	.0000
.2469-00	.4571-00
.2469-00	-.4571-00
.0000	.0000
.0000	.0000

3)-TO-C(1) NUMERATOR

OT LOCUS GAIN= .2675+03

DE GAIN = -.8594+02

OTS

REAL PART	IMAGINARY PART
.6552-07	.0000
-.5756+01	.0000
-.4376-00	.1243+01
-.4376-00	-.1243+01
-.1683-00	.5427-01
-.1683-00	-.5427-01
.5270-00	.0000
.1012+00	.0000
.0000	.0000
.0000	.0000

4)-TO-C(1) NUMERATOR

OT LOCUS GAIN= -.4360+01

DE GAIN = .1337-05

OTS

REAL PART	IMAGINARY PART
-.7197-01	.0000
.4797-00	.1931+01
.4797-00	-.1931+01
.4021-00	.4378-00
.4021-00	-.4378-00
-.1240+01	.0000
-.3083-00	.0000
.4141-06	.0000
.9772-07	.0000
.0000	.0000

5)-TO-C(1) NUMERATOR

OT LOCUS GAIN= -.3064+01

DE GAIN = .4479-01

OTS

REAL PART	IMAGINARY PART
.2412-03	.3427-01
.2412-03	-.3427-01
-.6163+01	.0000
-.3179-00	.1276+01
-.3179-00	-.1276+01
-.6104-00	.0000
-.8289-01	.0000
.0000	.0000
.0000	.0000
-.4191-07	.0000

6)-TO-C(1) NUMERATOR

OOT LOCUS GAIN= .1275+01

ODE GAIN = .2915-04

OOTS

REAL PART	IMAGINARY PART
.2061-05	.0000
.7562+01	.0000
-.7974-01	.5159-00
-.7978-01	-.5159-00
.3134-00	.3810-00
.3134-00	-.3810-00
-.3667+01	.0000
-.3132-00	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .5731+01

BODE GAIN = -.5687+03

NOT RÉPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
.4871-06	.0000
-.2215+02	.0000
-.2114-00	.2794+01
-.2114-00	-.2794+01
-.4101-00	.1170+01
-.4101-00	-.1170+01
-.4644-00	.0000
-.4150-01	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.3391+02

BODE GAIN = .1603+04

ROOTS

REAL PART	IMAGINARY PART
.6667-07	.0000
-.3642+02	.0000
-.2078-00	.0000
.5784-01	.2310-00
.5784-01	-.2310-00
-.2873+01	.0000
-.3807-00	.1358+01
-.3807-00	-.1358+01
.0000	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.1393+01

BODE GAIN = ..2419+03

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.5076-07	.0000
-.5429-01	.2326-00
-.5429-01	-.2326-00
-.6248-01	.0000
-.2485+02	.3212+02
-.2485+02	-.3212+02
-.4058-00	.1170+01
-.4058-00	-.1170+01
.0000	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.5317+02

BODE GAIN = .6378+01

ROOTS

REAL PART	IMAGINARY PART
-.5678-07	.0000
-.4226-00	.1167+01
-.4226-00	-.1167+01
.9606-01	.3452-00
.9606-01	-.3452-00
-.1354+01	.0000
-.3242-00	.0000
-.7167-01	.0000
.4623-09	.0000
.0000	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.1232+01

BODE GAIN = .8877-01

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
.1051-01	.4891-01
.1051-01	-.4891-01
-.8016-01	.0000
-.1849+02	.0000
-.4098-00	.1174+01
-.4098-00	-.1174+01
-.6419-00	.0000
-.2554-07	.0000
.1902-07	.0000
.0000	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .1277+02

BODE GAIN = .2805+02

ROOTS

REAL PART	IMAGINARY PART
.4158-01	.3446-00
.4158-01	-.3446-00
-.2869-00	.0000
-.2302+01	.0000
-.3039-00	.1304+01
-.3039-00	-.1304+01
.7994-00	.0000
.1263-07	.0000
.0000	.0000
.0000	.0000

NOT REPRODUCIBLE

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.4579+02

BODE GAIN = .2976+04

ROOTS

REAL PART	IMAGINARY PART
-.4161-07	.0000
-.4670-00	.0000
-.9328-01	.0000
-.1658-00	.2636+01
-.1658-00	-.2636+01
-.5675+01	.0000
-.4362-00	.1226+01
-.4362-00	-.1226+01
.0000	.0000
.0000	.0000

X(2)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2312+01

BODE GAIN = .1703+03

ROOTS

REAL PART	IMAGINARY PART
-.5377-01	.5932-01
-.5377-01	-.5932-01
.5799+02	.0000
.1990-00	.0000

NOT REPRODUCIBLE

-.5127+01	.0000
.4220-00	.3146+01
.4220-00	-.3146+01
.0000	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.5741+02

BODE GAIN = -.6717+03

ROOTS

REAL PART	IMAGINARY PART
-.9179-01	.0000
.1220+02	.0000
-.6331-01	.2307-00
-.6331-01	-.2307-00
-.5653+01	.0000
-.4370-00	.1219+01
-.4370-00	-.1219+01
-.6613-06	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2960+01

BODE GAIN = -.8888-06

ROOTS

REAL PART	IMAGINARY PART	
-.6365-02	.3809-01	
-.6365-02	-.3809-01	
-.7161-01	.0000	
-.8849+01	.0000	
-.6098-01	.1523+01	
-.6098-01	-.1523+01	
-.1234+01	.0000	
.0000	.0000	
-.5750-05	.0000	NOT REPRODUCIBLE
-.7512-07	.0000	

X(5)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= .7451+01

BODE GAIN = .1433-06

ROOTS

REAL PART	IMAGINARY PART
.1392-02	.0000
-.5678+01	.0000
-.4243-00	.1232+01
-.4243-00	-.1232+01
-.6397-00	.0000
-.9087-01	.0000
-.1914-01	.0000
.6671-06	.0000
.5352-06	.0000
.0000	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1475+01

BODE GAIN = -.2705-05

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.3982-05	.0000
-.6925-01	.5327-00
-.6925-01	-.5327-00
-.4950-02	.3915-01
-.4950-02	-.3915-01
.1299-00	.3352+01
.1299-00	-.3352+01
-.4729+01	.0000
.2279-08	.0000
.0000	.0000

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .5538-00

BODE GAIN = .6045+02

ROOTS

REAL PART	IMAGINARY PART
-.2595-01	.0000
-.3165+02	.0000
-.5534-00	.2642+01
-.5534-00	-.2642+01
-.1499+01	.0000
.1349+01	.0000
-.4682-00	.0000
-.7451-08	.0000
.0000	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1215+02

BODE GAIN = .7336+02

ROOTS

REAL PART	IMAGINARY PART
-.1344-06	.0000
-.6478+02	.0000
-.4894+01	.0000
-.1440+01	.0000
-.4043-00	.0000
.4028-01	.3176-00
.4028-01	-.3176-00
-.1655-01	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1243+00

BODE GAIN = -.3664+02

ROOTS

REAL PART	IMAGINARY PART
-.5417-01	.0000
-.5483-01	.2344-00
-.5483-01	-.2344-00
.3688+02	.7300+01
.3688+02	-.7300+01
.2296+01	.0000
-.1501+01	.0000
-.2568-08	.0000
.0000	.0000
.0000	.0000

X(4)-T0-C(4) NUMERATOR

ROOT LOCUS GAIN= -.5951+01

BODE GAIN = .1189-05

ROOTS

REAL PART	IMAGINARY PART
-.7130-01	.0000
-.1446+01	.0000
-.1236+01	.0000
-.3450-00	.0000
.2463+01	.0000
.7304-01	.3307-00
.7304-01	-.3307-00
.0000	.0000
-.8336-06	.0000
.2546-07	.0000

X(5)-T0-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1048+00

BODE GAIN = -.1985-01

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
.1685-01	.5526-01
.1685-01	-.5526-01
-.7165-01	.0000
-.2567+02	.0000
-.1493+01	.0000
.1526+01	.0000
-.6380-00	.0000
-.5273-07	.3990-07
-.5273-07	-.3990-07
-.1741-06	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .7943+01

BODE GAIN = -.6274+01

ROOTS

REAL PART	IMAGINARY PART
.1052-07	.0000
-.4525+01	.0000
-.1440+01	.0000
-.7452-01	.4019-00
-.7452-01	-.4019-00
.9315-01	.3015-00
.9315-01	-.3015-00
-.3781-00	.0000
.1360-08	.0000
.0000	.0000

NOT REPRODUCIBLE

SIKORSKY S-58 HELICOPTER JUNE 2 1970 VOSTAR-R DERIVATIVES
CASE 22 SPEED= 167.0 FT/SEC. W=0018-22.5 FT/SEC. GAMMA=-7.05 DEG.
GROSS WEIGHT= 11867.LB. SEA LEVEL DYNAMIC TIP LOSS (YES)

STABILITY DERIVATIVE MATRICES-

	U	V	W	P	Q	R
X	-.1740+02	-.4024-01	-.3744+02	-.7831+03	.1238+04	.6114+02
Y	.1738-00	-.4255+02	-.4392-00	-.1235+04	-.6547+03	.8002+03
Z	-.2142+02	-.3493+01	-.2725+03	-.9071+03	-.4266+03	.6403+03
L	.4712+01	-.1407+03	-.1333+01	-.1772+05	-.8793+04	.2121+04
M	.6273+02	.1213+02	.1566+03	.1039+03	-.2414+05	-.2037+03
N	-.6353+02	.4031+03	-.5336+03	-.1501+04	.4755+04	-.2433+05

	U DOT	V DOT	W DOT	P DOT	Q DOT	R DOT
X	-.1782-02	.3227-03	-.3931-01	-.2576+02	-.6765+01	.1756+01
Y	.3568-02	.7963-01	.5949-01	.9454+01	-.2391+02	-.3403+01
Z	-.3395-02	-.2677-02	-.2423-03	.6253+01	.1802-00	-.4128-00
L	.1776-00	.1717-00	.2921+01	.2640+04	-.3571+03	-.1852+03
M	.7312-02	-.2951-01	.2476-00	.3845+03	.2655+04	-.2547+02
N	-.3133-01	-.2674+01	-.4573-00	-.3306+03	.4868-00	.1162+03

	C(1)	C(2)	C(3)	C(4)
X	-.1741+05	-.6531+03	.1620+05	-.4957+02
Y	.4196+03	.1204+05	.7274+03	.5151+04
Z	-.1176+06	.2003+02	.4422+05	-.5047+02
L	.2343+05	.1777+06	.6945+04	.1249+05
M	.1505+06	.7640+04	-.2057+06	-.1471+04
N	-.4054+05	-.1625+05	.8781+05	-.1722+06

NOT REPRODUCIBLE

THE INERTIA TENSOR

.6158+04	-.5858-07	.1717+04
-.4434-07	.2750+05	.7098-08
.1717+04	.7096-08	.2291+05

TRIMMED VELOCITIES WITH RESPECT TO OVERALL VEHICLE REFERENCE AXES-

U	V	W	P	Q	R
.1671+03	-.6765-09	.1697+02	-.0000	.0000	-.0000

TRIMMED ITERATION COLUMN VECTOR, TB-

.1970-00	-.1292-01	.7074-01	.1445-01	-.3230-01	-.1145-02

STABILITY AXIS SYSTEM EULER ANGLES- THETA= -.1330-00 PHI -.1195-02
AIRCRAFT INERTIAL SPEED= .1697+03

DENOMINATOR CHARACTERISTIC
ROOTS

REAL PART	IMAGINARY PART
-.1[illegible]-05	.0000
-.5740+01	.0000
-.4207-00	.0000
-.9263-01	.0000
.9074-01	.3100-00
.9074-01	-.3100-00
-.5577-00	.1536+01
-.5577-00	-.1536+01
-.1[illegible]5+01	.0000
-.8767-08	.0000
.0000	.0000
.0000	.0000

NUMERATORS
(NOTE- NUMERATOR ROOTS LESS THAN 1.0E-7 TIMES THE
LARGEST NUMERATOR ROOT ARE NOT INCLUDED IN THE BODE GAIN).

X(1)-TO-Y(1) NUMERATOR

ROOT LOCUS GAIN = .4790+02

BODE GAIN = .8857+09

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.7473-01	.0000
-.5314-00	.0000
-.1507-00	.2196+01
-.1907-00	-.2196+01
-.5751+01	.0000
-.5105-00	.1724+01
-.5105-00	-.1724+01
.0000	.0000
.3612-07	.0000
.0000	.0000

X(2)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN = -.6965-00

BODE GAIN = -.5702+00

ROOTS

REAL PART	IMAGINARY PART
-.9616-06	.0000
-.4972+03	.0000
-.5128+01	.0000
.2060-00	.0000
.1677-01	.0000
.1254+01	.2306+01
.1254+01	-.2306+01
-.2069-00	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= .3190+03

BODE GAIN = .1471+09

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.9403-01	.0000
-.5607+01	.0000
-.5548-00	.1685+01
-.5548-00	-.1685+01
.2452+01	.0000
-.1677-00	.0000
.1298-00	.0000
-.1077-06	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.7424+01

BODE GAIN = -.1366+01

ROOTS

REAL PART	IMAGINARY PART
.6897-07	.9816-07
.6897-07	-.9816-07
.1681-05	.0000
-.2540-01	.0000
.2010-00	.0000
-.2053-00	.0000
.1276-00	.2146+01
.1276-00	-.2146+01
.2089+01	.0000
-.2076+01	.0000

X(5)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN= -.6574+01

BODE GAIN = .7229+04

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.1624-06	.0000
-.5877+01	.0000
-.4791-00	.1680+01
-.4791-00	-.1680+01
.6595-02	.0000
-.6000-00	.0000
-.6132-01	.0000
-.4859-01	.0000
.0000	.0000
-.3725-04	.0000

X(6)-TO-C(1) NUMERATOR

ROOT LOCUS GAIN = .2790+01

BODE GAIN = -.6050+07

ROOTS

REAL PART	IMAGINARY PART
.2007-00	.0000
-.2056-00	.0000
-.4675+01	.0000
-.4140-01	.5529-00
-.4140-01	-.5529-00
.1325+01	.2295+01
.1325+01	-.2295+01
.9779-08	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .5661+01

BODE GAIN = .4114+09

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.4814-01	.0000
-.2262+02	.0000
-.2018-00	.2712+01
-.2018-00	-.2712+01
-.5563-00	.1638+01
-.5563-00	-.1638+01
-.5797-00	.0000
.0000	.0000
.3625-07	.0000
.0000	.0000

X(2)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.3429+02

BODE GAIN = -.1692+04

ROOTS

REAL PART	IMAGINARY PART
.2950-05	.0000
-.2519+02	.0000
-.4732+01	.0000
-.1499-00	.2035+01
-.1099-00	-.2035+01
.8586-01	.1306-00
.8586-01	-.1606-00
-.1497-00	.0000
.0000	.0000
.0000	.0000

X(3)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.9917-00

NOT REPRODUCIBLE

BODE GAIN= -.5602+04

ROOTS

REAL PART	IMAGINARY PART
-.5495-02	.1002+00
-.5495-02	-.1002+00
-.8959-01	.0000
-.2427+02	.5843+02
-.2427+02	-.5843+02
-.5546-00	.1639+01
-.5546-00	-.1639+01
.1007-08	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.5485+02

BODE GAIN = -.1345+02

ROOTS

REAL PART	IMAGINARY PART
-.2506-01	.0000
-.5563-00	.1663+01
-.5563-00	-.1663+01
.2517-00	.2927-00
.2517-00	-.2927-00
-.1942+01	.0000
-.2423-00	.0000
.9324-05	.0000
-.3075-10	.0000
-.9313-09	.0000

X(5)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= -.1164+01

BODE GAIN = .1283+05

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
.1631-01	.0000
-.4631-01	.2853-01
-.4631-01	-.2853-01
-.2109+02	.0000
-.5544-00	.1647+01
-.5544-00	-.1647+01
-.6084-00	.0000
.0000	.0000
.0000	.0000
.7451-16	.0000

X(6)-TO-C(2) NUMERATOR

ROOT LOCUS GAIN= .5644+01

BODE GAIN = -.1073+08

ROOTS

REAL PART	IMAGINARY PART
-.2362-00	.0000
.1690-00	.4447-00
.1690-00	-.4447-00
.5869-00	.0000
-.3589+01	.0000
-.6178-02	.1802+01
-.6178-02	-.1802+01
.0000	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.4410+02

BODE GAIN = -.1438+10

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
-.9290-01	.0000
-.5692-00	.0000
-.1690-00	.2677+01
-.1690-00	-.2677+01
-.5457+01	.0000
-.5583-00	.1645+01
-.5583-00	-.1645+01
.1794-09	.0000
-.4444-08	.0000
.0000	.0000

X(2)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.2520+01

BODE GAIN = -.7028+08

ROOTS

REAL PART	IMAGINARY PART
-.4916-05	.0000
.2420+03	.0000
.1285-00	.0000
-.5193-01	.0000
-.8736-01	.0000
-.5201+01	.0000
-.1311-00	.2700+01
-.1311-00	-.2700+01
.0000	.0000
.0000	.0000

X(3)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.1200+03

BODE GAIN = .5311+02

NOT REPRODUCIBLE

ROOTS

REAL PART	IMAGINARY PART
.1545-05	.0000
.1045+02	.0000
-.9258-01	.0000
-.2739-01	.5192-01
-.2739-01	-.5192-01
-.5436+01	.0000
-.5648-00	.1647+01
-.5648-00	-.1647+01
.0000	.0000
.0000	.0000

X(4)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.8994-00

BODE GAIN = .1363+06

ROOTS

REAL PART	IMAGINARY PART
-.2592-01	.0000
-.3167+02	.0000
-.8852-02	.1974+01
-.8852-02	-.1974+01
-.2135+01	.0000
-.8973-01	.0000
.4626-01	.0000
.1670-07	.0000
-.4376-06	.0000
-.9269-07	.0000

X(5)-TO-C(3) NUMERATOR.

NOT REPRODUCIBLE

ROOT LOCUS GAIN= .6264+01

BODE GAIN = -.1230+04

ROOTS

REAL PART	IMAGINARY PART
.9081-03	.0000
-.5457+01	.0000
-.5533-00	.1656+01
-.5533-00	-.1656+01
-.6712-00	.0000
-.9296-01	.0000
-.3033-01	.0000
.2627-06	.0000
-.1115-07	.0000
.0000	.0000

X(6)-TO-C(3) NUMERATOR

ROOT LOCUS GAIN= -.3769+01

BODE GAIN = .1029+07

ROOTS

REAL PART	IMAGINARY PART
.5042-01	.0000
-.8973-01	.0000
-.5951-01	.5498-00
-.5951-01	-.5498-00
-.4999+01	.0000
-.1722-00	.2749+01
-.1722-00	-.2749+01
.3201-07	.0000
.0000	.0000
.0000	.0000

X(1)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= .7517-00

NOT REPRODUCIBLE

BODE GAIN = -.7292+08

ROOTS

REAL PART	IMAGINARY PART
.2315-07	.0000
-.4191-07	.0000
-.2669+02	.0000
-.5798-00	.0000
-.3885-01	.0000
-.3311-00	.2523+01
-.3311-00	-.2523+01
-.2246+01	.0000
.2154+01	.0000
.0000	.0000

X(2)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1427+02

BODE GAIN = -.5615+08

ROOTS

REAL PART	IMAGINARY PART
-.1159-06	.0000
-.9620+02	.0000
-.5184+01	.0000
-.1955+01	.0000
-.2798-00	.0000
.1565-00	.3171-00
.1565-00	-.3171-00
-.2218-01	.0000
.4627-09	.0000
.0000	.0000

NOT REPRODUCIBLE

X(3)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN= -.1211-01

BODE GAIN = .1485+08

ROOTS

REAL PART	IMAGINARY PART
-.2596-05	.0000
.2426+04	.0000
.1091+02	.0000
.3667+01	.0000
-.2381-02	.1095+00
-.2381-02	-.1095+00
-.2256+01	.0000
-.8975-01	.0000
.0000	.0000
.0000	.0000

X(4)-TO-C(4) COMPENSATOR

ROOT LOCUS GAIN = -.6241+01

BODE GAIN = .3455+06

ROOTS

REAL PART	IMAGINARY PART
-.2548-07	.6572-07
-.2[illegible]-07	-.6572-07
-.2[illegible]+01	.0000
-.1955+01	.0000
-.2553-00	.0000
-.2530-01	.0000
.2540+01	.0000
.2072-00	.3[illegible]-00
.2072-00	-.3755-00
-.1213-06	.0000

X(5)-TO-C(4) COMPENSATOR

ROOT LOCUS GAIN = -.6077-01

BODE GAIN = -.3428+04 **NOT REPRODUCIBLE**

ROOTS

REAL PART	IMAGINARY PART
.2051-01	.0000
-.4540-01	.3182-01
-.4540-01	-.3182-01
-.4679+02	.0000
-.2724+01	.0000
.2374+01	.0000
-.6050-02	.0000
.4217-06	.1576-07
.4217-06	-.1576-07
.2942-06	.0000

X(6)-TO-C(4) NUMERATOR

ROOT LOCUS GAIN = .6297+01

BODE GAIN = .2869+07

ROOTS

REAL PART	IMAGINARY PART
-.1614-07	.0000
-.4938+01	.0000
-.1953+01	.0000
-.5768-01	.4776-00
-.5768-01	-.4776-00
.1693-00	.2796-00
.1693-00	-.2796-00
-.2612-00	.0000
.1720-10	.0000
.0000	.0000

NOT REPRODUCIBLE