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SCHOOL OF ENGINEERING
AND APPLIED SCIENCE

Proving the Correctness of the Flight Director Program EADIFD

Volume Two

Proofs of Paths
1 Through 29

By

Frank J. Lee
Department of Electrical Engineering
&
Computer Science
School of Engineering & Applied Science
The George Washington University

July 1977

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COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 1

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: EFDRTN1.EQ.&RA
H4: &AC1.EQ.TMEFLG
H5: .NOT.&AC1.EQ.0
H6: &AC2.EQ.PCUMWD
H7: &AC3.EQ.AND(&AC2,T12)
H8: MPILS1.EQ.&AC3
H9: &AC4.EQ.MPILS1
H10: .NOT.&AC4.EQ.0
H11: &AC5.EQ.ILSUN
H12: .NOT.&AC5.EQ.0
H13: &AC6.EQ.GRUND
H14: .NOT.&AC6.EQ.0
H15: START1.EQ.0
H16: LOCFD1.EQ.0
H17: GSFD1.EQ.0

CONCLUSIONS
C1: CCRUZFD
C2: START1.EQ.START04
C3: LOCFD1.EQ.LOCF006
C4: GSFD1.EQ.GSFD02
C5: MPILS1.EQ.MPILS01
C6: TP1.EQ.TP102
C7: TP2.EQ.TP202
C8: TP3.EQ.TP302
C9: TP4.EQ.TP402
C10: TP5.EQ.TP502
C11: TP6.EQ.TP602
C12: TP7.EQ.TP702
C13: LOCDC.EQ.LOCDC04
C14: FLARE.EQ.FLARE02
C15: YETA.EQ.YETA02
C16: PSIE.EQ.PSIE02
C17: TMEFLG.NE.0
C18: .NOT.CFD42

THEOREMS USED
EQ2(P,Q)=P.EQ.Q.EQV.Q.EQ.P
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
NOT2(P,Q)=.NOT.P.EQ.C.EQV.P.NE.Q
OR2(A,B)=B.IMP.A.OR.B
EQV2(A,B)=B.(A.EQV.B).IMP.A
AND4(A,B)=A.B.IMP.A.AND.B
IF3(I,J,K,A)=I=J.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
OR1(A,B)=A.IMP.A.OR.B
NOT4(A)=A.EQV..NOT.(.NOT.A)
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
EQV3(A,B)=(A.EQV.B).,NOT.B.IMP..NOT.A
IF4(I,J,K,A)=I=K.,NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
NOTORAND3(A,B)=.NOT.A.IMP..NOT.(A.AND.B)

PROOF
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```
EQ3(MPILS1,&AC3.AND(PCUMWD,T12))

MACEXP(MPILS01)
EQ4(MPILS1,AND(PCUMWD,T12),MPILS01)

SUBST1(&AC1,TMEFLG,X,.NOT.(X.EQ.0))

NOT2(TMEFLG,0)
SUBST1(&AC6,GRUND,X,.NOT.(X.EQ.0))

NOT2(GRUND,0)
OR2((AND(PCUMWD,T12).EQ.0.OR.ILSON.EQ.0),
    GRUND.NE.0)
MACEXP(T1CRUZFD)

EQV2(T1CRUZFD,(AND(PCUMWD,T12).EQ.0).OR.(
    ILSON.EQ.0).OR.(GRUND.NE.0))


MACEXP(CFDIN1)
AND4(TMEFLG.NE.0,T1CRUZFD)

EQV2(CFDIN1,TMEFLG.NE.0.AND.T1CRUZFD)

MACEXP(LOCFD06)

IF3(LOCFD1.0,.IF.CLANDFD.THEN.LOCFD05.ELS
    E.LOCFD03,CFDIN1)

EQ4(LOCFD1,.IF.CFDIN1.THEN.0.ELSE..IF.CLA
    NDFD.THEN.LOCFD05.ELSE.LOCFD03,LOCFD0


MACEXP(CCRUZFD)

OR1(CFDIN1,CFD2.AND.LOCFD03=0)
EQV2(CCRUZFD,CFDIN1.OR.(CFD2.AND.LOCFD03=
    0))


MACEXP(START04)

IF3(START1.0,START03,CFDIN1)

EQ4(START1,.IF.CFDIN1.THEN.0.ELSE.START03
    ,START04)


MACEXP(GSFD02)

IF3(GSFD1.0,GSFD,CFDIN1)

EQ4(GSFD1,.IF.CFDIN1.THEN.0.ELSE.GSFD,GSF
    D02)


NOT4(T1CRUZFD)
OR2(.NOT.(TMEFLG.NE.0),.NOT.(.NOT.T1CRUZF
    D))
NOT3(TMEFLG.NE.0,.NOT.T1CRUZFD)
```

```
H7: &AC3.EQ.AND(&AC2,T12)
H8: MPILS1.EQ.&AC3
L1: &AC3.EQ.AND(PCUMWD,T12)
NONE
L2: MPILS1.EQ.AND(PCUMWD,T12)
L3: MPILS01.EQ.AND(PCUMWD,T12)
H4: &AC1.EQ.TMEFLG
H5: .NOT.&AC1.EQ.0
L4: .NOT.TMEFLG.EQ.0
H13: &AC6.EQ.GRUND
H14: .NOT.&AC6.EQ.0
L5: .NOT.GRUND.EQ.0
L6: GRUND.NE.0

NONE

L7: AND(PCUMWD,T12).EQ.0.OR.ILSON.EQ.0.OR
    .GRUND.NE.0
L8: T1CRUZFD.EQV.AND(PCUMWD,T12).EQ.0.OR.
    ILSON.EQ.0.OR.GRUND.NE.0
NONE
*C17: TMEFLG.NE.0
L9: T1CRUZFD
L11: TMEFLG.NE.0.AND.T1CRUZFD
L10: CFDIN1.EQV.TMEFLG.NE.0.AND.T1CRUZFD
NONE

H16: LOCFD1.EQ.0

L12: CFDIN1
L14: LOCFD1.EQ..IF.CFDIN1.THEN.0.ELSE..IF
    .CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L13: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
    F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
NONE

L12: CFDIN1
L16: CFDIN1.OR.CFD2.AND.LOCFD03.EQ.0

L15: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
NONE

H15: START1.EQ.0

L12: CFDIN1
L18: START1.EQ..IF.CFDIN1.THEN.0.ELSE.STA
    RT03
L17: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
NONE

H17: GSFD1.EQ.0

L12: CFDIN1
L20: GSFD1.EQ..IF.CFDIN1.THEN.0.ELSE.GSFD

L19: GSFD02.EQ..IF.CFDIN1.THEN.0.ELSE.GSF
    D
L9: T1CRUZFD
L21: .NOT.(.NOT.T1CRUZFD)

L22: .NOT.TMEFLG.NE.0.OR..NOT.(.NOT.T1CRU
```

```
L2: MPILS1.EQ.AND(PCUMWD,T12)

L3: MPILS01.EQ.AND(PCUMWD,T12)
*C5: MPILS1.EQ.MPILS01

L4: .NOT.TMEFLG.EQ.0

*C17: TMEFLG.NE.0
L5: .NOT.GRUND.EQ.0

L6: GRUND.NE.0
L7: AND(PCUMWD,T12).EQ.0.OR.ILSON.EQ.0.OR
    .GRUND.NE.0
L8: T1CRUZFD.EQV.AND(PCUMWD,T12).EQ.0.OR.
    ILSON.EQ.0.OR.GRUND.NE.0
L9: T1CRUZFD


L10: CFDIN1.EQV.TMEFLG.NE.0.AND.T1CRUZFD
L11: TMEFLG.NE.0.AND.T1CRUZFD

L12: CFDIN1

L13: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
    F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L14: LOCFD1.EQ..IF.CFDIN1.THEN.0.ELSE..IF
    .CLANDFD.THEN.LOCFD05.ELSE.LOCFD03

*C3: LOCFD1.EQ.LOCFD06


L15: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
L16: CFDIN1.OR.CFD2.AND.LOCFD03 .EQ.0
*C1: CCRUZFD


L17: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
L18: START1.EQ..IF.CFDIN1.THEN.0.ELSE.STA
    RT03

*C2: START1.EQ.START04


L19: GSFD02.EQ..IF.CFDIN1.THEN.0.ELSE.GSF
    D
L20: GSFD1.EQ..IF.CFDIN1.THEN.0.ELSE.GSFD

*C4: GSFD1.EQ.GSFD02


L21: .NOT.(.NOT.T1CRUZFD)
L22: .NOT.TMEFLG.NE.0.OR..NOT.(.NOT.T1CRU
    ZFD)
L23: .NOT.(TMEFLG.NE.0.AND..NOT.T1CRUZFD)
```

```
EQV3(CFDIN2,TMEFLG.NE.0.AND..NOT.TICRUZFD
     )


MACEXP(CFDIN3)
OR1(.NOT.CFDIN2..NOT.START=0)
NOT3(CFDIN2.START=0)
EQV3(CFDIN3,CFDIN2.AND.START=0)

MACEXP(TP102)
IF4(TP1.0.TP1.CFDIN3)

EQ4(TP1,.IF.CFDIN3.THEN.0.ELSE.TP1.TP102)


MACEXP(TP202)
IF4(TP2.0.TP2.CFDIN3)

EQ4(TP2,.IF.CFDIN3.THEN.0.ELSE.TP2.TP202)


MACEXP(TP302)
IF4(TP3,0,TP3,CFDIN3)

EQ4(TP3,.IF.CFDIN3.THEN.0.ELSE.TP3,TP302)


MACEXP(TP402)
IF4(TP4.0.TP4.CFDIN3)

EQ4(TP4,.IF.CFDIN3.THEN.0.ELSE.TP4,TP402)


MACEXP(TP502)
IF4(TP5.0.TP5.CFDIN3)

EQ4(TP5,.IF.CFDIN3.THEN.0.ELSE.TP5.TP502)


MACEXP(TP602)
IF4(TP6.0.TP6.CFDIN3)

EQ4(TP6,.IF.CFDIN3.THEN.0.ELSE.TP6,TP602)


MACEXP(TP702)
IF4(TP7.0.TP7.CFDIN3)

EQ4(TP7,.IF.CFDIN3.THEN.0.ELSE.TP7.TP702)


MACEXP(LOCOC04)

MACEXP(LOCOC02)

IF4(LOCOC.0.LOCOC.CFDIN3)


EQ4(LOCOC,.IF.CFDIN3.THEN.0.ELSE.LOCOC.LO
    COC02)


MACEXP(CFD3)
```

```
L24: CFDIN2.EQV.TMEFLG.NE.0.AND..NOT.TICR
     UZFD
L23: .NOT.(TMEFLG.NE.0.AND..NOT.TICRUZFD)

NONE
L25: .NOT.CFDIN2
L27: .NOT.CFDIN2.OR..NOT.START.EQ.0
L26: CFDIN3.EQV.CFDIN2.AND.START.EQ.0
L28: .NOT.(CFDIN2.AND.START.EQ.0)
NONE
A1: TP1.EQ.TP1
L29: .NOT.CFDIN3
L31: TP1.EQ..IF.CFDIN3.THEN.0.ELSE.TP1

L30: TP102.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
NONE
A2: TP2.EQ.TP2
L29: .NOT.CFDIN3
L33: TP2.EQ..IF.CFDIN3.THEN.0.ELSE.TP2

L32: TP202.EQ..IF.CFDIN3.THEN.0.ELSE.TP2
NONE
A3: TP3.EQ.TP3
L29: .NOT.CFDIN3
L35: TP3.EQ..IF.CFDIN3.THEN.0.ELSE.TP3

L34: TP302.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
NONE
A4: TP4.EQ.TP4
L29: .NOT.CFDIN3
L37: TP4.EQ..IF.CFDIN3.THEN.0.ELSE.TP4

L36: TP402.EQ..IF.CFDIN3.THEN.0.ELSE.TP4
NONE
A5: TP5.EQ.TP5
L29: .NOT.CFDIN3
L39: TP5.EQ..IF.CFDIN3.THEN.0.ELSE.TP5

L38: TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
NONE
A6: TP6.EQ.TP6
L29: .NOT.CFDIN3
L41: TP6.EQ..IF.CFDIN3.THEN.0.ELSE.TP6

L40: TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
NONE
A7: TP7.EQ.TP7
L29: .NOT.CFDIN3
L43: TP7.EQ..IF.CFDIN3.THEN.0.ELSE.TP7

L42: TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
NONE

NONE

A8: LOCOC.EQ.LOCOC

L29: .NOT.CFDIN3
L46: LOCOC.EQ..IF.CFDIN3.THEN.0.ELSE.LOCO
     C
L45: LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
     COC
NONE
```

```
L25: .NOT.CFDIN2


L26: CFDIN3.EQV.CFDIN2.AND.START.EQ.0
L27: .NOT.CFDIN2.OR..NOT.START.EQ.0
L28: .NOT.(CFDIN2.AND.START.EQ.0)
L29: .NOT.CFDIN3

L30: TP102.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
L31: TP1.EQ..IF.CFDIN3.THEN.0.ELSE.TP1

*C6: TP1.EQ.TP102


L32: TP202.EQ..IF.CFDIN3.THEN.0.ELSE.TP2
L33: TP2.EQ..IF.CFDIN3.THEN.0.ELSE.TP2

*C7: TP2.EQ.TP202


L34: TP302.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
L35: TP3.EQ..IF.CFDIN3.THEN.0.ELSE.TP3

*C8: TP3.EQ.TP302


L36: TP402.EQ..IF.CFDIN3.THEN.0.ELSE.TP4
L37: TP4.EQ..IF.CFDIN3.THEN.0.ELSE.TP4

*C9: TP4.EQ.TP402


L38: TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
L39: TP5.EQ..IF.CFDIN3.THEN.0.ELSE.TP5

*C10: TP5.EQ.TP502


L40: TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
L41: TP6.EQ..IF.CFDIN3.THEN.0.ELSE.TP6

*C11: TP6.EQ.TP602


L42: TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
L43: TP7.EQ..IF.CFDIN3.THEN.0.ELSE.TP7

*C12: TP7.EQ.TP702


L44: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
L45: LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
     COC
L46: LOCOC.EQ..IF.CFDIN3.THEN.0.ELSE.LOCO
     C

L47: LOCOC.EQ.LOCOC02


L48: CFD3.EQV.CFDIN2.AND.TFD3
```

```
EQV3(CFD3,CFDIN2.AND.TFD3)

IF4(LOCOC.SET.LOCOC02.CFD3)

EQ4(LOCOC,.IF.CFD3.THEN.SET.ELSE.LOCOC02.
    LOCOC04)

MACEXP(FLARE02)

IF4(FLARE,0,FLARE,CFDIN3)

EQ4(FLARE,.IF.CFDIN3.THEN.0.ELSE.FLARE,FL
    ARE02)

MACEXP(YETA02)

IF3(YETA,YETA,YETA01,CFDIN1)

EQ4(YETA,.IF.CFDIN1.THEN.YETA.ELSE.YETA01
    ,YETA02)

MACEXP(PSIE02)

IF3(PSIE,PSIE,PSIE01,CFDIN1)

EQ4(PSIE,.IF.CFDIN1.THEN.PSIE.ELSE.PSIE01
    ,PSIE02)

MACEXP(CFD42)

MACEXP(CFD4)

NOTORAND3(CFDIN2,TFD3.OR.GUID2D=0)

EQV3(CFD4,CFDIN2.AND.(TFD3.OR.GUID2D=0))


NOTORAND3(CFD4,LBS.NE.0)
NOTORAND3(CFD4.AND.LBS.NE.0,LOCFD03.NE.0)

EQV3(CFD42,CFD4.AND.LBS.NE.0.AND.LOCFD03.
    NE.0)


***** Q. F. D. *****
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L50: .NOT.(CFDIN2.AND.TFD3)
L47: LOCOC.EQ.LOCOC02

L51: .NOT.CFD3
L52: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
    C02
L44: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
    COC02
NONE

A9: FLARE.EQ.FLARE

L29: .NOT.CFDIN3
L54: FLARE.EQ..IF.CFDIN3.THEN.0.ELSE.FLAR
    E
L53: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
    ARE
NONE

A10: YETA.EQ.YETA

L12: CFDIN1
L56: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
    TA01
L55: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
    YETA01
NONE

A11: PSIE.EQ.PSIE

L12: CFDIN1
L58: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
    IE01
L57: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
    PSIE01
NONE

NONE

L25: .NOT.CFDIN2

L60: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
    EQ.0)
L61: .NOT.(CFDIN2.AND.(TFD3.OR.GUID2D.EQ.
    0))
L62: .NOT.CFD4
L63: .NOT.(CFD4.AND.LBS.NE.0)

L59: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D03.NE.0
L64: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    NE.0)
```

```
L52: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
    C02

*C13: LOCOC.EQ.LOCOC04


L53: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
    ARE
L54: FLARE.EQ..IF.CFDIN3.THEN.0.ELSE.FLAR
    E

*C14: FLARE.EQ.FLARE02


L55: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
    YETA01
L56: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
    TA01

*C15: YETA.EQ.YETA02


L57: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
    PSIE01
L58: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
    IE01

*C16: PSIE.EQ.PSIE02


L59: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D03.NE.0
L60: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
    EQ.0)
L61: .NOT.(CFDIN2.AND.(TFD3.OR.GUID2D.EQ.
    0))
L62: .NOT.CFD4


L63: .NOT.(CFD4.AND.LBS.NE.0)
L64: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    NE.0)
*C18: .NOT.CFD42
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COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 2

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: EPORTN1.EQ.ERA
H4: EAC1.EQ.TMEFLG
H5: .NOT.EAC1.EQ.0
H6: EACP.EQ.PCUMWD
H7: EAC3.EQ.AND(EAC2,T12)
H8: MPILS1.EQ.EAC3
H9: EAC4.EQ.MPILS1
H10: .NOT.EAC4.EQ.0
H11: EAC5.EQ.ILSON
H12: .NOT.EAC5.EQ.0
H13: EAC6.EQ.GROUND
H14: EAC6.EQ.0
H15: EAC7.EQ.START
H16: .NOT.EAC7.NE.0
H17: EAC8.EQ.SET
H18: START1.EQ.EAC8
H19: TP11.EQ.0
H20: TP21.EQ.0
H21: TP31.EQ.0
H22: TP41.EQ.0
H23: TP51.EQ.0
H24: TP61.EQ.0
H25: TP71.EQ.0
H26: LOCFD1.EQ.0
H27: LOCOC1.EQ.0
H28: FLARE1.EQ.0

CONCLUSIONS
C1: CFD1
C2: MPILS1.EQ.MPILS01
C3: TP11.EQ.TP102
C4: TP21.EQ.TP202
C5: TP31.EQ.TP302
C6: TP41.EQ.TP402
C7: TP51.EQ.TP502
C8: TP61.EQ.TP602
C9: TP71.EQ.TP702
C10: LOCFD1.EQ.LOCFD03
C11: LOCOC1.EQ.LOCOC02
C12: FLARE1.EQ.FLARE02
C13: START1.EQ.START03
C14: GSFD.EQ.GSFD02
C15: .NOT.CFDIN1
C16: TMEFLG.NE.0

THEOREMS USED
SUBST1(P,Q,R,A(P))=P.EQ.Q.A(P).IMP.A(Q)
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
NOT2(P,Q)=.NOT.P.EQ.Q.EQV.P.NE.Q
NOT3(P,Q)=P.EQ.Q.EQV..NOT.(P.NE.Q)
NOT6(A,B,C)=.NOT.A..NOT.B..NOT.C.IMP..NOT.(A.OR.B.OR.C)
EQV4(A,B)=(A.IMP.B).AND.(B.IMP.A).EQV..TRUE.
```

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IF3(I,J,K,A)=I=J.A.TMP.I=(.IF.A.THEN.J.ELSE.K)
OR2(A,B)=C.TMP.A.OR.B
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
IF4(I,J,K,A)=I=K..NOT.A.TMP.I=(.IF.A.THEN.J.ELSE.K)

PROOF

THEOREMS
SUBST1(&AC2,PCUMWD,X,&AC3=AND(X,T12))

EQ3(MPILS1,&AC3,AND(PCUMWD,T12))

MACEXP(MPILS01)
EQ4(MPILS1,AND(PCUMWD,T12),MPILS01)

SUBST1(&AC1,TMEFLG,X,.NOT.(X.EQ.0))

NOT2(TMEFLG,0)
SUBST1(&AC6,GRUND,X,(X.EQ.0))

NOT5(GRUND,0)
SUBST1(&AC5,ILSON,X,.NOT.(X.EQ.0))

SUBST1(&AC4,MPILS1,X,.NOT.(X.EQ.0))

SUBST1(MPILS1,AND(PCUMWD,T12),X,.NOT.(X.E
    Q.0))

NOT6(AND(PCUMWD,T12)=0,ILSON.EQ.0,GRUND.N
    E.0)

MACEXP(T1CRUZFD)

EQV3(T1CRUZFD,AND(PCUMWD,T12).EQ.0.OR.ILS
    ON.EQ.0.OR.GRUND.NE.0)

AND4(TMEFLG.NE.0,.NOT.T1CRUZFD)

MACEXP(CFDIN2)

EQV2(CFDIN2,TMEFLG.NE.0.AND..NOT.T1CRUZFD
    )

MACEXP(CFD1)
EQV2(CFD1,CFDIN2)

EQ3(&AC7,START,START)

SUBST1(&AC7,START,X,.NOT.(X.NE.0))

NOT5(START,0)
AND4(CFDIN2,START=0)

MACEXP(CFDIN3)
EQV2(CFDIN3,CFDIN2.AND.START.EQ.0)

MACEXP(TP102)
IF3(TP11.0,TP1,CFDIN3)

EQ4(TP11,.IF.CFDIN3.THEN.0.ELSE.TP1,TP102
    )
```

```
HYPOTHESES
H6: &AC2.EQ.PCUMWD
H7: &AC3.EQ.AND(&AC2,T12)
H8: MPILS1.EQ.&AC3
L1: &AC3.EQ.AND(PCUMWD,T12)
NONE
L2: MPILS1.EQ.AND(PCUMWD,T12)
L3: MPILS01.EQ.AND(PCUMWD,T12)
H4: &AC1.EQ.TMEFLG
H5: .NOT.&AC1.EQ.0
L4: .NOT.TMEFLG.EQ.0
H13: &AC6.EQ.GRUND
H14: &AC6.EQ.0
L5: GRUND.EQ.0
H11: &AC5.EQ.ILSON
H12: .NOT.&AC5.EQ.0
H9: &AC4.EQ.MPILS1
H10: .NOT.&AC4.EQ.0
L2: MPILS1.EQ.AND(PCUMWD,T12)

L8: .NOT.MPILS1.EQ.0
L9: .NOT.AND(PCUMWD,T12).EQ.0

L7: .NOT.ILSON.EQ.0
L6: .NOT.GRUND.NE.0
NONE

L11: T1CRUZFD.EQV.AND(PCUMWD,T12).EQ.0.OR
    .ILSON.EQ.0.OR.GRUND.NE.0
L10: .NOT.(AND(PCUMWD,T12).EQ.0.OR.ILSON.
    EQ.0.OR.GRUND.NE.0)
#C16: TMEFLG.NE.0
L12: .NOT.T1CRUZFD
NONE

L13: TMEFLG.NE.0.AND..NOT.T1CRUZFD

L14: CFDIN2.EQV.TMEFLG.NE.0.AND..NOT.T1CR
    UZFD
NONE
L15: CFDIN2
L16: CFD1.EQV.CFDIN2
H15: &AC7.EQ.START
A1: START.EQ.START
H15: &AC7.EQ.START
H16: .NOT.&AC7.NE.0
L17: .NOT.START.NE.0
L15: CFDIN2
L18: START.EQ.0
NONE
L19: CFDIN2.AND.START.EQ.0
L20: CFDIN3.EQV.CFDIN2.AND.START.EQ.0
NONE
H19: TP11.EQ.0
L21: CFDIN3
L23: TP11.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
```

```
CONCLUSIONS
L1: &AC3.EQ.AND(PCUMWD,T12)

L2: MPILS1.EQ.AND(PCUMWD,T12)

L3: MPILS01.EQ.AND(PCUMWD,T12)
&C2: MPILS1.EQ.MPILS01

L4: .NOT.TMEFLG.EQ.0

*C16: TMEFLG.NE.0
L5: GRUND.EQ.0

L6: .NOT.GRUND.NE.0
L7: .NOT.ILSON.EQ.0

L8: .NOT.MPILS1.EQ.0

L9: .NOT.AND(PCUMWD,T12).EQ.0

L10: .NOT.(AND(PCUMWD,T12).EQ.0.OR.ILSON.
    EQ.0.OR.GRUND.NE.0)

L11: T1CRUZFD.EQV.AND(PCUMWD,T12).EQ.0.OR
    .ILSON.EQ.0.OR.GRUND.NE.0
L12: .NOT.T1CRUZFD

L13: TMEFLG.NE.0.AND..NOT.T1CRUZFD

L14: CFDIN2.EQV.TMEFLG.NE.0.AND..NOT.T1CR
    UZFD
L15: CFDIN2

L16: CFD1.EQV.CFDIN2
*C1: CFD1

H15: &AC7.EQ.START

L17: .NOT.START.NE.0

L18: START.EQ.0
L19: CFDIN2.AND.START.EQ.0

L20: CFDIN3.EQV.CFDIN2.AND.START.EQ.0
L21: CFDIN3

L22: TP102.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
L23: TP11.EQ..IF.CFDIN3.THEN.0.ELSE.TP1

*C3: TP11.EQ.TP102
```

```
IF3(TP21.0,TP2,CFDIN3)

EQ4(TP21..IF.CFDIN3.THEN.0.ELSE.TP2,TP202
    )

MACEXP(TP302)
IF3(TP31.0,TP3,CFDIN3)

EQ4(TP31..IF.CFDIN3.THEN.0.ELSE.TP3,TP302
    )

MACEXP(TP402)
IF3(TP41.0,TP4,CFDIN3)

EQ4(TP41..IF.CFDIN3.THEN.0.ELSE.TP4,TP402
    )

MACEXP(TP502)
IF3(TP51.0,TP5,CFDIN3)

EQ4(TP51..IF.CFDIN3.THEN.0.ELSE.TP5,TP502
    )

MACEXP(TP602)
IF3(TP61.0,TP6,CFDIN3)

EQ4(TP61..IF.CFDIN3.THEN.0.ELSE.TP6,TP602
    )

MACEXP(TP702)
IF3(TP71.0,TP7,CFDIN3)

EQ4(TP71..IF.CFDIN3.THEN.0.ELSE.TP7,TP702
    )

MACEXP(LOCFD03)

IF3(LOCFD1.0,LOCFD,CFDIN3)

EQ4(LOCFD1..IF.CFDIN3.THEN.0.ELSE.LOCFD,L
    OCFD03)

MACEXP(LOCOC02)

IF3(LOCOC1.0,LOCOC,CFDIN3)

EQ4(LOCOC1..IF.CFDIN3.THEN.0.ELSE.LOCOC,L
    OCOC02)

MACEXP(FLARE02)

IF3(FLARE1.0,FLARE,CFDIN3)

EQ4(FLARE1..IF.CFDIN3.THEN.0.ELSE.FLARE,F
    LARE02)

MACEXP(START03)
```

```
H20: TP21.EQ.0
L21: CFDIN3
L25: TP21.EQ..IF.CFDIN3.THEN.0.ELSE.TP2

L24: TP202.EQ..IF.CFDIN3.THEN.0.ELSE.TP2
NONE
H21: TP31.EQ.0
L21: CFDIN3
L27: TP31.EQ..IF.CFDIN3.THEN.0.ELSE.TP3

L26: TP302.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
NONE
H22: TP41.EQ.0
L21: CFDIN3
L29: TP41.EQ..IF.CFDIN3.THEN.0.ELSE.TP4

L28: TP402.EQ..IF.CFDIN3.THEN.0.ELSE.TP4
NONE
H23: TP51.EQ.0
L21: CFDIN3
L31: TP51.EQ..IF.CFDIN3.THEN.0.ELSE.TP5

L30: TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
NONE
H24: TP61.EQ.0
L21: CFDIN3
L33: TP61.EQ..IF.CFDIN3.THEN.0.ELSE.TP6

L32: TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
NONE
H25: TP71.EQ.0
L21: CFDIN3
L35: TP71.EQ..IF.CFDIN3.THEN.0.ELSE.TP7

L34: TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
NONE

H26: LOCFD1.EQ.0

L21: CFDIN3
L37: LOCFD1.EQ..IF.CFDIN3.THEN.0.ELSE.LOC
     FD
L36: LOCFD03.EQ..IF.CFDIN3.THEN.0.ELSE.LO
     CFD
NONE

H27: LOCOC1.EQ.0

L21: CFDIN3
L39: LOCOC1.EQ..IF.CFDIN3.THEN.0.ELSE.LOC
     OC
L38: LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
     COC
NONE

H28: FLARE1.EQ.0

L21: CFDIN3
L41: FLARE1.EQ..IF.CFDIN3.THEN.0.ELSE.FLA
     RE
L40: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
     ARE
NONE
```

```
L25: TP21.EQ..IF.CFDIN3.THEN.0.ELSE.TP2

*C4: TP21.EQ.TP202


L26: TP302.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
L27: TP31.EQ..IF.CFDIN3.THEN.0.ELSE.TP3

*C5: TP31.EQ.TP302


L28: TP402.EQ..IF.CFDIN3.THEN.0.ELSE.TP4
L29: TP41.EQ..IF.CFDIN3.THEN.0.ELSE.TP4

*C6: TP41.EQ.TP402


L30: TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
L31: TP51.EQ..IF.CFDIN3.THEN.0.ELSE.TP5

*C7: TP51.EQ.TP502


L32: TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
L33: TP61.EQ..IF.CFDIN3.THEN.0.ELSE.TP6

*C8: TP61.EQ.TP602


L34: TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
L35: TP71.EQ..IF.CFDIN3.THEN.0.ELSE.TP7

*C9: TP71.EQ.TP702


L36: LOCFD03.EQ..IF.CFDIN3.THEN.0.ELSE.LO
     CFD
L37: LOCFD1.EQ..IF.CFDIN3.THEN.0.ELSE.LOC
     FD

*C10: LOCFD1.EQ.LOCFD03


L38: LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
     COC
L39: LOCOC1.EQ..IF.CFDIN3.THEN.0.ELSE.LOC
     OC

*C11: LOCOC1.EQ.LOCOC02


L40: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
     ARE
L41: FLARE1.EQ..IF.CFDIN3.THEN.0.ELSE.FLA
     RE

*C12: FLARE1.EQ.FLARE02


L42: START03.EQ..IF.CFDIN3.THEN.SET.ELSE.
```

```
IF3(START1.SET.START.CFDIN3)

EQ4(START1..IF.CFDIN3.THEN.SET.ELSE.START
    .START03)

MACEXP(GSFD02)

OR2(.NOT.(TMEFLG.NE.0)..NOT.T1CRUZFD)
NOT3(TMEFLG.NE.0.T1CRUZFD)
MACEXP(CFDIN1)
EQV3(CFDIN1.TMEFLG.NE.0.AND.T1CRUZFD)

IF4(GSFD.0.GSFD.CFDIN1)

EQ4(GSFD..IF.CFDIN1.THEN.0.ELSE.GSFD.GSFD
    02)

***** 0. E. 0. *****
```

```
L43: START1.EQ.SET

L21: CFDIN3
L44: START1.EQ..IF.CFDIN3.THEN.SET.ELSE.S
     TART
L42: START03.EQ..IF.CFDIN3.THEN.SET.ELSE.
     START
NONE

L19: .NOT.T1CRUZFD
L46: .NOT.TMEFLG.NE.0.OR..NOT.T1CRUZFD
NONE
L48: CFDIN1.EQV.TMEFLG.NE.0.AND.T1CRUZFD
L47: .NOT.(TMEFLG.NE.0.AND.T1CRUZFD)
A2: GSFD.EQ.GSFD
*C15: .NOT.CFDIN1
L49: GSFD.EQ..IF.CFDIN1.THEN.0.ELSE.GSFD

L45: GSFD02.EQ..IF.CFDIN1.THEN.0.ELSE.GSF
     D
```

```
L44: START1.EQ..IF.CFDIN3.THEN.SET.ELSE.S
     TART

*C13: START1.EQ.START03


L45: GSFD02.EQ..IF.CFDIN1.THEN.0.ELSE.GSF
     D
L46: .NOT.TMEFLG.NE.0.OR..NOT.T1CRUZFD
L47: .NOT.(TMEFLG.NE.0.AND.T1CRUZFD)
L48: CFDIN1.EQV.TMEFLG.NE.0.AND.T1CRUZFD
*C15: .NOT.CFDIN1

L49: GSFD.EQ..IF.CFDIN1.THEN.0.ELSE.GSFD

*C14: GSFD.EQ.GSFD02
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 3

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITC
H2: SPEC
H3: EEORTN1.EQ.&PA
H4: &AC1.EQ.TMPFLG
H5: .NOT.&AC1.EQ.0
H6: &AC2.EQ.PCUMWD
H7: &AC3.EQ.AND(&AC2,T12)
H8: MPILS1.EQ.&AC3
H9: &AC4.EQ.MPILS1
H10: .NOT.&AC4.EQ.0
H11: &AC5.EQ.ILSON
H12: .NOT.&AC5.EQ.0
H13: &AC6.EQ.GRUND
H14: &AC6.EQ.0
H15: &AC7.EQ.START
H16: &AC7.NE.3

CONCLUSIONS
C1: CFD1
C2: MPILS1.EQ.MPILS01
C3: TP1.EQ.TP102
C4: TP2.EQ.TP202
C5: TP3.EQ.TP302
C6: TP4.EQ.TP402
C7: TP5.EQ.TP502
C8: TP6.EQ.TP602
C9: TP7.EQ.TP702
C10: LOCFD.EQ.LOCFD03
C11: LOCOC.EQ.LOCOC02
C12: FLARE.EQ.FLARE02
C13: START.EQ.START03
C14: GSFD.EQ.GSFD02
C15: .NOT.CFD1N1
C16: TMPFLG.NE.0

THEOREMS USED
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
NOT2(P,Q)=.NOT.P.EQ.Q.EQV.P.NE.Q
NOT5(P,Q)=P.EQ.Q.EQV..NOT.(P.NE.Q)
NOT6(A,B,C)=.NOT.A.,.NOT.B.,.NOT.C.IMP..NOT.(A.OR.B.OR.C)
EQV3(A,B)=(A.EQV.B).,.NOT.B.IMP..NOT.A
AND4(A,B)=A.B.IMP.A.AND.B
EQV5(A,B)=B.(A.EQV.B).IMP.A
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
IF4(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
OR2(A,B)=B.IMP.A.OR.B

PROOF

THEOREMS
SUBST1(&AC2,PCUMWD,X,&AC3=AND(X,T12))

F.(C1,H1,H2,H3,H4,H5,H6,H7,H8,H9,H10,H11,H12,H13,H14,H15,H16)

HYPOTHESES
H6: &AC2.EQ.PCUMWD
H7: &AC2.EQ.AND(&AC2,T12)

CONCLUSIONS
L1: &AC3.EQ.AND(PCUMWD,T12)
```

```
EQ4(MPILS1,AND(PCUMWD,T12),MPILS01)

SUBST1(&AC1,TMEFLG,X,.NOT.(X.EQ.0))

NOT2(TMEFLG,0)
SUBST1(&AC6,GRUND,X,(X.EQ.0))

NOT5(GRUND,0)
SUBST1(&AC5,ILSON,X,.NOT.(X.EQ.0))

SUBST1(&AC4,MPILS1,X,.NOT.(X.EQ.0))

SUBST1(MPILS1,AND(PCUMWD,T12),X,.NOT.(X.E
    Q.0))

NOT6(AND(PCUMWD,T12)=0,ILSON.EQ.0.GRUND.N
    E.0)


MACEXP(T1CRUZFD)

EQV3(T1CRUZFD,AND(PCUMWD,T12).EQ.0.OR.ILS
    ON.EQ.0.OR.GRUND.NE.0)


AND4(TMEFLG.NE.0,.NOT.T1CRUZFD)

MACEXP(CFDIN2)

EQV2(CFDIN2,TMEFLG.NE.0.AND..NOT.T1CRUZFD
    )


MACEXP(CFD1)
EQV2(CFD1,CFDIN2)

EQ3(&AC7,START,START)

SUBST1(&AC7,START,X,X.NE.0)

NOT2(START,0)
OR2(.NOT.CFDIN2,.NOT.START=0)
NOT3(CFDIN2,START=0)
MACEXP(CFDIN3)
EQV3(CFDIN3,CFDIN2.AND.START=0)

MACEXP(TP102)
IF4(TP1,0,TP1,CFDIN3)

EQ4(TP1,.IF.CFDIN3.THEN.0.ELSE.TP1,TP102)


MACEXP(TP202)
IF4(TP2,0,TP2,CFDIN3)

EQ4(TP2,.IF.CFDIN3.THEN.0.ELSE.TP2,TP202)


MACEXP(TP302)
IF4(TP3,0,TP3,CFDIN3)

EQ4(TP3,.IF.CFDIN3.THEN.0.ELSE.TP3,TP302)
```

```
L2: MPILS1.EQ.AND(PCUMWD,T12)
L3: MPILS01.EQ.AND(PCUMWD,T12)
H4: &AC1.EQ.TMEFLG
H5: .NOT.&AC1.EQ.0
L4: .NOT.TMEFLG.EQ.0
H13: &AC6.EQ.GRUND
H14: &AC6.EQ.0
L5: GRUND.EQ.0
H11: &AC5.EQ.ILSON
H12: .NOT.&AC5.EQ.0
H9: &AC4.EQ.MPILS1
H10: .NOT.&AC4.EQ.0
L2: MPILS1.EQ.AND(PCUMWD,T12)
L8: .NOT.MPILS1.EQ.0
L9: .NOT.AND(PCUMWD,T12).EQ.0

L7: .NOT.ILSON.EQ.0
L6: .NOT.GRUND.NE.0
NONE

L11: T1CRUZFD.EQV.AND(PCUMWD,T12).EQ.0.OR
    .ILSON.EQ.0.OR.GRUND.NE.0
L10: .NOT.(AND(PCUMWD,T12).EQ.0.OR.ILSON.
    EQ.0.OR.GRUND.NE.0)
*C16: TMEFLG.NE.0
L12: .NOT.T1CRUZFD
NONE

L13: TMEFLG.NE.0.AND..NOT.T1CRUZFD

L14: CFDIN2.EQV.TMEFLG.NE.0.AND..NOT.T1CR
    UZFD
NONE
L15: CFDIN2
L16: CFD1.EQV.CFDIN2
H15: &AC7.EQ.START
A1: START.EQ.START
H15: &AC7.EQ.START
H16: &AC7.NE.0
L17: START.NE.0
L18: .NOT.START.EQ.0
L19: .NOT.CFDIN2.OR..NOT.START.EQ.0
NONE
L21: CFDIN3.EQV.CFDIN2.AND.START.EQ.0
L20: .NOT.(CFDIN2.AND.START.EQ.0)
NONE
A2: TP1.EQ.TP1
L22: .NOT.CFDIN3
L24: TP1.EQ..IF.CFDIN3.THEN.0.ELSE.TP1

L23: TP102.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
NONE
A3: TP2.EQ.TP2
L22: .NOT.CFDIN3
L26: TP2.EQ..IF.CFDIN3.THEN.0.ELSE.TP2

L25: TP202.EQ..IF.CFDIN3.THEN.0.ELSE.TP2
NONE
A4: TP3.EQ.TP3
L22: .NOT.CFDIN3
L28: TP3.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
```

```
*C2: MPILS1.EQ.MPILS01

L4: .NOT.TMEFLG.EQ.0

*C16: TMEFLG.NE.0
L5: GRUND.EQ.0

L6: .NOT.GRUND.NE.0
L7: .NOT.ILSON.EQ.0

L8: .NOT.MPILS1.EQ.0

L9: .NOT.AND(PCUMWD,T12).EQ.0


L10: .NOT.(AND(PCUMWD,T12).EQ.0.OR.ILSON.
    EQ.0.OR.GRUND.NE.0)


L11: T1CRUZFD.EQV.AND(PCUMWD,T12).EQ.0.OR
    .ILSON.EQ.0.OR.GRUND.NE.0
L12: .NOT.T1CRUZFD


L13: TMEFLG.NE.0.AND..NOT.T1CRUZFD

L14: CFDIN2.EQV.TMEFLG.NE.0.AND..NOT.T1CR
    UZFD
L15: CFDIN2


L16: CFD1.EQV.CFDIN2
*C1: CFD1

H15: &AC7.EQ.START

L17: START.NE.0

L18: .NOT.START.EQ.0
L19: .NOT.CFDIN2.OR..NOT.START.EQ.0
L20: .NOT.(CFDIN2.AND.START.EQ.0)
L21: CFDIN3.EQV.CFDIN2.AND.START.EQ.0
L22: .NOT.CFDIN3

L23: TP102.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
L24: TP1.EQ..IF.CFDIN3.THEN.0.ELSE.TP1

*C3: TP1.EQ.TP102

L25: TP202.EQ..IF.CFDIN3.THEN.0.ELSE.TP2
L26: TP2.EQ..IF.CFDIN3.THEN.0.ELSE.TP2

*C4: TP2.EQ.TP202

L27: TP302.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
L28: TP3.EQ..IF.CFDIN3.THEN.0.ELSE.TP3

*C5: TP3.EQ.TP302
```

```
EQ4(TP4,.IF.CFDIN3.THEN.0.ELSE.TP4,TP402)

MACEXP(TP502)
IF4(TP5,0,TP5,CFDIN3)

EQ4(TP5,.IF.CFDIN3.THEN.0.ELSE.TP5,TP502)

MACEXP(TP602)
IF4(TP6,0,TP6,CFDIN3)

EQ4(TP6,.IF.CFDIN3.THEN.0.ELSE.TP6,TP602)

MACEXP(TP702)
IF4(TP7,0,TP7,CFDIN3)

EQ4(TP7,.IF.CFDIN3.THEN.0.ELSE.TP7,TP702)

MACEXP(LOCFD03)

IF4(LOCFD,0,LOCFD,CFDIN3)

EQ4(LOCFD,.IF.CFDIN3.THEN.0.ELSE.LOCFD,LO
    CFD03)

MACEXP(LOCOC02)

IF4(LOCOC,0,LOCOC,CFDIN3)

EQ4(LOCOC,.IF.CFDIN3.THEN.0.ELSE.LOCOC,LO
    COC02)

MACEXP(FLARE02)

IF4(FLARE,0,FLARE,CFDIN3)

EQ4(FLARE,.IF.CFDIN3.THEN.0.ELSE.FLARE,FL
    ARE02)

MACEXP(START03)

IF4(START,SET,START,CFDIN3)

EQ4(START,.IF.CFDIN3.THEN.SET.ELSE.START,
    START03)

MACEXP(GSFD02)

OR2(.NOT.(TMEFLG.NE.0),.NOT.TICRUZFD)
NOT3(TMEFLG.NE.0,TICRUZFD)
MACEXP(CFDIN1)
EQV(...IN1,...
```

```
L22: .NOT.CFDIN3
L30: TP4.EQ..IF.CFDIN3.THEN.0.ELSE.TP4

L29: TP402.EQ..IF.CFDIN3.THEN.0.ELSE.TP4
NONE
A6: TP5.EQ.TP5
L22: .NOT.CFDIN3
L32: TP5.EQ..IF.CFDIN3.THEN.0.ELSE.TP5

L31: TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
NONE
A7: TP6.EQ.TP6
L22: .NOT.CFDIN3
L34: TP6.EQ..IF.CFDIN3.THEN.0.ELSE.TP6

L33: TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
NONE
A8: TP7.EQ.TP7
L22: .NOT.CFDIN3
L36: TP7.EQ..IF.CFDIN3.THEN.0.ELSE.TP7

L35: TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
NONE

A9: LOCFD.EQ.LOCFD

L22: .NOT.CFDIN3
L38: LOCFD.EQ..IF.CFDIN3.THEN.0.ELSE.LOCF
    D
L37: LOCFD03.EQ..IF.CFDIN3.THEN.0.ELSE.LO
    CFD
NONE

A10: LOCOC.EQ.LOCOC

L22: .NOT.CFDIN3
L40: LOCOC.EQ..IF.CFDIN3.THEN.0.ELSE.LOCO
    C
L39: LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
    COC
NONE

A11: FLARE.EQ.FLARE

L22: .NOT.CFDIN3
L42: FLARE.EQ..IF.CFDIN3.THEN.0.ELSE.FLAR
    E
L41: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
    ARE
NONE

A1: START.EQ.START

L22: .NOT.CFDIN3
L44: START.EQ..IF.CFDIN3.THEN.SET.ELSE.ST
    ART
L43: START03.EQ..IF.CFDIN3.THEN.SET.ELSE.
    START
NONE

L12: .NOT.TICRUZFD
L46: .NOT.TMEFLG.NE.0.OR..NOT.TICRUZFD
NONE
```

```
*C6: TP4.EQ.TP402

L31: TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
L32: TP5.EQ..IF.CFDIN3.THEN.0.ELSE.TP5

*C7: TP5.EQ.TP502

L33: TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
L34: TP6.EQ..IF.CFDIN3.THEN.0.ELSE.TP6

*C8: TP6.EQ.TP602

L35: TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
L36: TP7.EQ..IF.CFDIN3.THEN.0.ELSE.TP7

*C9: TP7.EQ.TP702

L37: LOCFD03.EQ..IF.CFDIN3.THEN.0.ELSE.LO
    CFD
L38: LOCFD.EQ..IF.CFDIN3.THEN.0.ELSE.LOCF
    D

*C10: LOCFD.EQ.LOCFD03

L39: LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
    COC
L40: LOCOC.EQ..IF.CFDIN3.THEN.0.ELSE.LOCO
    C

*C11: LOCOC.EQ.LOCOC02

L41: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
    ARE
L42: FLARE.EQ..IF.CFDIN3.THEN.0.ELSE.FLAR
    E

*C12: FLARE.EQ.FLARE02

L43: START03.EQ..IF.CFDIN3.THEN.SET.ELSE.
    START
L44: START.EQ..IF.CFDIN3.THEN.SET.ELSE.ST
    ART

*C13: START.EQ.START03

L45: GSFD02.EQ..IF.CFDIN1.THEN.0.ELSE.GSF
    D
L46: .NOT.TMEFLG.NE.0.OR..NOT.TICRUZFD
L47: .NOT.(TMEFLG.NE.0.AND.TICRUZFD)
L48: CFDIN1.EQV.TMEFLG.NE.0.AND.TICRUZFD
```

*C15: .NOT.CFDIN1

EQ4(GSFD..IF.CFDIN1.THEN.0.ELSE.GSFD,GSFD02)

L49: GSFD.EQ..IF.CFDIN1.THEN.0.ELSE.GSFD

*C14: GSFD.EQ.GSFD02

L45: GSFD02.EQ..IF.CFDIN1.THEN.0.ELSE.GSFD

***** Q. E. D. *****

COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 4

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: EFDRTN1.EQ.&PA
H4: &AC1.EQ.TMEFLG
H5: .NOT.&AC1.EQ.0
H6: &AC2.EQ.PCUMWD
H7: &AC3.EQ.AND(&AC2,T12)
H8: MPILS1.EQ.&AC3
H9: &AC4.EQ.MPILS1
H10: .NOT.&AC4.EQ.0
H11: &AC5.EQ.ILSON
H12: &AC5.EQ.0
H13: START1.EQ.0
H14: LOCFD1.EQ.0
H15: GSFD1.EQ.0

CONCLUSIONS
C1: CCRUZFD
C2: START1.EQ.START04
C3: LOCFD1.EQ.LOCFD06
C4: GSFD1.EQ.GSFD02
C5: MPILS1.EQ.MPILS01
C6: TP1.EQ.TP102
C7: TP2.EQ.TP202
C8: TP3.EQ.TP302
C9: TP4.EQ.TP402
C10: TP5.EQ.TP502
C11: TP6.EQ.TP602
C12: TP7.EQ.TP702
C13: LOCCC.EQ.LOCDC04
C14: FLARE.EQ.FLARE02
C15: YETA.EQ.YETA02
C16: PSIE.EQ.PSIE02
C17: TMEFLG.NE.0
C18: .NOT.CFD42

THEOREMS USED
EQ2(P,Q)=P.EQ.Q.EQV.Q.EQ.P
SUBST1(P,Q,R,A(R))=P.EQ.Q,A(P).IMP.A(Q)
EQ3(P,Q,R)=P.EQ.Q,Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q,R.EQ.Q.IMP.P.EQ.R
NOT2(P,Q)=.NOT.P.EQ.Q.EQV.P.NE.Q
OR2(A,B)=B.IMP.A.OR.B
EQV2(A,B)=B,(A.EQV.B).IMP.A
AND4(A,B)=A,B.IMP.A.AND.B
IF3(I,J,K,A)=I=J,A.IMP.I=(.IF.A.THEN.J.ELSE.K)
OR1(A,B)=A.IMP.A.OR.B
NOT4(A)=A.EQV..NOT.(.NOT.A)
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
EQV3(A,B)=(A.EQV.B),.NOT.B.IMP..NOT.A
IF4(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
NOTORAND3(A,B)=.NOT.A.IMP..NOT.(A.AND.B)

PROOF

THEOREMS HYPOTHESES CONCLUSIONS

```
EQ3(MPILS1,&AC3,AND(PCUMWD,T12))

MACEXP(MPILS01)
EQ4(MPILS1,AND(PCUMWD,T12),MPILS01)

SUBST1(&AC1,TMEFLG,X,,NOT,(X,EQ,0))

NOT2(TMEFLG,0)
EQ2(&AC5,ILSON)
EQ3(ILSON,&AC5,0)

OR2(AND(PCUMWD,T12),EQ,0,ILSON=0)
OR1(AND(PCUMWD,T12)=0,OR,ILSON=0,GRUND,NE
    ,0)
MACEXP(T1CRUZFD)

EQV2(T1CRUZFD,(AND(PCUMWD,T12),EQ,0),OR,(
    ILSON,EQ,0),OR,(GRUND,NE,0))


MACEXP(CFDIN1)
AND4(TMEFLG,NE,0,T1CRUZFD)

EQV2(CFDIN1,TMEFLG,NE,0,AND,T1CRUZFD)

MACEXP(LOCFD06)

IF3(LOCFD1,0,,IF,CLANDFD,THEN,LOCFD05,ELS
    E,LOCFD03,CFDIN1)

EQ4(LOCFD1,,IF,CFDIN1,THEN,0,ELSE,,IF,CLA
    NDFD,THEN,LOCFD05,ELSE,LOCFD03,LOCFD0


MACEXP(CCRUZFD)

OR1(CFDIN1,CFD2,AND,LOCFD03=0)
EQV2(CCRUZFD,CFDIN1,OR,(CFD2,AND,LOCFD03=
    0))


MACEXP(START04)

IF3(START1,0,START03,CFDIN1)


EQ4(START1,,IF,CFDIN1,THEN,0,ELSE,START03
    ,START04)


MACEXP(GSFD02)

IF3(GSFD1,0,GSFD,CFDIN1)


EQ4(GSFD1,,IF,CFDIN1,THEN,0,ELSE,GSFD,GSF
    D02)


NOT4(T1CRUZFD)
OR2(,NOT,(TMEFLG,NE,0),,NOT,(,NOT,T1CRUZF
    D))
NOT3(TMEFLG,NE,0,,NOT,T1CRUZFD)

MACEXP(
```

```
H3: MPILS1,EQ,&AC3
L1: &AC3,EQ,AND(PCUMWD,T12)
NONE
L2: MPILS1,EQ,AND(PCUMWD,T12)
L3: MPILS01,EQ,AND(PCUMWD,T12)
H4: &AC1,EQ,TMEFLG
H5: ,NOT,&AC1,EQ,0
L4: ,NOT,TMEFLG,EQ,0
H11: &AC5,EQ,ILSON
L5: ILSON,EQ,&AC5
H12: &AC5,EQ,0
L6: ILSON,EQ,0
L7: AND(PCUMWD,T12),EQ,0,OR,ILSON,EQ,0

NONE

L8: AND(PCUMWD,T12),EQ,0,OR,ILSON,EQ,0,OR
    ,GRUND,NE,0
L9: T1CRUZFD,EQV,AND(PCUMWD,T12),EQ,0,OR,
    ILSON,EQ,0,OR,GRUND,NE,0
NONE
*C17: TMEFLG,NE,0
L10: T1CRUZFD
L12: TMEFLG,NE,0,AND,T1CRUZFD
L11: CFDIN1,EQV,TMEFLG,NE,0,AND,T1CRUZFD
NONE

H14: LOCFD1,EQ,0

L13: CFDIN1
L15: LOCFD1,EQ,,IF,CFDIN1,THEN,0,ELSE,,IF
    ,CLANDFD,THEN,LOCFD05,ELSE,LOCFD03
L14: LOCFD06,EQ,,IF,CFDIN1,THEN,0,ELSE,,I
    F,CLANDFD,THEN,LOCFD05,ELSE,LOCFD03
NONE

L13: CFDIN1
L17: CFDIN1,OR,CFD2,AND,LOCFD03,EQ,0

L16: CCRUZFD,EQV,CFDIN1,OR,CFD2,AND,LOCFD
    03,EQ,0
NONE

H13: START1,EQ,0

L13: CFDIN1
L19: START1,EQ,,IF,CFDIN1,THEN,0,ELSE,STA
    RT03
L18: START04,EQ,,IF,CFDIN1,THEN,0,ELSE,ST
    ART03
NONE

H15: GSFD1,EQ,0

L13: CFDIN1
L21: GSFD1,EQ,,IF,CFDIN1,THEN,0,ELSE,GSFD

L20: GSFD02,EQ,,IF,CFDIN1,THEN,0,ELSE,GSF
    D
L10: T1CRUZFD
L22: ,NOT,(,NOT,T1CRUZFD)

L23: ,NOT,TMEFLG,NE,0,OR,,NOT,(,NOT,T1CRU
    ZFD)
```

```
L2: MPILS1,EQ,AND(PCUMWD,T12)
L3: MPILS01,EQ,AND(PCUMWD,T12)
*C5: MPILS1,EQ,MPILS01

L4: ,NOT,TMEFLG,EQ,0

*C17: TMEFLG,NE,0
L5: ILSON,EQ,&AC5
L6: ILSON,EQ,0

L7: AND(PCUMWD,T12),EQ,0,OR,ILSON,EQ,0
L8: AND(PCUMWD,T12),EQ,0,OR,ILSON,EQ,0,OR
    ,GRUND,NE,0
L9: T1CRUZFD,EQV,AND(PCUMWD,T12),EQ,0,OR,
    ILSON,EQ,0,OR,GRUND,NE,0
L10: T1CRUZFD


L11: CFDIN1,EQV,TMEFLG,NE,0,AND,T1CRUZFD
L12: TMEFLG,NE,0,AND,T1CRUZFD

L13: CFDIN1

L14: LOCFD06,EQ,,IF,CFDIN1,THEN,0,ELSE,,I
    F,CLANDFD,THEN,LOCFD05,ELSE,LOCFD03
L15: LOCFD1,EQ,,IF,CFDIN1,THEN,0,ELSE,,IF
    ,CLANDFD,THEN,LOCFD05,ELSE,LOCFD03

*C3: LOCFD1,EQ,LOCFD06


L16: CCRUZFD,EQV,CFDIN1,OR,CFD2,AND,LOCFD
    03,EQ,0
L17: CFDIN1,OR,CFD2,AND,LOCFD03,EQ,0
*C1: CCRUZFD


L18: START04,EQ,,IF,CFDIN1,THEN,0,ELSE,ST
    ART03
L19: START1,EQ,,IF,CFDIN1,THEN,0,ELSE,STA
    RT03

*C2: START1,EQ,START04


L20: GSFD02,EQ,,IF,CFDIN1,THEN,0,ELSE,GSF
    D
L21: GSFD1,EQ,,IF,CFDIN1,THEN,0,ELSE,GSFD

*C4: GSFD1,EQ,GSFD02


L22: ,NOT,(,NOT,T1CRUZFD)
L23: ,NOT,TMEFLG,NE,0,OR,,NOT,(,NOT,T1CRU
    ZFD)
L24: ,NOT,(TMEFLG,NE,0,AND,,NOT,T1CRUZFD)
```

```
      )                                          UZFD
                                                L24:  .NOT.(TMEFLG.NE.0.AND..NOT.TICRUZFD)

MACEXP(CFDIN3)                                  NONE                                    L27:  CFDIN3.EQV.CFDIN2.AND.START.EQ.0
OR1(.NOT.CFDIN2..NOT.START=0)                   L26:  .NOT.CFDIN2                       L28:  .NOT.CFDIN2.OR..NOT.START.EQ.0
NOT3(CFDIN2.START=0)                            L28:  .NOT.CFDIN2.OR..NOT.START.EQ.0    L29:  .NOT.(CFDIN2.AND.START.EQ.0)
EQV3(CFDIN3.CFDIN2.AND.START=0)                 L27:  CFDIN3.EQV.CFDIN2.AND.START.EQ.0  L30:  .NOT.CFDIN3
                                                L29:  .NOT.(CFDIN2.AND.START.EQ.0)

MACEXP(TP102)                                   NONE                                    L31:  TP102.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
IF4(TP1.0.TP1.CFDIN3)                           A1:  TP1.EQ.TP1                         L32:  TP1.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
                                                L30:  .NOT.CFDIN3
EQ4(TP1,.IF.CFDIN3.THEN.0.ELSE.TP1.TP102)       L32:  TP1.EQ..IF.CFDIN3.THEN.0.ELSE.TP1 *C6:  TP1.EQ.TP102

                                                L31:  TP102.EQ..IF.CFDIN3.THEN.0.ELSE.TP1

MACEXP(TP202)                                   NONE                                    L33:  TP202.EQ..IF.CFDIN3.THEN.0.ELSE.TP2
IF4(TP2.0.TP2.CFDIN3)                           A2:  TP2.EQ.TP2                         L34:  TP2.EQ..IF.CFDIN3.THEN.0.ELSE.TP2
                                                L30:  .NOT.CFDIN3
EQ4(TP2,.IF.CFDIN3.THEN.0.ELSE.TP2.TP202)       L34:  TP2.EQ..IF.CFDIN3.THEN.0.ELSE.TP2 *C7:  TP2.EQ.TP202

                                                L33:  TP202.EQ..IF.CFDIN3.THEN.0.ELSE.TP2

MACEXP(TP302)                                   NONE                                    L35:  TP302.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
IF4(TP3.0.TP3.CFDIN3)                           A3:  TP3.EQ.TP3                         L36:  TP3.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
                                                L30:  .NOT.CFDIN3
EQ4(TP3,.IF.CFDIN3.THEN.0.ELSE.TP3.TP302)       L36:  TP3.EQ..IF.CFDIN3.THEN.0.ELSE.TP3 *C8:  TP3.EQ.TP302

                                                L35:  TP302.EQ..IF.CFDIN3.THEN.0.ELSE.TP3

MACEXP(TP402)                                   NONE                                    L37:  TP402.EQ..IF.CFDIN3.THEN.0.ELSE.TP4
IF4(TP4.0.TP4.CFDIN3)                           A4:  TP4.EQ.TP4                         L38:  TP4.EQ..IF.CFDIN3.THEN.0.ELSE.TP4
                                                L30:  .NOT.CFDIN3
EQ4(TP4,.IF.CFDIN3.THEN.0.ELSE.TP4.TP402)       L38:  TP4.EQ..IF.CFDIN3.THEN.0.ELSE.TP4 *C9:  TP4.EQ.TP402

                                                L37:  TP402.EQ..IF.CFDIN3.THEN.0.ELSE.TP4

MACEXP(TP502)                                   NONE                                    L39:  TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
IF4(TP5.0.TP5.CFDIN3)                           A5:  TP5.EQ.TP5                         L40:  TP5.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
                                                L30:  .NOT.CFDIN3
EQ4(TP5,.IF.CFDIN3.THEN.0.ELSE.TP5.TP502)       L40:  TP5.EQ..IF.CFDIN3.THEN.0.ELSE.TP5 *C10:  TP5.EQ.TP502

                                                L39:  TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5

MACEXP(TP602)                                   NONE                                    L41:  TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
IF4(TP6.0.TP6.CFDIN3)                           A6:  TP6.EQ.TP6                         L42:  TP6.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
                                                L30:  .NOT.CFDIN3
EQ4(TP6,.IF.CFDIN3.THEN.0.ELSE.TP6.TP602)       L42:  TP6.EQ..IF.CFDIN3.THEN.0.ELSE.TP6 *C11:  TP6.EQ.TP602

                                                L41:  TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6

MACEXP(TP702)                                   NONE                                    L43:  TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
IF4(TP7.0.TP7.CFDIN3)                           A7:  TP7.EQ.TP7                         L44:  TP7.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
                                                L30:  .NOT.CFDIN3
EQ4(TP7,.IF.CFDIN3.THEN.0.ELSE.TP7.TP702)       L44:  TP7.EQ..IF.CFDIN3.THEN.0.ELSE.TP7 *C12:  TP7.EQ.TP702

                                                L43:  TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7

MACEXP(LOCOC04)                                 NONE                                    L45:  LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
                                                                                              COC02

MACEXP(LOCOC02)                                 NONE                                    L46:  LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
                                                                                              COC

IF4(LOCOC.0.LOCOC.CFDIN3)                       A8:  LOCOC.EQ.LOCOC                     L47:  LOCOC.EQ..IF.CFDIN3.THEN.0.ELSE.LOCO

                                                L30:  .NOT.CFDIN3
EQ4(LOCOC,.IF.CFDIN3.THEN.0.ELSE.LOCOC.LO       L47:  LOCOC.EQ..IF.CFDIN3.THEN.0.ELSE.LOCO  L48:  LOCOC.EQ.LOCOC02
      COC02)                                          C
                                                L46:  LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
                                                      COC

MACEXP(CFD3)                                    NONE                                    L49:  CFD3.EQV.CFDIN2.AND.TFD3
OR1(.NOT.CFDIN2,.NOT.TFD3)                      L26:  .NOT.CFDIN2                       L50:  .NOT.CFDIN2.OR..NOT.TFD3
```

```
IF4(LOCOC,SET,LOCOC02,CFD3)

EQ4(LOCOC,.IF.CFD3.THEN.SET.ELSE.LOCOC02.
    LOCOC04)

MACEXP(FLARE02)

IF4(FLARE,0,FLARE,CFDIN3)

EQ4(FLARE,.IF.CFDIN3.THEN.0.ELSE.FLARE,FL
    ARE02)

MACEXP(YETA02)

IF3(YETA,YETA,YETA01,CFDIN1)

EQ4(YETA,.IF.CFDIN1.THEN.YETA.ELSE.YETA01
    .YETA02)

MACEXP(PSIE02)

IF3(PSIE,PSIE,PSIE01,CFDIN1)

EQ4(PSIE,.IF.CFDIN1.THEN.PSIE.ELSE.PSIE01
    ,PSIE02)

MACEXP(CFD42)

MACEXP(CFD4)

NOTORAND3(CFDIN2,TFD3.OR.GUID2D=0)

EQV3(CFD4,CFDIN2.AND.(TFD3.OR.GUID2D=0))


NOTORAND3(CFD4.LBS.NE.0)
NOTORAND3(CFD4.AND.LBS.NE.0.LOCFD03.NE.0)

EQV3(CFD42,CFD4.AND.LBS.NE.0.AND.LOCFD03.
    NE.0)


***** O. E. D. *****
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```
L48: LOCOC.EQ.LOCOC02

L52: .NOT.CFD3
L53: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
     C02
L45: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
NONE

A9: FLARE.EQ.FLARE

L30: .NOT.CFDIN3
L55: FLARE.EQ..IF.CFDIN3.THEN.0.ELSE.FLAR
     E
L54: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
     ARE
NONE

A10: YETA.EQ.YETA

L13: CFDIN1
L57: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
     TA01
L56: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
     YETA01
NONE

A11: PSIE.EQ.PSIE

L13: CFDIN1
L59: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
     IE01
L58: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
     PSIE01
NONE

NONE

L26: .NOT.CFDIN2

L61: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
     EQ.0)
L62: .NOT.(CFDIN2.AND.(TFD3.OR.GUID2D.EQ.
     0))
L63: .NOT.CFD4
L64: .NOT.(CFD4.AND.LBS.NE.0)

L60: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
     D03.NE.0
L65: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
     NE.0)
```

```
L53: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
     C02

*C13: LOCOC.EQ.LOCOC04

L54: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
     ARE
L55: FLARE.EQ..IF.CFDIN3.THEN.0.ELSE.FLAR
     E

*C14: FLARE.EQ.FLARE02

L56: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
     YETA01
L57: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
     TA01

*C15: YETA.EQ.YETA02

L58: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
     PSIE01
L59: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
     IE01

*C16: PSIE.EQ.PSIE02

L60: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
     D03.NE.0
L61: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
     EQ.0)
L62: .NOT.(CFDIN2.AND.(TFD3.OR.GUID2D.EQ.
     0))
L63: .NOT.CFD4

L64: .NOT.(CFD4.AND.LBS.NE.0)
L65: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
     NE.0)
*C18: .NOT.CFD42
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 5

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CFXIT0
H2: SPSC
H3: EFDRTN1.EQ.CFA
H4: &AC1.EQ.TMEFLG
H5: .NOT.&AC1.EQ.0
H6: &AC2.EQ.PCUM%D
H7: &AC3.EQ.AND(&AC2,T12)
H8: MPILS1.EQ.&AC3
H9: &AC4.EQ.MPILS1
H10: &AC4.EQ.0
H11: START1.EQ.1
H12: LOCFD1.EQ.0
H13: GSFD1.EQ.0

CONCLUSIONS
C1: CCRUZFD
C2: START1.EQ.START04
C3: LOCFD1.EQ.LOCFD06
C4: GSFD1.EQ.GSFD02
C5: MPILS1.EQ.MPILS01
C6: TP1.EQ.TP102
C7: TP2.EQ.TP202
C8: TP3.EQ.TP302
C9: TP4.EQ.TP402
C10: TP5.EQ.TP502
C11: TP6.EQ.TP602
C12: TP7.EQ.TP702
C13: LOCCC.EQ.LOCCC04
C14: FLARE.EQ.FLARE02
C15: YETA.EQ.YETA02
C16: PSIE.EQ.PSIE02
C17: TMEFLG.NE.0
C18: .NOT.CFD42

THEOREMS USED
EQ2(P,Q)=P.EQ.Q.EQV.Q.EQ.P
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
NOT2(P,Q)=.NOT.P.EQ.Q.EQV.P.NE.Q
OR2(A,B)=B.IMP.A.OR.B
EQV2(A,B)=B.(A.EQV.B).IMP.A
AND4(A,B)=A.B.IMP.A.AND.B
IF3(I,J,K,A)=I=J.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
EQV3(A,B)=(A.EQV.B).,NOT.B.IMP.,NOT.A
OR1(A,B)=A.IMP.A.OR.B
NOT3(A,B)=.NOT.A.OR.,NOT.B.EQV.,NOT.(A.AND.B)
NOT4(A)=A.EQV.,NOT.(.NOT.A)
IF4(I,J,K,A)=I=K.,NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
NOTORAND3(A,B)=.NOT.A.IMP.,NOT.(A.AND.B)

PROOF

THEOREM
```

```
EQ3(MPILS1,&AC3,AND(PCUMWD,T12))

MACEXP(MPILSC1)
EQ4(MPILS1,AND(PCUMWD,T12),MPILSC1)

SUBST1(&AC1,TMEFLG,X,.NOT.(X.EQ.0))

NOT2(TMEFLG.0)
SUBST1(&AC4,MPILS1,X,X,EQ.0)

EQ2(MPILS1,AND(PCUMWD,T12))
EQ3(AND(PCUMWD,T12),MPILS1,0)

OR1(AND(PCUMWD,T12)=0,ILSON=0)
OR1(AND(PCUMWD,T12)=0.OR.ILSON=0,GROUND.NE
    .0)
MACEXP(T1CRUZFD)

EQV2(T1CRUZFD,(AND(PCUMWD,T12).EQ.0).OR.(
    ILSON.EQ.0).OR.(GROUND.NE.0))


MACEXP(CFDIN1)
AND4(TMEFLG.NE.0,T1CRUZFD)

EQV2(CFDIN1,TMEFLG.NE.0.AND.T1CRUZFD)

MACEXP(LOCFD06)

IF3(LOCFD1,0,.IF.CLANDFD.THEN.LOCFD05.ELS
    E.LOCFD03",CFDIN1)

EQ4(LOCFD1,.IF.CFDIN1.THEN.0.ELSE..IF.CLA
    NDFD.THEN.LOCFD05.ELSE.LOCFD03.LOCFD0
    6)

MACEXP(CCRUZFD)

OR1(CFDIN1.CFD2.AND.LOCFD03=0)
EQV2(CCRUZFD.CFDIN1.OR.(CFD2.AND.LOCFD03=
    0))

MACEXP(START04)

IF3(START1,0,START03,CFDIN1)

EQ4(START1,.IF.CFDIN1.THEN.0.ELSE.START03
    .START04)

MACEXP(GSFD02)

IF3(GSFD1,0,GSFD,CFDIN1)

EQ4(GSFD1,.IF.CFDIN1.THEN.0.ELSE.GSFD,GSF
    D02)

NOT4(T1CRUZFD)
OR2(.NOT.(TMEFLG.NE.0),.NOT.(.NOT.T1CRUZF
    D))

#3: MPILS1.EQ.&AC3
L1: &AC3.EQ.AND(PCUMWD,T12)
NONE
L2: MPILS1.EQ.AND(PCUMWD,T12)
L3: MPILSC1.EQ.AND(PCUMWD,T12)
#4: &AC1.EQ.TMEFLG
#5: .NOT.&AC1.EQ.0
L4: .NOT.TMEFLG.EQ.0
#9: &AC4.EQ.MPILS1
#10: &AC4.EQ.0
L2: MPILS1.EQ.AND(PCUMWD,T12)
L6: AND(PCUMWD,T12).EQ.MPILS1
L5: MPILS1.EQ.0
L7: AND(PCUMWD,T12).EQ.0
L8: AND(PCUMWD,T12).EQ.0.OR.ILSON.EQ.0

NONE

L9: AND(PCUMWD,T12).EQ.0.OR.ILSON.EQ.0.OR
    .GROUND.NE.0
L10: T1CRUZFD.EQV.AND(PCUMWD,T12).EQ.0.OR
    .ILSON.EQ.0.OR.GROUND.NE.0
NONE
#C17: TMEFLG.NE.0
L11: T1CRUZFD
L13: TMEFLG.NE.0.AND.T1CRUZFD
L12: CFDIN1.EQV.TMEFLG.NE.0.AND.T1CRUZFD
NONE

#12: LOCFD1.EQ.0

L14: CFDIN1
L16: LOCFD1.EQ..IF.CFDIN1.THEN.0.ELSE..IF
    .CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L15: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
    F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
NONE

L14: CFDIN1
L16: CFDIN1.OR.CFD2.AND.LOCFD03.EQ.0

L17: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
NONE

#11: START1.EQ.0

L14: CFDIN1
L20: START1.EQ..IF.CFDIN1.THEN.0.ELSE.STA
    RT03
L19: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
NONE

#13: GSFD1.EQ.0

L14: CFDIN1
L22: GSFD1.EQ..IF.CFDIN1.THEN.0.ELSE.GSFD

L21: GSFD02.EQ..IF.CFDIN1.THEN.0.ELSE.GSF
    D
L11: T1CRUZFD
L23: .NOT.(.NOT.T1CRUZFD)
L2: MPILS1.EQ.AND(PCUMWD,T12)

L3: MPILSC1.EQ.AND(PCUMWD,T12)
#C5: MPILS1.EQ.MPILSC1

L4: .NOT.TMEFLG.EQ.0

#C17: TMEFLG.NE.0
L5: MPILS1.EQ.0

L6: AND(PCUMWD,T12).EQ.MPILS1
L7: AND(PCUMWD,T12).EQ.0

L8: AND(PCUMWD,T12).EQ.0.OR.ILSON.EQ.0
L9: AND(PCUMWD,T12).EQ.0.OR.ILSON.EQ.0.OR
    .GROUND.NE.0
L10: T1CRUZFD.EQV.AND(PCUMWD,T12).EQ.0.OR
    .ILSON.EQ.0.OR.GROUND.NE.0
L11: T1CRUZFD


L12: CFDIN1.EQV.TMEFLG.NE.0.AND.T1CRUZFD
L13: TMEFLG.NE.0.AND.T1CRUZFD

L14: CFDIN1

L15: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
    F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L16: LOCFD1.EQ..IF.CFDIN1.THEN.0.ELSE..IF
    .CLANDFD.THEN.LOCFD05.ELSE.LOCFD03

#C3: LOCFD1.EQ.LOCFD06


L17: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
L18: CFDIN1.OR.CFD2.AND.LOCFD03.EQ.0
#C1: CCRUZFD


L19: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
L20: START1.EQ..IF.CFDIN1.THEN.0.ELSE.STA
    RT03

#C2: START1.EQ.START04


L21: GSFD02.EQ..IF.CFDIN1.THEN.0.ELSE.GSF
    D
L22: GSFD1.EQ..IF.CFDIN1.THEN.0.ELSE.GSFD

#C4: GSFD1.EQ.GSFD02


L23: .NOT.(.NOT.T1CRUZFD)
L24: .NOT.T1CRUZFD.OR.(.NOT.T1CRUZFD.AND.T1CRUZFD)
```

```
MACEXP(CFDIN2)

EQV3(CFDIN2,TMEFLG.NE.0.AND..NOT.TICRUZFL
     )


MACEXP(CFDIN3)
OR1(.NOT.CFDIN2,.NOT.START=0)
NOT3(CFDIN2,START=0)
EQV3(CFDIN3,CFDIN2.AND.START=0)

MACEXP(TP102)
IF4(TP1,0,TP1,CFDIN3)

EQ4(TP1,.IF.CFDIN2.THEN.0.ELSE.TP1,TP102)


MACEXP(TP202)
IF4(TP2,0,TP2,CFDIN3)

EQ4(TP2,.IF.CFDIN3.THEN.0.ELSE.TP2,TP202)


MACEXP(TP302)
IF4(TP3,0,TP3,CFDIN3)

EQ4(TP3,.IF.CFDIN3.THEN.0.ELSE.TP3,TP302)


MACEXP(TP402)
IF4(TP4,0,TP4,CFDIN3)

EQ4(TP4,.IF.CFDIN3.THEN.0.ELSE.TP4,TP402)


MACEXP(TP502)
IF4(TP5,0,TP5,CFDIN3)

EQ4(TP5,.IF.CFDIN3.THEN.0.ELSE.TP5,TP502)


MACEXP(TP602)
IF4(TP6,0,TP6,CFDIN3)

EQ4(TP6,.IF.CFDIN3.THEN.0.ELSE.TP6,TP602)


MACEXP(TP702)
IF4(TP7,0,TP7,CFDIN3)

EQ4(TP7,.IF.CFDIN3.THEN.0.ELSE.TP7,TP702)


MACEXP(LOCOC04)

MACEXP(LOCOC02)

IF4(LOCOC,0,LOCOC,CFDIN3)


EQ4(LOCOC,.IF.CFDIN3.THEN.0.ELSE.LOCOC,LO
    COC02)
```

```
NONE
L26: CFDIN2.EQV.TMEFLG.NE.0.AND..NOT.TICR
     UZFD
L25: .NOT.(TMEFLG.NE.0.AND..NOT.TICRUZFD)

NONE
L27: .NOT.CFDIN2
L29: .NOT.CFDIN2.OR..NOT.START.EQ.0
L28: CFDIN3.EQV.CFDIN2.AND.START.EQ.0
L30: .NOT.(CFDIN2.AND.START.EQ.0)
NONE
A1: TP1.EQ.TP1
L31: .NOT.CFDIN3
L33: TP1.EQ..IF.CFDIN3.THEN.0.ELSE.TP1

L32: TP102.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
NONE
A2: TP2.EQ.TP2
L31: .NOT.CFDIN3
L35: TP2.EQ..IF.CFDIN3.THEN.0.ELSE.TP2

L34: TP202.EQ..IF.CFDIN3.THEN.0.ELSE.TP2
NONE
A3: TP3.EQ.TP3
L31: .NOT.CFDIN3
L37: TP3.EQ..IF.CFDIN3.THEN.0.ELSE.TP3

L36: TP302.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
NONE
A4: TP4.EQ.TP4
L31: .NOT.CFDIN3
L39: TP4.EQ..IF.CFDIN3.THEN.0.ELSE.TP4

L38: TP402.EQ..IF.CFDIN3.THEN.0.ELSE.TP4
NONE
A5: TP5.EQ.TP5
L31: .NOT.CFDIN3
L41: TP5.EQ..IF.CFDIN3.THEN.0.ELSE.TP5

L40: TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
NONE
A6: TP6.EQ.TP6
L31: .NOT.CFDIN3
L43: TP6.EQ..IF.CFDIN3.THEN.0.ELSE.TP6

L42: TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
NONE
A7: TP7.EQ.TP7
L31: .NOT.CFDIN3
L45: TP7.EQ..IF.CFDIN3.THEN.0.ELSE.TP7

L44: TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
NONE

NONE

A8: LOCOC.EQ.LOCOC

L31: .NOT.CFDIN3
L48: LOCOC.EQ..IF.CFDIN3.THEN.0.ELSE.LOCO
     C
L47: LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
```

```
L26: CFDIN2.EQV.TMEFLG.NE.0.AND..NOT.TICR
     UZFD
L27: .NOT.CFDIN2


L28: CFDIN3.EQV.CFDIN2.AND.START.EQ.0
L29: .NOT.CFDIN2.OR..NOT.START.EQ.0
L30: .NOT.(CFDIN2.AND.START.EQ.0)
L31: .NOT.CFDIN3

L32: TP102.EQ..IF.CFDIN3.THEN.0.ELSE.TP1
L33: TP1.EQ..IF.CFDIN3.THEN.0.ELSE.TP1

*C6: TP1.EQ.TP102


L34: TP202.EQ..IF.CFDIN3.THEN.0.ELSE.TP2
L35: TP2.EQ..IF.CFDIN3.THEN.0.ELSE.TP2

*C7: TP2.EQ.TP202


L36: TP302.EQ..IF.CFDIN3.THEN.0.ELSE.TP3
L37: TP3.EQ..IF.CFDIN3.THEN.0.ELSE.TP3

*C8: TP3.EQ.TP302


L38: TP402.EQ..IF.CFDIN3.THEN.0.ELSE.TP4
L39: TP4.EQ..IF.CFDIN3.THEN.0.ELSE.TP4

*C9: TP4.EQ.TP402


L40: TP502.EQ..IF.CFDIN3.THEN.0.ELSE.TP5
L41: TP5.EQ..IF.CFDIN3.THEN.0.ELSE.TP5

*C10: TP5.EQ.TP502


L42: TP602.EQ..IF.CFDIN3.THEN.0.ELSE.TP6
L43: TP6.EQ..IF.CFDIN3.THEN.0.ELSE.TP6

*C11: TP6.EQ.TP602


L44: TP702.EQ..IF.CFDIN3.THEN.0.ELSE.TP7
L45: TP7.EQ..IF.CFDIN3.THEN.0.ELSE.TP7

*C12: TP7.EQ.TP702


L46: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
L47: LOCOC02.EQ..IF.CFDIN3.THEN.0.ELSE.LO
     COC
L48: LOCOC.EQ..IF.CFDIN3.THEN.0.ELSE.LOCO
     C

L49: LOCOC.EQ.LOCOC02
```

```
NOT3(CFDIN2,TFD3)
EQV3(CFD3,CFDIN2.AND.TFD3)

IF4(LOCOC,SET,LOCOC02,CFD3)

EQ4(LOCOC,,IF.CFD3.THEN.SET.ELSE.LOCUC02.
    LOCOC04)

MACEXP(FLARE02)

IF4(FLARE,C,FLARE,CFDIN3)

EQ4(FLARE,,IF.CFDIN3.THEN.0.ELSE.FLARE,FL
    ARE02)

MACEXP(YETA02)

IF3(YETA,YETA,YETA01,CFDIN1)

EQ4(YETA,,IF.CFDIN1.THEN.YETA.ELSE.YETA01
    ,YETA02)

MACEXP(PSIE02)

IF3(PSIE,PSIE,PSIE01,CFDIN1)

EQ4(PSIE,,IF.CFDIN1.THEN.PSIE.ELSE.PSIE01
    ,PSIE02)

MACEXP(CFD4)

MACEXP(CFD42)

NOTORAND3(CFDIN2,TFD3.OR.GUID2D=0)

EQV3(CFD4,CFDIN2.AND.(TFD3.OR.GUID2D=0))

NOTORAND3(CFD4,LBS.NE.0)
NOTORAND3(CFD4.AND.LBS.NE.0,LOCFD03.EQ.0)

EQV3(CFD42,CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)

***** O. F. D. *****
```

```
L51: .NOT.CFDIN2.OR..NOT.TFD3
L50: CFD3.EQV.CFDIN2.AND.TFD3
L52: .NOT.(CFDIN2.AND.TFD3)
L49: LOCOC.EQ.LOCOC02

L53: .NOT.CFD3
L54: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCU
     C02
L46: LOCUC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
NONE

A9: FLARE.EQ.FLARE

L31: .NOT.CFDIN3
L56: FLARE.EQ..IF.CFDIN3.THEN.0.ELSE.FLAR
     E
L55: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
     ARE
NONE

A10: YETA.EQ.YETA

L14: CFDIN1
L58: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
     TA01
L57: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
     YETA01
NONE

A11: PSIE.EQ.PSIE

L14: CFDIN1
L60: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
     IE01
L59: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
     PSIE01
NONE

NONE

L27: .NOT.CFDIN2

L61: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
     EQ.0)
L63: .NOT.(CFDIN2.AND.(TFD3.OR.GUID2D.EQ.
     0))
L64: .NOT.CFD4
L65: .NOT.(CFD4.AND.LBS.NE.0)
L62: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
     D03.EQ.0
L36: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
     EQ.0)
```

```
L52: .NOT.(CFDIN2.AND.TFD3)
L53: .NOT.CFD3

L54: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
     C02
*C13: LOCOC.EQ.LOCOC04

L55: FLARE02.EQ..IF.CFDIN3.THEN.0.ELSE.FL
     ARE
L56: FLARE.EQ..IF.CFDIN3.THEN.0.ELSE.FLAR
     E
*C14: FLARE.EQ.FLARE02

L57: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
     YETA01
L58: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
     TA01
*C13: YETA.EQ.YETA02

L59: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
     PSIE01
L60: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
     IE01
*C15: PSIE.EQ.PSIE02

L61: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
     EQ.0)
L62: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
     D03.EQ.0
L63: .NOT.(CFDIN2.AND.(TFD3.OR.GUID2D.EQ.
     0))
L64: .NOT.CFD4

L65: .NOT.(CFD4.AND.LBS.NE.0)
L66: .NOT.(CFD4.AND.LBS.NE.0.AND._OCFD03.
     EQ.0)
*C13: .NOT.CFD42
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 6

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: EFDRTN1.EQ.ERA
H4: EAC1.EQ.TMEFLG
H5: EAC1.EQ.0
H6: RCMVLD1.EQ.0
H7: PCMVLD1.EQ.0

CONCLUSIONS
C1: .FALSE.

THEOREMS USED
EQ2(P,0)=P.EQ.0.EQV.0.EQ.P
EQ3(P,0,R)=P.EQ.0.0.EQ.R.IMP.P.EQ.R
EQV1(A,B)=A.(A.EQV.B).IMP.B
AND8(A,B)=A.AND.B.IMP.A
EQV4(A,B)=(A.EQV.B).,NOT.A.IMP.,NOT.B
NOTORAND1(A,B)=.NOT.(A.OR.B).EQV.,NOT.A.AND.,NOT.B
FE1(A)=A.,NOT.A.IMP.,FALSE.

PROOF

THEOREMS
EQ2(EAC1.TMEFLG)
EQ3(TMEFLG,EAC1,0)

MACEXP(CEXITO)
MACEXP(CVCRUZ)
MACEXP(CFD112)
MACEXP(CEXIT1)

EQV1(CEXITO.CVCRUZ.AND.TEXITO)

AND8(CVCRUZ,TEXITO)
EQV1(CVCRUZ,CFD112.AND.TVCRUZ)

AND8(CFD112,TVCRUZ)
EQV1(CFD112,.NOT.CEXIT1)

EQV4(CEXIT1.TMEFLG=0.OR.CCRUZFD.AND.GUID2
    D=0)

NOTORAND1(TMEFLG=0.CCRUZFD.AND.GUID2D=0)

AND8(.NOT.TMEFLG=0.,NOT.(CCRUZFD.AND.GUID
    2D=0))
FE1(TMEFLG=0)

***** Q. E. D. *****
```

```
HYPOTHESES
H4: EAC1.EQ.TMEFLG
L1: TMEFLG.EQ.EAC1
H5: EAC1.EQ.0
NONE
NONE
NONE
NONE

H1: CEXITO
L3: CEXITO.EQV.CVCRUZ.AND.TEXITO
L7: CVCRUZ.AND.TEXITO
L8: CVCRUZ
L4: CVCRUZ.EQV.CFD112.AND.TVCRUZ
L9: CFD112.AND.TVCRUZ
L10: CFD112
L5: CFD112.EQV.,NOT.CEXIT1
L6: CEXIT1.EQV.TMEFLG.EQ.0.OR.CCRUZFD.AND
    .GUID2D.EQ.0
L11: .NOT.CEXIT1
L12: .NOT.(TMEFLG.EQ.0.OR.CCRUZFD.AND.GUI
    D2D.EQ.0)
L13: .NOT.TMEFLG.EQ.0.AND.,NOT.(CCRUZFD.A
    ND.GUID2D.EQ.0)
L2: TMEFLG.EQ.0
L14: .NOT.TMEFLG.EQ.0
```

```
CONCLUSIONS
L1: TMEFLG.EQ.EAC1
L2: TMEFLG.EQ.0

L3: CEXITO.EQV.CVCRUZ.AND.TEXITO
L4: CVCRUZ.EQV.CFD112.AND.TVCRUZ
L5: CFD112.EQV.,NOT.CEXIT1
L6: CEXIT1.EQV.TMEFLG.EQ.0.OR.CCRUZFD.AND
    .GUID2D.EQ.0
L7: CVCRUZ.AND.TEXITO

L8: CVCRUZ
L9: CFD112.AND.TVCRUZ

L10: CFD112
L11: .NOT.CEXIT1

L12: .NOT.(TMEFLG.EQ.0.OR.CCRUZFD.AND.GUI
    D2D.EQ.0)

L13: .NOT.TMEFLG.EQ.0.AND.,NOT.(CCRUZFD.A
    ND.GUID2D.EQ.0)
L14: .NOT.TMEFLG.EQ.0

*C1: .FALSE.
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 7

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: CFD1
H4: MPILS.EQ.MPILSO1
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD03
H13: LOCCC.EQ.LOCOCC2
H14: FLARE.EQ.FLAREC2
H15: START.EQ.START03
H16: GSFD.EQ.GSFD02
H17: .NOT.CFDIN1
H18: TMEFLG.NE.0
H19: &AC1.EQ.LOCDEV
H20: &MU1.EQ.MULTM(&AC1,K1)
H21: &AC2.EQ.MULT(&AC1,K1)
H22: YETA1.EQ.&AC2
H23: &AC3.EQ.TK
H24: &AC4.EQ.N(&AC3-RWYHDG)
H25: PSIE1.EQ.&AC4
H26: &AC5.EQ.ABS(&AC4)
H27: &AC6.EQ.N(&AC5-DEG2)
H28: .NOT.&AC6.LT.0
H29: &AC7.EQ.YETA1
H30: &AC8.EQ.ABS(&AC7)
H31: &AC9.EQ.&AC8-LIMLOC
H32: .NOT.&AC9.LT.0
H33: &AC10.EQ.60D20
H34: .NOT.&AC10.EQ.0
H35: &AC11.EQ.LOCFD
H36: .NOT.&AC11.NE.0

CONCLUSIONS
C1: R(&AC8-LIMLOC)
C2: COPUZFD
C3: START.EQ.START01
C4: LOCFD.EQ.LOCFD05
C5: LOCOC.EQ.LOCOCC0
C6: YETA1.EQ.YETA02
C7: PSIE1.EQ.PSIE02
C8: .NOT.CFD42

THEOREMS USED
AND4(A,B)=A.H.IMP.A.AND.B
APT1(X,Y)=X.GE.0.Y.GE.0.IMP.R(X-Y)
APT2(X)=ABS(X).GE.0
EQ2(P,Q)=P.EQ.Q.EQV.Q.EQ.P
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
```

```
EQV3(A,B)=(A.EQV.B).AND.B.IMP..NOT.A
IF4(I,J,K,A)=I=K..NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
IF5(A,B,P,Q,R,S)=P.EQ.Q..NOT.A..NOT.B.IMP.R=.IF.A.THEN.R.ELSE..IF.B.THEN.S.ELSE.Q
NOTAND1(A,B)=B.IMP..NOT.(A.AND..NOT.B)
NCTOR1(A,B)=.NOT.A..AND.B.IMP..NOT.(A.OR.B)
NCT2(P,Q)=.NOT.P.EQ.Q.EQV.P.NE.Q
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
NCT5(P,Q)=P.EQ.Q.EQV..NOT.(P.NE.Q)
OR2(A,B)=B.IMP.A.OR.B
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
SUBST2(P,Q,R,A(R))=P.EQ.Q.A(Q).IMP.A(P)
NOTORAND2(A,B)=.NOT.B.IMP..NOT.(A.AND.B)
NOTORAND3(A,B)=.NOT.A.IMP..NOT.(A.AND.B)
NOT7(A,B)=.NOT.A..NOT.B.IMP..NOT.(A.OR.B)

PROOF

THEOREMS
SUBST1(&AC7.YETA1.X.&AC8=ABS(X))

APT2(YETA1)
HYPEXP(SPEC,LIMLOC=100.B23)
SUBST2(LIMLOC.100.B23.X.X.GE.0)

APT1(ABS(YETA1).LIMLOC)

SUBST2(&AC8.ABS(YETA1).X.R(X-LIMLOC))

SUBST1(&AC11.LOCFD.X..NOT.X.NE.0)

NOT5(LOCFD.0)
SUBST1(&AC10.GUID2D.X..NOT.X.EQ.0)

NOT2(GUID2D.0)
SUBST1(&AC9.&AC8-LIMLOC.X..NOT.X.LT.0)

SUBST1(&AC8.ABS(YETA1).X..NOT.X-LIMLOC.LT
    .0)

SUBST1(&AC6.N(&AC5-DEG2).X..NOT.X.LT.0)

SUBST2(PSIE1.&AC4.X.&AC5.EQ.ABS(X))

SUBST1(&AC5.ABS(PSIE1).X..NOT.N(X-DEG2).L
    T.0)

EQ3(PSIE1.&AC4.N(&AC3-RWYHDG))

SUBST1(&AC3.TK.X.PSIE1.EQ..(X-RWYHDG))

MACRO(YETA01)
MACEXP(CFD42)

MACRO(PSIE01)
EQ4(PSIE1.N(TK-RWYHDG).PSIE01)

SUBST2(PSIE01.PSIE1.X..NOT.N(ABS(X)-DEG2)
    .LT.0)

EQ3(YETA1.&AC2.MULT(&AC1.K1))

SUBST1(&AC1.LOCDEV.X.YETA1.EQ.MULT(X.K1))
```

```
HYPOTHESES
H29: &AC7.EQ.YETA1
H30: &AC8.EQ.ABS(&AC7)
NONE
NONE
L3: LIMLOC.EQ.100.B23
A1: 100.B23.GE.0
L2: ABS(YETA1).GE.0
L4: LIMLOC.GE.0
L1: &AC8.EQ.ABS(YETA1)
L5: R(ABS(YETA1)-LIMLOC)
H35: &AC11.EQ.LOCFD
H36: .NOT.&AC11.NE.0
L6: .NOT.LOCFD.NE.0
H33: &AC10.EQ.GUID2D
H34: .NOT.&AC10.EQ.0
L8: .NOT.GUID2D.EQ.0
H31: &AC9.EQ.&AC8-LIMLOC
H32: .NOT.&AC9.LT.0
L11: &AC8.EQ.ABS(YETA1)

L10: .NOT.&AC8-LIMLOC.LT.0
H27: &AC6.EQ.N(&AC5-DEG2)
H28: .NOT.&AC6.LT.0
H25: PSIE1.EQ.&AC4
H26: &AC5.EQ.ABS(&AC4)
L13: &AC5.EQ.ABS(PSIE1)

L12: .NOT.N(&AC5-DEG2).LT.0
H25: PSIE1.EQ.&AC4
H24: &AC4.EQ.N(&AC3-RWYHDG)
H23: &AC3.EQ.TK
L15: PSIE1.EQ.N(&AC3-RWYHDG)
NONE
NONE

NONE
L16: PSIE1.EQ.N(TK-RWYHDG)
L19: PSIE01.EQ.N(TK-RWYHDG)
L20: PSIE1.EQ.PSIE01

L14: .NOT.N(ABS(PSIE1)-DEG2).LT.0
H22: YETA1.EQ.&AC2
H21: &AC2.EQ.MULT(&AC1.K1)
H19: &AC1.EQ.LOCDEV
```

```
CONCLUSIONS
L1: &AC8.EQ.ABS(YETA1)

L2: ABS(YETA1).GE.0
L3: LIMLOC.EQ.100.B23
L4: LIMLOC.GE.0

L5: R(ABS(YETA1)-LIMLOC)

AC1: R(&AC8-LIMLOC)

L6: .NOT.LOCFD.NE.0

L7: LOCFD.EQ.0
L8: .NOT.GUID2D.EQ.0

L9: GUID2D.NE.0
L10: .NOT.&AC8-LIMLOC.LT.0

L11: .NOT.ABS(YETA1)-LIMLOC.LT.0

L12: .NOT.N(&AC5-DEG2).LT.0

L13: &AC5.EQ.ABS(PSIE1)

L14: .NOT.N(ABS(PSIE1)-DEG2).LT.0

L15: PSIE1.EQ.N(&AC3-RWYHDG)

L16: PSIE1.EQ.N(TK-RWYHDG)

L17: YETA01.EQ.MULT(LOCDEV,K1)
L18: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D3.EQ.0
L19: PSIE01.EQ.N(TK-RWYHDG)
L20: PSIE1.EQ.PSIE01

L21: .NOT.N(ABS(PSIE01)-DEG2).LT.0

L22: YETA1.EQ.MULT(&AC1.K1)

L23: YETA1.EQ.MULT(LOCDEV.K1)
```

```
SUBST2(YETA01,YETA1,X,.NOT.(ABS(X)-LIMLOC
    .LT.0))

MACRO(TFD3)

NOTOR1(ABS(YETA01)-LIMLOC.LT.0.N(ABS(PSIE
    01)-DEG2).LT.0)

EQV3(TFD3,ABS(YETA01)-LIMLOC.LT.0.OR.N(AB
    S(PSIE01)-DEG2).LT.0)

NOT7(TFD3.GUID2D=0)

MACEXP(CFD4)

NOTORAND2(CFDIN2,TFD3.OR.GUID2D=0)

EQV3(CFD4,CFDIN2.AND.(TFD3.OR.GUID2D=0))

NOTOPAND2(CFD4,LBS.NE.0)
NOTORAND3(CFD4.AND.LBS.NE.0,LOCFD03=0)

EQV3(CFD42,CFD4.AND.LBS.NE.0.AND.LOCFD03=
    0)

MACRO(CFD1)
EQV1(CFD1,CFDIN2)

AND4(CFDIN2,.NOT.TFD3)

AND4(CFDIN2.AND..NOT.TFD3,GUID2D.NE.0)

OR2(CFD4.AND.LBS.EQ.0,CFDIN2.AND..NOT.TFD
    3.AND.GUID2D.NE.0)
MACRO(CFD2)

EQV2(CFD2,CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND
    ..NOT.TFD3.AND.GUID2D.NE.0)

EQ2(LOCFD,LOCFD03)
EQ3(LOCFD03,LOCFD,0)

AND4(CFD2,LOCFD03=0)

OR2(CFDIN1,CFD2.AND.LOCFD03.EQ.0)
MACRO(CCRUZFD)

EQV2(CCRUZFD,CFDIN1.OR.(CFD2.AND.LOCFD03=
    0))

IF4(START.C.START03,CFDIN1)

MACRO(START04)

EQ4(START..E.CFDIN1.THEN.3.ELSE.START04,
```

```
L24: YETA1.EQ.YETA01

L11: .NOT.ABS(YETA1)-LIMLOC.LT.0
NONE

L25: .NOT.ABS(YETA01)-LIMLOC.LT.0

L21: .NOT.N(ABS(PSIE01)-DEG2).LT.0
L26: TFD3.EQV.ABS(YETA01)-LIMLOC.LT.0.OR.
    N(ABS(PSIE01)-DEG2).LT.0
L27: .NOT.(ABS(YETA01)-LIMLOC.LT.0.OR.N(A
    BS(PSIE01)-DEG2).LT.0)
L28: .NOT.TFD3
L8: .NOT.GUID2D.EQ.0
NONE

L29: .NOT.(TFD3.OR.GUID2D.EQ.0)

L30: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
    EQ.0)
L31: .NOT.(CFDIN2.AND.(TFD3.OR.GUID2D.EQ.
    0))
L32: .NOT.CFD4
L33: .NOT.(CFD4.AND.LBS.NE.0)
L34: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)
L14: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D03.EQ.0
L34: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)
NONE
H3: CFD1
L35: CFD1.EQV.CFDIN2
L36: CFDIN2
L28: .NOT.TFD3
L37: CFDIN2.AND..NOT.TFD3

L9: GUID2D.NE.0
L38: CFDIN2.AND..NOT.TFD3.AND.GUID2D.NE.0

NONE

L39: CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND..NOT
    .TFD3.AND.GUID2D.NE.0
L40: CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2
    .AND..NOT.TFD3.AND.GUID2D.NE.0
H12: LOCFD.EQ.LOCFD03
L42: LOCFD03.EQ.LOCFD
L7: LOCFD.EQ.0
L41: CFD2
L43: LOCFD03.EQ.0
L44: CFD2.AND.LOCFD03.EQ.0

L45: CFDIN1.OR.CFD2.AND.LOCFD03.EQ.0
NONE

L45: CFDIN1.OR.CFD2.AND.LOCFD03.EQ.0)

L46: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
H15: START.EQ.START03

H17: .NOT.CFDIN1
NONE

L47: START..E..IF.CFDIN1.THEN.3.ELSE.STA
```

```
L25: .NOT.ABS(YETA01)-LIMLOC..T.0

L26: TFD3.EQV.ABS(YETA01)-LIMLOC..T.0.OR.
    N(ABS(PSIE01)-DEG2).LT.0
L27: .NOT.(ABS(YETA01)-LIMLOC.LT.0.OR.N(A
    BS(PSIE01)-DEG2).LT.0)

L28: .NOT.TFD3

L29: .NOT.(TFD3.OR.GUID2D.EQ.0)

L30: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
    EQ.0)
L31: .NOT.(CFDIN2.AND.(TFD3.OR.GUID2D.EQ.
    0))
L32: .NOT.CFD4

L33: .NOT.(CFD4.AND.LBS.NE.0)
L34: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)
#C8: .NOT.CFD42

L35: CFD1.EQV.CFDIN2
L36: CFDIN2

L37: CFDIN2.AND..NOT.TFD3

L38: CFDIN2.AND..NOT.TFD3.AND.GUID2D.NE.0

L3: CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND..NOT
    .TFD3.AND.GUID2D.NE.0
L40: CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2
    .AND..NOT.TFD3.AND.GUID2D.NE.0
L41: CFD2

L42: LOCFD03.EQ.LOCFD
L43: LOCFD03.EQ.0

L44: CFD2.AND.LOCFD03.EQ.0

L45: CFDIN1.OR.CFD2.AND.LOCFD03.EQ.0
L46: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
#C2: CCRUZFD

L47: START.EQ..IF.CFDIN1.THEN.3.ELSE.STAR
    T03

L48: START04.EQ..IF.CFDIN1.THEN.3.ELSE.ST
    ART03
#C4: START..E..IF.CFDIN1
```

```
MACRO(LOCFD06)

MACRO(CLANDFD)

NOT5(LOCFDC3,0)
NOT0rAND2(.NOT.CFDIN1.AND.CFD2,LOCFD03.NE
.0)
NOTORI(.NOT.CFDIN1.AND.CFD2.AND.LOCFD03.N
E.0.CFD4.AND.LB3.NE.0)

EQV3(CLANDFD,.NOT.CFDIN1.AND.CFD2.AND.LOC
FD03.NE.0.OR.CFD4.AND.LB5.NE.0)

IF9(CFDIN1,CLANDFD,LOCFD,LOCFD03,0,LOCFD0
5)

EQ4(LOCFD,.IF.CFDIN1.THEN.0.ELSE..IF.CLAN
DFD.THEN.LOCFD05.ELSE.LOCFD03,LOCFD06

MACRO(CFD3)
OR2(.NOT.CFDIN2,.NOT.TFD3)
NOT3(CFDIN2,TFD3)
EQV3(CFD3,CFDIN2.AND.TFD3)

MACRO(LOCOC04)

IF4(LOCOC.SET.LOCOC02,CFD3)

EQ4(LOCOC,.IF.CFD3.THEN.SET.ELSE.LOCOC02,
LOCOC04)

MACRO(YETAC2)

MACRO(PSIE02)

IF4(YETA1,YETA,YETAC1,CFDIN1)

IF4(PSIE1,PSIE,PSIE01,CFDIN1)

EQ4(YETA1,.IF.CFDIN1.THEN.YETA.ELSE.YETAC
1,YETAC2)

EQ4(PSIE1,.IF.CFDIN1.THEN.PSIE.ELSE.PSIEC
1,PSIEC2)

***** O. F. D. *****
```

```
NONE

NONE

L42: LOCFD03.EQ.0
L51: .NOT.LOCFD03.NE.0

L52: .NOT.(.NOT.CFDIN1.AND.CFD2.AND.LOCFD
     03.NE.0)
L33: .NOT.(CFD4.AND.LB5.NE.0)
L50: CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND
     .LOCFD03.NE.0.OR.CFD4.AND.LB5.NE.0
L53: .NOT.(.NOT.CFDIN1.AND.CFD2.AND.LOCFD
     03.NE.0.OR.CFD4.AND.LB5.NE.0)
H12: LOCFD.EQ.LOCFD02

H17: .NOT.CFDIN1
L54: .NOT.CLANDFD
L55: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
     CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L49: LOCFD05.EQ..IF.CFDIN1.THEN.0.ELSE..I
     F.CLANDFD.THEN.LOCFD06.ELSE.LOCFD03
NONE
L28: .NOT.TFD3
L57: .NOT.CFDIN2.OR..NOT.TFD3
L56: CFD3.EQV.CFDIN2.AND.TFD3
L58: .NOT.(CFDIN2.AND.TFD3)
NONE

H13: LOCOC.EQ.LOCOC02

L59: .NOT.CFD3
L61: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
     C02
L60: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
NONE

NONE

L24: YETA1.EQ.YETAC1

H17: .NOT.CFDIN1
L20: PSIE1.EQ.PSIEC1

H17: .NOT.CFDIN1
L64: YETA1.EQ..IF.CFDIN1.THEN.YETA.ELSE.Y
     ETAC1
L62: YETAC2.EQ..IF.CFDIN1.THEN.YETA.ELSE.
     YETAC1
L65: PSIE1.EQ..IF.CFDIN1.THEN.PSIE.ELSE.P
     SIEC1
L63: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
     PSIE01
```

```
L49: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
     F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L50: CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND
     .LOCFD03.NE.0.OR.CFD4.AND.LB5.NE.0
L51: .NOT.LOCFD03.NE.0
L52: .NOT.(.NOT.CFDIN1.AND.CFD2.AND.LOCFD
     03.NE.0)
L53: .NOT.(.NOT.CFDIN1.AND.CFD2.AND.LOCFD
     03.NE.0.OR.CFD4.AND.LB5.NE.0)

L54: .NOT.CLANDFD

L55: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
     CLANDFD.THEN.LOCFD05.ELSE.LOCFD03

*C4: LOCFD.EQ.LOCFD06

L56: CFD3.EQV.CFDIN2.AND.TFD3
L57: .NOT.CFDIN2.OR..NOT.TFD3
L58: .NOT.(CFDIN2.AND.TFD3)
L59: .NOT.CFD3

L60: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
L61: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
     C02

*C5: LOCOC.EQ.LOCOC04

L62: YETAC2.EQ..IF.CFDIN1.THEN.YETA.ELSE.
     YETAC1
L63: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
     PSIE01
L64: YETA1.EQ..IF.CFDIN1.THEN.YETA.ELSE.Y
     ETAC1

L65: PSIE1.EQ..IF.CFDIN1.THEN.PSIE.ELSE.P
     SIEC1

*C6: YETA1.EQ.YETAC2

*C7: PSIE1.EQ.PSIEC2
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 8

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CFD1
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD03
H13: LOCOC.EQ.LOCOC02
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: GSFD.EQ.GSFD02
H17: .NOT.CFDIN1
H18: TMEFLG.NE.0
H19: &AC1.EQ.LOCDEV
H20: &MQ1.EQ.MULTM(&AC1,K1)
H21: &AC2.EQ.MULT(&AC1,K1)
H22: YETA1.EQ.&AC2
H23: &AC3.EQ.TK
H24: &AC4.EQ.N(&AC3-RWYHDG)
H25: PSIE1.EQ.&AC4
H26: &AC5.EQ.ABS(&AC4)
H27: &AC6.EQ.N(&AC5-DEG2)
H28: .NOT.&AC6.LT.0
H29: &AC7.EQ.YETA1
H30: &AC8.EQ.ABS(&AC7)
H31: &AC9.EQ.&AC8-LIMLOC
H32: .NOT.&AC9.LT.0
H33: &AC10.EQ.GUID2D
H34: .NOT.&AC10.EQ.0
H35: &AC11.EQ.LOCFD
H36: &AC11.NE.0

CONCLUSIONS
C1: P(&AC8-LIMLOC)
C2: CLANDFD
C3: LOCFD.EQ.LOCFD05
C4: LOCOC.EQ.LOCOC04
C5: RLFD.EQ.RLFD02
C6: YETA1.EQ.YETA01
C7: PSIE1.EQ.PSIEC1
C8: .NOT.CCMUZFD

THEOREMS USED
APT1(X,Y)=X.GE.0.Y.GE.0.IMP.R(X=Y)
APT2(X)=ABS(X).GE.0
AND4(A,B)=A.B.IMP.A.AND.B
EQ2(P,Q)=P.EQ.0.EQV.Q.EQ.P
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.R.EQ.P
[illegible]
```

```
EQV3(A,B)=(A.EQV.B).AND.B.IMP.NOT.A
IF3(I,J,K,A)=I=J.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
IFA(I,J,K,A)=I=K..NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
NOT2(P,Q)=.NOT.P.EQ.Q.EQV.P.NE.Q
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
NOT5(P,Q)=P.EQ.Q.EQV..NOT.(P.NE.Q)
NOTOR1(A,B)=.NOT.A..NOT.B.IMP..NOT.(A.OR.B)
OR1(A,B)=A.IMP.A.OR.B
OR2(A,B)=B.IMP.A.OR.B
SUBST1(P,Q,R,A(R))=P.EQ.Q,A(P).IMP.A(Q)
SUBST2(P,Q,R,A(R))=P.EQ.Q,A(Q).IMP.A(P)
ABS15(P)=ABS(P).GE.0
NOT7(A,B)=.NOT.A..NOT.B.IMP..NOT.(A.OR.B)
NOTORAND2(A,B)=.NOT.B.IMP..NOT.(A.AND.B)

PROOF

THEOREMS
HYPEXP(SPEC,LIMLOC=100.823)
SUBST2(LIMLOC.100.823,X,X,GE.0)

ABS15(&AC7)
SUBST2(&AC8,ABS(&AC7),X,X,GE.0)

APT1(&AC8,LIMLOC)

MACRO(CLANDFD)

SUBST1(&AC11,LOCFD,X,X,NE.2)

SUBST1(LOCFD,LOCFD03,X,X,NE.0)

MACEXP(CCRUZFD)

NOT2(LOCFD03,0)
NOTORAND2(CFD2,LOCFD03=0)
NOT7(CFDIN1,CFD2.AND.LOCFD03=0)


EQV3(CCRUZFD,CFDIN1.OR.CFD2.AND.LOCFD03=0
    )


SUBST1(&AC10,GUID2D,X,.NOT.X.EQ.0)

NOT2(GUID2D,0)
SUBST1(&AC7,YETA1,X,&AC9=ABS(X))

SUBST1(&AC9,&AC8-LIMLOC,X,.NOT.X.LT.0)

SUBST1(&AC8,ABS(YETA1),X,.NOT.X-LIMLOC.LT
    .0)

SUBST1(&AC6,N(&AC5-DLG2),X,.NOT.X.LT.0)

SUBST2(PSIE1,&AC4,X,&AC5.EQ.ABS(X))

SUBST1(&AC5,ABS(PSIE1),X,.NOT.N(X-DEG2).L
    T.0)

EQ3   E1,&AC4,N(&AC3-RWYHDG))

SUBST1(&AC3,TK,X,PSIE1.EQ.N(X-RWYHDG))
```

```
HYPOTHESES
NONE
L1: LIMLOC.EQ.100.823
A1: 100.823.GE.0
NONE
H30: &AC8.EQ.ABS(&AC7)
L3: ABS(&AC7).GE.0
L4: &AC8.GE.0
L2: LIMLOC.GE.0
NONE

H35: &AC11.EQ.LOCFD
H36: &AC11.NE.2
H12: LOCFD.EQ.LOCFD03
L6: LOCFD.NE.0
NONE

L7: LOCFD03.NE.0
L9: .NOT.LOCFD03.EQ.0
H17: .NOT.CFDIN1

L10: .NOT.(CFD2.AND.LOCFD03.EQ.0)
L8: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD0
    3.EQ.0
L11: .NOT.(CFDIN1.OR.CFD2.AND.LOCFD03.EQ.
    0)
H33: &AC10.EQ.GUID2D
H34: .NOT.&AC10.EQ.0
L12: .NOT.GUID2D.EQ.0
H29: &AC7.EQ.YETA1
H30: &AC8.EQ.ABS(&AC7)
H31: &AC9.EQ.&AC8-LIMLOC
H32: .NOT.&AC9.LT.0
L14: &AC8.EQ.ABS(YETA1)

L15: .NOT.&AC8-LIMLOC.LT.0
H27: &AC6.EQ.N(&AC5-DEG2)
H26: .NOT.&AC6.LT.0
H25: PSIE1.EQ.&AC4
H26: &AC5.EQ.ABS(&AC4)
L18: &AC5.EQ.ABS(PSIE1)

L17: .NOT.N(&AC5-DEG2).LT.0
H25: PSIE1.EQ.&AC4
H24: &AC4.EQ.N(&AC3-RWYHDG)
H23: &AC3.EQ.TK
L20: PSIE1.EQ.N(&AC3-RWYHDG)
```

```
CONCLUSIONS
L1: LIMLOC.EQ.100.823
L2: LIMLOC.GE.0

L3: ABS(&AC7).GE.0
L4: &AC8.GE.0

#C1: R(&AC8-LIMLOC)

L5: CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND.
    LOCFD03.NE.0.OR.CFD4.AND.LBS.NE.0
L6: LOCFD.NE.0

L7: LOCFD03.NE.0

L8: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD0
    3.EQ.0
L9: .NOT.LOCFD03.EQ.0
L10: .NOT.(CFD2.AND.LOCFD03.EQ.0)
L11: .NOT.(CFDIN1.OR.CFD2.AND.LOCFD03.EQ.
    0)

#C8: .NOT.CCRUZFD


L12: .NOT.GUID2D.EQ.0

L13: GUID2D.NE.0
L14: &AC8.EQ.ABS(YETA1)

L15: .NOT.&AC8-LIMLOC.LT.0

L16: .NOT.ABS(YETA1)-LIMLOC.LT.0


L17: .NOT.N(&AC6-DEG2).LT.0

L18: &AC6.EQ.ABS(PSIE1)

L19: .NOT.N(ABS(PSIE1)-DEG2).LT.0


L20: PSIE1.EQ.N(&AC3-RWYHDG)

   T: PSIE1.EQ.N(TK-RWYHDG)
```

```
EQ4(PSIE1,N(TK-RWYHDG),PSIE01)

SUBST2(PSIE01,PSIE1,X,.NOT.N(ABS(X)-DEG2)
    .LT.0)

EQ3(YETA1,&AC2,MULT(&AC1,K1))

SUBST1(&AC1,LOCDEV,X,YETA1,EQ,MULT(X,K1))

EQ4(YETA1,MULT(LOCDEV,K1),YETA01)

SUBST2(YETA01,YETA1,X,.NOT.(ABS(X)-LIMLOC
    .LT.0))

MACRO(TFD3)

NOTOR1(ABS(YETA01)-LIMLOC.LT.0,N(ABS(PSIE
    01)-DEG2).LT.0)

EQV3(TFD3,ABS(YETA01)-LIMLOC.LT.0.OR.N(AB
    S(PSIE01)-DEG2).LT.0)


MACRO(CFD1)
EQV1(CFD1,CFDIN2)

AND4(CFDIN2,.NOT.TFD3)

AND4(CFDIN2.AND..NOT.TFD3,GUID2D.NE.0)


OR2(CFD4.AND.LBS.EQ.0,CFDIN2.AND..NOT.TFD
    3.AND.GUID2D.NE.0)
MACRO(CFD2)

EQV2(CFD2,CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND
    ..NOT.TFD3.AND.GUID2D.NE.0)


AND4(.NOT.CFDIN1,CFD2)

AND4(.NOT.CFDIN1.AND.CFD2,LOCFD03.NE.0)


OR1(.NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.0
    .CFD4.AND.LBS.NE.0)
EQV2(CLANDFD,.NOT.CFDIN1.AND.CFD2.AND.LOC
    FD03.NE.0.OR.CFD4.AND.LBS.NE.0)


MACRO(LOCFD05)

MACRO(CFD42)

OR2(.NOT.(CFD4.AND.LBS.NE.0).AND.NOT.LOCFD03
    .EQ.0)
NOT3(CFD4.AND.LBS.NE.0,LOCFD03=0)

EQV3(CFD42,CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)


IF4(L[illegible])
```

```
L21: PSIE1.EQ.N(TK-RWYHDG)
L23: PSIE01.EQ.N(TK-RWYHDG)
#C7: PSIE1.EQ.PSIE01

L19: .NOT.N(ABS(PSIE1)-DEG2).LT.0
H22: YETA1.EQ.&AC2
H21: &AC2.EQ.MULT(&AC1,K1)
H19: &AC1.EQ.LOCDEV

L25: YETA1.EQ.MULT(&AC1,K1)
L26: YETA1.EQ.MULT(LOCDEV,K1)
L22: YETA01.EQ.MULT(LOCDEV,K1)
#C6: YETA1.EQ.YETA01

L16: .NOT.ABS(YETA1)-LIMLOC.LT.0
NONE

L27: .NOT.ABS(YETA01)-LIMLOC.LT.0

L24: .NOT.N(ABS(PSIE01)-DEG2).LT.0
L28: TFD3.EQV.ABS(YETA01)-LIMLOC.LT.0.OR.
    N(ABS(PSIE01)-DEG2).LT.0
L29: .NOT.(ABS(YETA01)-LIMLOC.LT.0.OR.N(A
    BS(PSIE01)-DEG2).LT.0)
NONE
H3: CFD1
L31: CFD1.EQV.CFDIN2
L32: CFDIN2
L30: .NOT.TFD3
L33: CFDIN2.AND..NOT.TFD3

L13: GUID2D.NE.0
L34: CFDIN2.AND..NOT.TFD3.AND.GUID2D.NE.0

NONE

L35: CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND..NOT
    .TFD3.AND.GUID2D.NE.0
L36: CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2
    .AND..NOT.TFD3.AND.GUID2D.NE.0
H17: .NOT.CFDIN1
L37: CFD2
L38: .NOT.CFDIN1.AND.CFD2

L7: LOCFD03.NE.0
L39: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.
    0
L40: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.
    0.OR.CFD4.AND.LBS.NE.0
L5: CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND.
    LOCFD03.NE.0.OR.CFD4.AND.LBS.NE.0
NONE

NONE

L9: .NOT.LOCFD03.EQ.0

L43: .NOT.(CFD4.AND.LBS.NE.0).OR..NOT.LOC
    FD03.EQ.0
L42: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D03.EQ.0
L44: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)
L[illegible]
```

```
#C7: PSIE1.EQ.PSIE01

L24: .NOT.N(ABS(PSIE01)-DEG2).LT.0


L25: YETA1.EQ.MULT(&AC1,K1)

L26: YETA1.EQ.MULT(LOCDEV,K1)


#C6: YETA1.EQ.YETA01

L27: .NOT.ABS(YETA01)-LIMLOC.LT.0


L28: TFD3.EQV.ABS(YETA01)-LIMLOC.LT.0.OR.
    N(ABS(PSIE01)-DEG2).LT.0
L29: .NOT.(ABS(YETA01)-LIMLOC.LT.0.OR.N(A
    BS(PSIE01)-DEG2).LT.0)

L30: .NOT.TFD3


L31: CFD1.EQV.CFDIN2
L32: CFDIN2

L33: CFDIN2.AND..NOT.TFD3

L34: CFDIN2.AND..NOT.TFD3.AND.GUID2D.NE.0


L35: CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND..NOT
    .TFD3.AND.GUID2D.NE.0
L36: CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2
    .AND..NOT.TFD3.AND.GUID2D.NE.0
L37: CFD2


L38: .NOT.CFDIN1.AND.CFD2

L39: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.
    0

L40: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.
    0.OR.CFD4.AND.LBS.NE.0
#C2: CLANDFD


L41: LOCFD05.EQ..IF.CFD42.THEN.SET.ELSE.L
    OCFD03
L42: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D03.EQ.0
L43: .NOT.(CFD4.AND.LBS.NE.0).OR..NOT.LOC
    FD03.EQ.0
L44: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)
L45: .NOT.CFD42
```

```
EQ4(LOCFD..IF.CFD42.THEN.SET.ELSE.LOCFD03
    .LOCFD05)

MACRO(CFD3)
OR2(.NOT.CFDIN2..NOT.TFD3)
NOT3(CFDIN2,TFD3)
EQV3(CFD3,CFDIN2.AND.TFD3)

MACRO(LOCOC04)

IF4(LOCOC.SET.LOCOC02.CFD3)

EQ4(LOCOC..IF.CFD3.THEN.SET.ELSE.LOCOC02.
    LOCOC04)

MACRO(RLFD02)

IF4(RLFD.ROLL.RLFD.CFD42)

EQ4(RLFD..IF.CFD42.THEN.ROLL.ELSE.RLFD.RL
    FD02)

***** O. E. D. *****
```

```
L40: LOCFD.EQ..IF.CFD42.THEN.SET.ELSE.LOC
     FD03
L41: LOCFD05.EQ..IF.CFD42.THEN.SET.ELSE.L
     OCFD03
NONE
L38: .NOT.TFD3
L48: .NOT.CFDIN2.OR..NOT.TFD3
L47: CFD3.EQV.CFDIN2.AND.TFD3
L49: .NOT.(CFDIN2.AND.TFD3)
NONE

H13: LOCOC.EQ.LOCOC02

L50: .NOT.CFD3
L52: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
     C02
L51: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
NONE

A2: RLFD.EQ.RLFD

L45: .NOT.CFD42
L54: RLFD.EQ..IF.CFD42.THEN.ROLL.ELSE.RLF
     D
L53: RLFD02.EQ..IF.CFD42.THEN.ROLL.ELSE.R
     LFD
```

```
#C3: LOCFD.EQ.LOCFD05

L47: CFD3.EQV.CFDIN2.AND.TFD3
L48: .NOT.CFDIN2.OR..NOT.TFD3
L49: .NOT.(CFDIN2.AND.TFD3)
L50: .NOT.CFD3

L51: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
L52: LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
     C02

#C4: LOCOC.EQ.LOCOC04

L53: RLFD02.EQ..IF.CFD42.THEN.ROLL.ELSE.R
     LFD
L54: RLFD.EQ..IF.CFD42.THEN.ROLL.ELSE.RLF
     D

#C5: RLFD.EQ.RLFD02
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 9

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: CFD1
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD03
H13: LOCOC.EQ.LOCOC02
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: GSFD.EQ.GSFD02
H17: .NOT.CFDIN1
H18: TMEFLG.NE.0
H19: &AC1.EQ.LOCDEV
H20: &M01.EQ.MULTM(&AC1,K1)
H21: &AC2.EQ.MULT(&AC1,K1)
H22: YETA1.EQ.&AC2
H23: &AC3.EQ.TK
H24: &AC4.EQ.N(&AC3-RWYHDG)
H25: PSIE1.EQ.&AC4
H26: &AC5.EQ.ABS(&AC4)
H27: &AC6.EQ.N(&AC5-DEG2)
H28: .NOT.&AC6.LT.0
H29: &AC7.EQ.YETA1
H30: &AC8.EQ.ABS(&AC7)
H31: &AC9.EQ.&AC8-LIMLOC
H32: .NOT.&AC9.LT.0
H33: &AC10.EQ.GUID2D
H34: &AC10.EQ.0

CONCLUSIONS
C1: R(&AC8-LIMLOC)
C2: CFD4
C3: LOCOC.EQ.LOCOC04
C4: YETA1.EQ.YETA01
C5: PSIE1.EQ.PSIE01

THEOREMS USED
APT1(X,Y)=X.GE.0.Y.GE.0.IMP.R(X-Y)
APT2(X)=ABS(X).GE.0
AND4(A,B)=A.B.IMP.A.AND.B
EQ2(P,Q)=P.EQ.Q.EQV.Q.EQ.P
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
EQV1(A,B)=A,(A.EQV.B).IMP.B
EQV2(A,B)=B,(A.EQV.B).IMP.A
EQV3(A,B)=(A.EQV.B),.NOT.B.IMP..NOT.A
IF4(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
NOT2(P,Q)=.NOT.P.EQ.Q.EQV.).NE.Q
```

```
NOTOR1(A,B)=.NOT.A..NOT.B.IMP..NOT.(A.OR.B)
OR2(A,B)=B.IMP.A.OR.B
SUBST1(P.O.R.A(R))=P.EQ.O.A(P).IMP.A(Q)
SUBST2(P.O.R.A(R))=P.EQ.O.A(Q).IMP.A(P)

PROOF

THEOREMS
HYPEXP(SPEC.LIMLOC=100.B23)
SUBST1(&AC7.YETA1.X.&AC8.EQ.ABS(X))

APT2(YETA1)
SUBST2(LIMLOC.100.B23.X.X.GE.0)

APT1(ABS(YETA1).LIMLOC)

SUBST2(&AC8.ABS(YETA1).X.R(X-LIMLOC))

MACRO(CFD4)

SUBST1(&AC10.GUID2D.X.X.EQ.0)

MACRO(CFD1)
EQV1(CFD1.CFDIN2)

OR2(TFD3.GUID2D.EQ.0)
AND4(CFDIN2.TFD3.OR.GUID2D.EQ.0)

MACRO(LOCOC04)

MACRO(CFD3)
EQV2(CFD4.CFDIN2.AND.(TFD3.OR.GUID2D=0))

MACRO(TFD3)

SUBST1(&AC9.&AC8-LIMLOC.X..NOT.X.LT.0)

SUBST1(&AC8.ABS(YETA1).X..NOT.X-LIMLOC.LT
    .0)

SUBST1(&AC6.N(&AC5-DEG2).X..NOT.X.LT.0)

SUBST2(PSIE1.&AC4.X.&AC5.EQ.ABS(X))

SUBST1(&AC5.ABS(PSIE1).X..NOT.N(X-DEG2).L
    T.0)

EQ4(PSIE1.&AC4.N(&AC3-RWYHDG))

SUBST1(&AC3.TK.X.PSIE1.EQ.N(X-RWYHDG))

MACRO(YETA01)
MACRO(PSIE01)
EQ4(PSIE1.N(TK-RWYHDG).PSIE01)

SUBST2(PSIE01.PSIE1.X..NOT.N(ABS(X)-DEG2)
    .LT.0)

EQ3(YETA1.&AC2.MULT(&AC1.K1))

SUBST1(&AC1.LOCDEV.X.YETA1.EQ.MULT(X.K1))
```

```
HYPOTHESES
NONE
H29: &AC7.EQ.YETA1
H30: &AC8.EQ.ABS(&AC7)
NONE
L1: LIMLOC.EQ.100.B23
A1: 100.B23.GE.0
L3: ABS(YETA1).GE.0
L4: LIMLOC.GE.0
L2: &AC8.EQ.ABS(YETA1)
L5: R(ABS(YETA1)-LIMLOC)
NONE

H33: &AC10.EQ.GUID2D
H34: &AC10.EQ.0
NONE
H3: CFD1
L8: CFD1.EQV.CFDIN2
L7: GUID2D.EQ.0
L9: CFDIN2
L10: TFD3.OR.GUID2D.EQ.0
NONE

NONE
L11: CFDIN2.AND.(TFD3.OR.GUID2D.EQ.0)
L6: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.E
    Q.0)
NONE

H31: &AC9.EQ.&AC8-LIMLOC
H32: .NOT.&AC9.LT.0
L2: &AC8.EQ.ABS(YETA1)

L15: .NOT.&AC8-LIMLOC.LT.0
H27: &AC6.EQ.N(&AC5-DEG2)
H28: .NOT.&AC6.LT.0
H25: PSIE1.EQ.&AC4
H26: &AC5.EQ.ABS(&AC4)
L18: &AC5.EQ.ABS(PSIE1)

L17: .NOT.N(&AC5-DEG2).LT.0
H25: PSIE1.EQ.&AC4
H24: &AC4.EQ.N(&AC3-RWYHDG)
H23: &AC3.EQ.TK
L20: PSIE1.EQ.N(&AC3-RWYHDG)
NONE
NONE
L21: PSIE1.EQ.N(TK-RWYHDG)
L23: PSIE01.EQ.N(TK-RWYHDG)
*C5: PSIE1.EQ.PSIE01

L19: .NOT.N(ABS(PSIE1)-DEG2).LT.0
H22: YETA1.EQ.&AC2
H21: &AC2.EQ.MULT(&AC1.K1)
H19: &AC1.EQ.LOCDEV

[illegible]
```

```
CONCLUSIONS
L1: LIMLOC.EQ.100.B23
L2: &AC8.EQ.ABS(YETA1)

L3: ABS(YETA1).GE.0
L4: LIMLOC.GE.0

L5: R(ABS(YETA1)-LIMLOC)

*C1: R(&AC8-LIMLOC)

L6: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.E
    Q.0)
L7: GUID2D.EQ.0

L8: CFD1.EQV.CFDIN2
L9: CFDIN2

L10: TFD3.OR.GUID2D.EQ.0
L11: CFDIN2.AND.(TFD3.OR.GUID2D.EQ.0)

L12: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
    COC02
L13: CFD3.EQV.CFDIN2.AND.TFD3
*C2: CFD4


L14: TFD3.EQV.ABS(YETA01)-LIMLOC.LT.0.OR.
    N(ABS(PSIE01)-DEG2).LT.0
L15: .NOT.&AC8-LIMLOC.LT.0

L16: .NOT.ABS(YETA1)-LIMLOC.LT.0


L17: .NOT.N(&AC5-DEG2).LT.0

L18: &AC5.EQ.ABS(PSIE1)

L19: .NOT.N(ABS(PSIE1)-DEG2).LT.0


L20: PSIE1.EQ.N(&AC3-RWYHDG)

L21: PSIE1.EQ.N(TK-RWYHDG)

L22: YETA01.EQ.MULT(LOCDEV.K1)
L23: PSIE01.EQ.N(TK-RWYHDG)
*C5: PSIE1.EQ.PSIE01

L24: .NOT.N(ABS(PSIE01)-DEG2).LT.0


L25: YETA1.EQ.MULT(&AC1.K1)

L26: YETA1.EQ.MULT(LOCDEV.K1)
```

```
SUBST2(YETA01,YETA1,X,.NOT.(ABS(X)-LIMLOC
     .LT.0))

NOTOR1(ABS(YETA01)-LIMLOC.LT.0,N(ABS(PSIE
     01)-DEG2).LT.0)

EQV3(TFD3,ABS(YETA01)-LIMLOC.LT.0.OR.N(AB
     S(PSIE01)-DEG2).LT.0)


OR2(.NOT.CFDIN2,.NOT.TFD3)
NOT3(CFDIN2,TFD3)
EQV3(CFD3,CFDIN2.AND.TFD3)

IF4(LOCOC,SET,LOCOC02,CFD3)


EQ4(LOCOC,.IF.CFD3.THEN.SET.ELSE.LOCOC02,
     LOCOC04)


***** Q. E. D. *****
```

```
*C4:  YETA1.EQ.YETA01

L16:  .NOT.ABS(YETA1)-LIMLOC.LT.0
L27:  .NOT.ABS(YETA01)-LIMLOC.LT.0

L24:  .NOT.N(ABS(PSIE01)-DEG2).LT.0
L14:  TFD3.EQV.ABS(YETA01)-LIMLOC.LT.0.OR.
     N(ABS(PSIE01)-DEG2).LT.0
L28:  .NOT.(ABS(YETA01)-LIMLOC.LT.0.OR.N(A
     BS(PSIE01)-DEG2).LT.0)
L29:  .NOT.TFD3
L30:  .NOT.CFDIN2.OR..NOT.TFD3
L13:  CFD3.EQV.CFDIN2.AND.TFD3
L31:  .NOT.(CFDIN2.AND.TFD3)
H13:  LOCOC.EQ.LOCOC02

L32:  .NOT.CFD3
L33:  LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
     C02
L12:  LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
```

```
L27:  .NOT.ABS(YETA01)-LIMLOC.LT.0


L28:  .NOT.(ABS(YETA01)-LIMLOC.LT.0.OR.N(A
     BS(PSIE01)-DEG2).LT.0)

L29:  .NOT.TFD3


L30:  .NOT.CFDIN2.OR..NOT.TFD3
L31:  .NOT.(CFDIN2.AND.TFD3)
L32:  .NOT.CFD3

L33:  LOCOC.EQ..IF.CFD3.THEN.SET.ELSE.LOCO
     C02

*C3:  LOCOC.EQ.LOCOC04
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 10

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CFD1
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD03
H13: LOCOC.EQ.LOCOC02
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: GSFD.EQ.GSFD02
H17: .NOT.CFDIN1
H18: TMEFLG.NE.0
H19: &AC1.EQ.LOCDEV
H20: &M01.EQ.MULTM(&AC1,K1)
H21: &AC2.EQ.MULT(&AC1,K1)
H22: YETA1.EQ.&AC2
H23: &AC3.EQ.TK
H24: &AC4.EQ.N(&AC3-RWYHDG)
H25: PSIE1.EQ.&AC4
H26: &AC5.EQ.ABS(&AC4)
H27: &AC6.EQ.N(&AC5-DEG2)
H28: .NOT.&AC6.LT.0
H29: &AC7.EQ.YETA1
H30: &AC8.EQ.ABS(&AC7)
H31: &AC9.EQ.&AC8-LIMLOC
H32: &AC9.LT.0
H33: &AC10.EQ.SET
H34: LOCOC1.EQ.&AC10

CONCLUSIONS
C1: R(&AC9-LIMLOC)
C2: CFD4
C3: LOCOC1.EQ.LOCOC04
C4: YETA1.EQ.YETA01
C5: PSIE1.EQ.PSIE01

THEOREMS USED
APT1(X,Y)=X.GE.0.Y.GE.0.IMP.R(X-Y)
APT2(X)=ABS(X).GE.0
AND4(A,B)=A.B.IMP.A.AND.B
EQ2(P,Q)=P.EQ.Q.EQV.Q.EQ.P
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
EQV1(A,B)=A.(A.EQV.B).IMP.B
EQV2(A,B)=B.(A.EQV.B).IMP.A
EQV3(A,B)=(A.EQV.B).NOT.B.IMP..NOT.A
IF3(I,J,K,A)=I=J.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
IF4(I,J,K,A)=I=K.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
```

```
NOTS(P,Q)=P.EQ.Q.EQV..NOT.(P.NE.Q)
NOTOR1(A,B)=.NOT.A..NOT.B.IMP..NOT.(A.OR.B)
OR1(A,B)=A.IMP.A.OR.B
OR2(A,B)=B.IMP.A.OR.B
SUBST1(P,Q,R,A(R))=P.EQ.Q,A(P).IMP.A(Q)
SUBST2(P,Q,R,A(R))=P.EQ.Q,A(Q).IMP.A(P)
ABS1S(P)=ABS(P).GE.0

PROOF

THEOREMS
HYPEXP(SPEC,LIMLOC=100.B23)
SUBST2(LIMLOC.100.B23,X,X.GE.0)

ABS1S(&AC7)
SUBST2(&AC8,ABS(&AC7),X,X.GE.0)

APT1(&AC8,LIMLOC)

EQ3(PSIE1,&AC4,N(&AC3-RWYHDG))

SUBST1(&AC3,TK,X,PSIE1.EQ.N(X-RWYHDG))

MACRO(YETA01)
MACRO(PSIE01)
EQ4(PSIE01,N(TK-RWYHDG),PSIE1)

EQ3(YETA1,&AC2,MULT(&AC1,K1))

SUBST1(&AC1,LOCDEV,X,YETA1.EQ.MULT(X,K1))

EQ4(YETA1,MULT(LOCDEV,K1),YETA01)

SUBST1(&AC7,YETA1,X,&AC8=ABS(X))

MACRO(CFD4)

MACRO(CFD1)
EQV1(CFD1,CFDIN2)

MACRO(LOCOC04)

EQ3(LOCOC1,&AC10,SET)

MACRO(CFD3)
MACRO(CFD1)
MACRO(TFD3)

SUBST1(&AC8,ABS(YETA1),X,&AC9=X-LIMLOC)

SUBST1(&AC9,ABS(YETA1)-LIMLOC,X,X.LT.0)

SUBST1(YETA1,YETA01,X,ABS(X)-LIMLOC.LT.0)

OR1(ABS(YETA01)-LIMLOC.LT.0,N(ABS(PSIE01)
    -DEG2).LT.0)
EQV2(TFD3,ABS(YETA01)-LIMLOC.LT.0.OR.N(AB
    S(PSIE01)-DEG2).LT.0)

AND4(CFDIN2,TFD3)
```

```
HYPOTHESES
NONE
L1: LIMLOC.EQ.100.B23
A1: 100.B23.GE.0
NONE
H30: &AC8.EQ.ABS(&AC7)
L3: ABS(&AC7).GE.0
L4: &AC8.GE.0
L2: LIMLOC.GE.0
H25: PSIE1.EQ.&AC4
H24: &AC4.EQ.N(&AC3-RWYHDG)
H23: &AC3.EQ.TK
L5: PSIE1.EQ.N(&AC3-RWYHDG)
NONE
NONE
L8: PSIE01.EQ.N(TK-RWYHDG)
L6: PSIE1.EQ.N(TK-RWYHDG)
H22: YETA1.EQ.&AC2
H21: &AC2.EQ.MULT(&AC1.K1)
H19: &AC1.EQ.LOCDEV

L10: YETA1.EQ.MULT(&AC1,K1)
L11: YETA1.EQ.MULT(LOCDEV,K1)
L7: YETA01.EQ.MULT(LOCDEV,K1)
H29: &AC7.EQ.YETA1
H30: &AC8.EQ.ABS(&AC7)
NONE

NONE
H3: CFD1
L14: CFD1.EQV.CFDIN2
NONE

H34: LOCOC1.EQ.&AC10
H33: &AC10.EQ.SET
NONE
NONE
NONE

L12: &AC8.EQ.ABS(YETA1)
H31: &AC9.EQ.&AC8-LIMLOC
L20: &AC9.EQ.ABS(YETA1)-LIMLOC
H32: &AC9.LT.0
*C4: YETA1.EQ.YETA01

L21: ABS(YETA1)-LIMLOC.LT.0
L22: ABS(YETA01)-LIMLOC.LT.0

L23: ABS(YETA01)-LIMLOC.LT.0.OR.N(ABS(PSI
    E01)-DEG2).LT.0
L19: TFD3.EQV.ABS(YETA01)-LIMLOC.LT.0.OR.
    N(ABS(PSIE01)-DEG2).LT.0
L15: CFDIN2
L24: TFD3
```

```
CONCLUSIONS
L1: LIMLOC.EQ.100.B23
L2: LIMLOC.GE.0

L3: ABS(&AC7).GE.0
L4: &AC8.GE.0

*C1: R(&AC8-LIMLOC)

L5: PSIE1.EQ.N(&AC3-RWYHDG)

L6: PSIE1.EQ.N(TK-RWYHDG)

L7: YETA01.EQ.MULT(LOCDEV,K1)
L8: PSIE01.EQ.N(TK-RWYHDG)
L9: PSIE01.EQ.PSIE1

L10: YETA1.EQ.MULT(&AC1,K1)

L11: YETA1.EQ.MULT(LOCDEV,K1)

*C4: YETA1.EQ.YETA01

L12: &AC8.EQ.ABS(YETA1)

L13: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
    EQ.0)
L14: CFD1.EQV.CFDIN2
L15: CFDIN2

L16: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
    COC02
L17: LOCOC1.EQ.SET

L18: CFD3.EQV.CFDIN2.AND.TFD3
L14: CFD1.EQV.CFDIN2
L19: TFD3.EQV.ABS(YETA01)-LIMLOC._T.0.OR.
    N(ABS(PSIE01)-DEG2).LT.0
L20: &AC9.EQ.ABS(YETA1)-LIMLOC

L21: ABS(YETA1)-LIMLOC.LT.0

L22: ABS(YETA01)-LIMLOC.LT.0

L23: ABS(YETA01)-LIMLOC.LT.0.OR.N(ABS(PSI
    E01)-DEG2).LT.0
L24: TFD3

L25: CFDIN2.AND.TFD3
```

```
IF3(LOCOC1,SET,LOCOC02,CFD3)

EQ4(LOCOC1,.IF.CFD3.THEN.SET.ELSE.LOCOC02
    ,LOCOC04)

OR1(TFD3,GUID2D.EQ.0)
AND4(CFDIN2,TFD3.OR.GUID2D.EQ.0)

EQV2(CFD4,CFDIN2.AND.(TFD3.OR.GUID2D=0))

EQ2(PSIE01,PSIE1)

***** O. E. D. *****
```

```
L17: LOCOC1.EQ.SET

L26: CFD3
L27: LOCOC1.EQ..IF.CFD3.THEN.SET.ELSE.LOC
     OC02
L16: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
     COC02
L24: TFD3
L15: CFDIN2
L28: TFD3.OR.GUID2D.EQ.0
L29: CFDIN2.AND.(TFD3.OR.GUID2D.EQ.0)
L13: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
     EQ.0)
L9: PSIE01.EQ.PSIE1
```

```
L27: LOCOC1.EQ..IF.CFD3.THEN.SET.ELSE.LOC
     OC02

*C3: LOCOC1.EQ.LOCOC04

L28: TFD3.OR.GUID2D.EQ.0
L29: CFDIN2.AND.(TFD3.OR.GUID2D.EQ.0)

*C2: CFD4

*C5: PSIE1.EQ.PSIE01
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 11

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CFD1
H4: MEILS.EQ.MEILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD03
H13: LOCOC.EQ.LOCOC02
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: GSFD.EQ.GSFD02
H17: &AC1.EQ.LOCDEV
H18: &MQ1.EQ.MULTM(&AC1,K1)
H19: &AC2.EQ.MULT(&AC1,K1)
H20: YETA1.EQ.&AC2
H21: &AC3.EQ.TK
H22: &AC4.EQ.N(&AC3-EWYHDG)
H23: PSIE1.EQ.&AC4
H24: &AC5.EQ.ABS(&AC4)
H25: &AC6.EQ.N(&AC5-DEG2)
H26: &AC6.LT.0
H27: &AC7.EQ.SET
H28: LOCOC1.EQ.&AC7

CONCLUSIONS
C1: CFD4
C2: LOCOC1.EQ.LOCOC04
C3: YETA1.EQ.YETA01
C4: PSIE1.EQ.PSIE01

THEOREMS USED
AND4(A,B)=A,B.IMP.A.AND.B
EQ3(P,Q,R)=P.EQ.Q,Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q,R.EQ.Q.IMP.P.EQ.R
EQV1(A,B)=A,(A.EQV.B).IMP.B
EQV2(A,B)=B,(A.EQV.B).IMP.A
EQV3(A,B)=(A.EQV.B),.NOT.B.IMP..NOT.A
IF3(I,J,K,A)=I=J,A.IMP.I=(.IF.A.THEN.J.ELSE.K)
OR1(A,B)=A.IMP.A.OR.B
OR2(A,B)=B.IMP.A.OR.B
SUBST1(P,Q,R,A(R))=P.EQ.Q,A(P).IMP.A(Q)

PROOF

THEOREMS
EQ3(LOCOC1,&AC7,SET)

SUBST1(&AC6,N(&AC5-DEG2),X,X.LT.0)

HYPOTHESES
H28: LOCOC1.EQ.&AC7
H27: &AC7.EQ.SET
H25: &AC6.EQ.N(&AC5-DEG2)
H26: &AC6.LT.0

CONCLUSIONS
L1: LOCOC1.EQ.SET

L2: N(&AC5-DEG2).LT.0
```

```
SUBST1(&AC4,PSIE1,X,N(ABS(X)-DEG2).LT.0)

SUBST1(&AC3,TK,X,&AC4=N(X-RWYHDG))

EQ3(PSIE1,&AC4,N(TK-RWYHDG))

MACRO(PSIE01)
EQ4(PSIE1,N(TK-RWYHDG),PSIE01)

SUBST1(PSIE1,PSIE01,X,N(ABS(X)-DEG2).LT.0
    )

OR2(ABS(YETA01)-LIMLOC.LT.0,N(ABS(PSIE01)
    -DEG2).LT.0)
MACRO(TFD3)

EQV2(TFD3,ABS(YETA01)-LIMLOC.LT.0.OR.N(AB
    S(PSIE01)-DEG2).LT.0)


MACRO(CFD3)
MACRO(CFD1)
EQV1(CFD1,CFDIN2)

AND4(CFDIN2,TFD3)

EQV2(CFD3,CFDIN2.AND.TFD3)

IF3(LOCOC1,SET,LOCOC02,CFD3)


MACRO(CFD4)

OR1(TFD3,GUID2D=0)
AND4(CFDIN2,TFD3.OR.GUID2D=0)

EQV2(CFD4,CFDIN2.AND.(TFD3.OR.GUID2D=0))


MACRO(LOCOC04)

EQ4(LOCOC1,.IF.CFD3.THEN.SET.ELSE.LOCOC02
    ,LOCCC04)


MACRO(YETA01)
SUBST1(&AC1,LOCDEV,X,&AC2=MULT(X,K1))

EQ3(YETA1,&AC2,MULT(LOCDEV,K1))

EQ4(YETA1,MULT(LOCDEV,K1),YETA01)


***** Q. E. D. *****
```

```
H23: PSIE1.EQ.&AC4
L3: N(ABS(&AC4)-DEG2).LT.0
H21: &AC3.EQ.TK
H22: &AC4.EQ.N(&AC3-RWYHDG)
H23: PSIE1.EQ.&AC4
L5: &AC4.EQ.N(TK-RWYHDG)
NONE
L6: PSIE1.EQ.N(TK-RWYHDG)
L7: PSIE01.EQ.N(TK-RWYHDG)
*C4: PSIE1.EQ.PSIE01

L4: N(ABS(PSIE1)-DEG2).LT.0
L8: N(ABS(PSIE01)-DEG2).LT.0

NONE

L9: ABS(YETA01)-LIMLOC.LT.0.OR.N(ABS(PSIE
    01)-DEG2).LT.0
L10: TFD3.EQV.ABS(YETA01)-LIMLOC.LT.0.OR.
    N(ABS(PSIE01)-DEG2).LT.0
NONE
NONE
H3: CFD1
L13: CFD1.EQV.CFDIN2
L14: CFDIN2
L11: TFD3
L15: CFDIN2.AND.TFD3
L12: CFD3.EQV.CFDIN2.AND.TFD3
L1: LOCOC1.EQ.SET

L16: CFD3
NONE

L11: TFD3
L14: CFDIN2
L19: TFD3.OR.GUID2D.EQ.0
L20: CFDIN2.AND.(TFD3.OR.GUID2D.EQ.0)
L18: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
    EQ.0)
NONE

L17: LOCOC1.EQ..IF.CFD3.THEN.SET.ELSE.LOC
    OC02
L21: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
    COC02
NONE
H17: &AC1.EQ.LOCDEV
H19: &AC2.EQ.MULT(&AC1,K1)
H20: YETA1.EQ.&AC2
L23: &AC2.EQ.MULT(LOCDEV,K1)
L24: YETA1.EQ.MULT(LOCDEV,K1)
L22: YETA01.EQ.MULT(LOCDEV,K1)
```

```
L4: N(ABS(PSIE1)-DEG2).LT.0

L5: &AC4.EQ.N(TK-RWYHDG)

L6: PSIE1.EQ.N(TK-RWYHDG)

L7: PSIE01.EQ.N(TK-RWYHDG)
*C4: PSIE1.EQ.PSIE01

L8: N(ABS(PSIE01)-DEG2).LT.0


L9: ABS(YETA01)-LIMLOC.LT.0.OR.N(ABS(PSIE
    01)-DEG2).LT.0
L10: TFD3.EQV.ABS(YETA01)-LIMLOC.LT.0.OR.
    N(ABS(PSIE01)-DEG2).LT.0
L11: TFD3


L12: CFD3.EQV.CFDIN2.AND.TFD3
L13: CFD1.EQV.CFDIN2
L14: CFDIN2

L15: CFDIN2.AND.TFD3

L16: CFD3

L17: LOCOC1.EQ..IF.CFD3.THEN.SET.ELSE.LOC
    OC02

L18: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
    EQ.0)
L19: TFD3.OR.GUID2D.EQ.0
L20: CFDIN2.AND.(TFD3.OR.GUID2D.EQ.0)

*C1: CFD4


L21: LOCOC04.EQ..IF.CFD3.THEN.SET.ELSE.LO
    COC02
*C2: LOCOC1.EQ.LOCOC04


L22: YETA01.EQ.MULT(LOCDEV,K1)
L23: &AC2.EQ.MULT(LOCDEV,K1)

L24: YETA1.EQ.MULT(LOCDEV,K1)

*C3: YETA1.EQ.YETA01
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 12

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CFD4
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD03
H13: LOCOC.EQ.LOCOC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: YETA.EQ.YETA01
H17: PSIE.EQ.PSIE01
H18: GSFD.EQ.GSFD02
H19: .NOT.CFDIN1
H20: TMEFLG.NE.0
H21: &AC1.EQ.LBS
H22: .NOT.&AC1.EQ.0
H23: &AC2.EQ.LOCFD
H24: .NOT.&AC2.NE.0
H25: &AC3.EQ.SET
H26: LOCFD1.EQ.&AC3
H27: &AC4.EQ.RCLL
H28: RLFD1.EQ.&AC4

CONCLUSIONS
C1: CLANDFD
C2: LOCFD1.EQ.LOCFD05
C3: RLFD1.EQ.RLFD02
C4: .NOT.CCRUZFD

THEOREMS USED
AND4(A,B)=A.B.IMP.A.AND.B
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q.P.EQ.Q.IMP.P.EQ.R
EQV1(A,B)=A.(A.EQV.B).IMP.B
EQV2(A,B)=B.(A.EQV.B).IMP.A
EQV3(A,B)=(A.EQV.B).NOT.B.IMP..NOT.A
IF3(I,J,K,A)=I=J.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
OR2(A,B)=B.IMP.A.OR.B
NOT2(P,Q)=.NOT.P.EQ.Q.EQV.P.NE.Q
NOT5(P,Q)=P.EQ.Q.EQV..NOT.(P.NE.Q)
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
SUBST5(A,B,C,D(C))=(A.IMP.B).D(A).IMP.D(B)
NOT7(A,B)=.NOT.A..NOT.B.IMP..NOT.(A.OR.B)
NOTORAND9(A,B,C)=A.AND.(B.OR.C).IMP..NOT.(A.AND..NOT.B.AND..NOT.C)
NOTORAND2(A,B)=.NOT.B.IMP..NOT.(A.AND.B)
NOTORAND3(A,B)=.NOT.A.IMP..NOT.(A.AND.B)

PROOF
```

```
EQ3(RLFD1,&AC4,ROLL)

EQ3(LOCFD1,&AC3,SET)

SUBST1(&AC2,LOCFD,X,.NOT.X.NE.0)

SUBST1(&AC1,LBS,X,.NOT.X.EQ.0)

MACRO(CLANDFD)

NOT2(LBS,0)
AND4(CFD4,LBS.NE.0)

OR2(.NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.0
    .CFD4.AND.LBS.NE.0)
EQV2(CLANDFD,.NOT.CFDIN1.AND.CFD2.AND.LOC
    FD03.NE.0.OR.CFD4.AND.LBS.NE.0)


MACRO(LOCFD05)

MACRO(CFD42)

NOT2(LBS,0)
NOT5(LOCFD,0)
EQ3(LOCFD03,LOCFD,0)

AND4(CFD4,LBS.NE.0)

AND4(CFD4.AND.LBS.NE.0,LOCFD03=0)

EQV2(CFD42,CFD4.AND.LBS.NE.0.AND.LOCFD03=
    0)


IF3(LOCFD1,SET,LOCFD03,CFD42)


EQ4(LOCFD1,.IF.CFD42.THEN.SET.ELSE.LOCFD0
    3,LOCFD05)


MACRO(RLFD02)

IF3(RLFD1,ROLL,RLFD,CFD42)


EQ4(RLFD1,.IF.CFD42.THEN.ROLL.ELSE.RLFD,R
    LFD02)


MACEXP(CCRUZFD)

MACEXP(CFD2)

NOTORAND2(CFD4,LBS=0)
MACEXP(CFD4)

EQV1(CFD4,CFDIN2.AND.(TFD3.OR.GUID2D.EQ.0
    ))


NOTORAND9(CFDIN2,TFD3,GUID2D=0)
```

```
H28: RLFD1.EQ.&AC4
H27: &AC4.EQ.ROLL
H26: LOCFD1.EQ.&AC3
H25: &AC3.EQ.SET
H23: &AC2.EQ.LOCFD
H24: .NOT.&AC2.NE.0
H21: &AC1.EQ.LBS
H22: .NOT.&AC1.EQ.0
NONE

L4: .NOT.LBS.EQ.0
H3: CFD4
L6: LBS.NE.0
L7: CFD4.AND.LBS.NE.0

L8: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.0
    .OR.CFD4.AND.LBS.NE.0
L5: CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND.
    LOCFD03.NE.0.OR.CFD4.AND.LBS.NE.0
NONE

NONE

L4: .NOT.LBS.EQ.0
L3: .NOT.LOCFD.NE.0
H12: LOCFD.EQ.LOCFD03
L11: LOCFD.EQ.0
H3: CFD4
L6: LBS.NE.0
L7: CFD4.AND.LBS.NE.0
L12: LOCFD03.EQ.0
L13: CFD4.AND.LBS.NE.0.AND.LOCFD03.EQ.0

L10: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D03.EQ.0
L2: LOCFD1.EQ.SET

L14: CFD42
L15: LOCFD1.EQ..IF.CFD42.THEN.SET.ELSE.LO
    CFD03
L9: LOCFD05.EQ..IF.CFD42.THEN.SET.ELSE.LO
    CFD03
NONE

L1: RLFD1.EQ.ROLL

L14: CFD42
L17: RLFD1.EQ..IF.CFD42.THEN.ROLL.ELSE.RL
    FD
L16: RLFD02.EQ..IF.CFD42.THEN.ROLL.ELSE.R
    LFD
NONE

NONE

L4: .NOT.LBS.EQ.0
NONE

H3: CFD4

L21: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
    EQ.0)
L22: CFDIN2.AND.(TFD3.OR.GUID2D.EQ.0)
```

```
L1: RLFD1.EQ.ROLL

L2: LOCFD1.EQ.SET

L3: .NOT.LOCFD.NE.0

L4: .NOT.LBS.EQ.0

L5: CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND.
    LOCFD03.NE.0.OR.CFD4.AND.LBS.NE.0
L6: LBS.NE.0
L7: CFD4.AND.LBS.NE.0

L8: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.0
    .OR.CFD4.AND.LBS.NE.0
*C1: CLANDFD


L9: LOCFD05.EQ..IF.CFD42.THEN.SET.ELSE.LO
    CFD03
L10: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D03.EQ.0
L6: LBS.NE.0
L11: LOCFD.EQ.0
L12: LOCFD03.EQ.0

L7: CFD4.AND.LBS.NE.0

L13: CFD4.AND.LBS.NE.0.AND.LOCFD03.EQ.0

L14: CFD42


L15: LOCFD1.EQ..IF.CFD42.THEN.SET.ELSE.LO
    CFD03

*C2: LOCFD1.EQ.LOCFD05


L16: RLFD02.EQ..IF.CFD42.THEN.ROLL.ELSE.R
    LFD
L17: RLFD1.EQ..IF.CFD42.THEN.ROLL.ELSE.RL
    FD

*C3: RLFD1.EQ.RLFD02


L18: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
L19: CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2
    .AND..NOT.TFD3.AND.GUID2D.NE.0
L20: .NOT.(CFD4.AND.LBS.EQ.0)
L21: CFD4.EQV.CFDIN2.AND.(TFD3.OR.GUID2D.
    EQ.0)
L22: CFDIN2.AND.(TFD3.OR.GUID2D.EQ.0)


L23: .NOT.(CFDIN2.AND..NOT.TFD3.AND..NOT.
```

```
      CFDIN2.AND..NOT.TFD3.AND.A))

NOT7(CFD4.AND.LBS=0.CFDIN2.AND..NOT.TFD3.
     AND.GUID2D.NE.0)

EQV3(CFD2.CFD4.AND.LBS=0.OR.CFDIN2.AND..N
     OT.TFD3.AND.GUID2D.NE.0)

NOTORAND3(CFD2,LOCFD03=0)
NOT7(CFDIN1.CFD2.AND.LOCFD03=0)

EQV3(CCRUZFD,CFDIN1.OR.CFD2.AND.LOCFD03=0
     )

***** Q. E. D. *****
```

```
L23:  .NOT.(CFDIN2.AND..NOT.TFD3.AND..NOT.
      GUID2D.EQ.0)
L20:  .NOT.(CFD4.AND.LBS.EQ.0)

L25:  .NOT.(CFDIN2.AND..NOT.TFD3.AND.GUID2
      D.NE.0)
L19:  CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2
      .AND..NOT.TFD3.AND.GUID2D.NE.0
L26:  .NOT.(CFD4.AND.LBS.EQ.0.OR.CFDIN2.AN
      D..NOT.TFD3.AND.GUID2D.NE.0)
L27:  .NOT.CFD2
H19:  .NOT.CFDIN1

L28:  .NOT.(CFD2.AND.LOCFD03.EQ.0)
L18:  CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
      03.EQ.0
L29:  .NOT.(CFDIN1.OR.CFD2.AND.LOCFD03.EQ.
      0)
```

```
      D.NE.0)

L26:  .NOT.(CFD4.AND.LBS.EQ.0.OR.CFDIN2.AN
      D..NOT.TFD3.AND.GUID2D.NE.0)

L27:  .NOT.CFD2

L28:  .NOT.(CFD2.AND.LOCFD03.EQ.0)
L29:  .NOT.(CFDIN1.OR.CFD2.AND.LOCFD03.EQ.
      0)

*C4:  .NOT.CCRUZFD
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 13

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: CFD4
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD03
H13: LOCGC.EQ.LOCGC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: YETA.EQ.YETA01
H17: PSIF.EQ.PSIF01
H18: GSFD.EQ.GSFD02
H19: .NOT.CFDIN1
H20: TMERLG.NE.0
H21: &AC1.EQ.LBS
H22: .NOT.&AC1.EQ.0
H23: &AC2.EQ.LOCFD
H24: &AC2.NE.0

CONCLUSIONS
C1: CLANDFD
C2: LOCFD.EQ.LOCFD05
C3: RLFD.EQ.RLFD02
C4: .NOT.CCRUZFD

THEOREMS USED
AND4(A,B)=A.B.IMP.A.AND.B
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
EQV1(A,B)=A.(A.EQV.B).IMP.B
EQV2(A,B)=B.(A.EQV.B).IMP.A
EQV3(A,B)=(A.EQV.B).NOT.B.IMP..NOT.A
IF4(I,J,K,A)=IFK..NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
NOT2(P,Q)=.NOT.P.EQ.Q.EQV.P.NE.Q
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
OR2(A,B)=B.IMP.A.OR.B
SUBST1(P,Q,R,A(P))=P.EQ.Q.A(P).IMP.A(Q)
NOT7(A,B)=.NOT.A..NOT.B.IMP..NOT.(A.OR.B)
NOTORAND2(A,B)=.NOT.B.IMP..NOT.(A.AND.B)

PROOF

THEOREMS
SUBST1(&AC2,LOCFD,X,X,NE,0)

SUBST1(&AC1,LBS,X,.NOT.X,EQ,0)

HYPOTHESES
H23: &AC2.EQ.LOCFD
H24: &AC2.NE.0
H21: &AC1.EQ.LBS
H22: .NOT.&AC1.EQ.0

CONCLUSIONS
L1: LOCFD.NE.0

L2: .NOT.LBS.EQ.0
```

```
NOT2(L8S.0)
AND4(CFD4,L8S.NE.0)

OR2(.NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.0
    ,CFD4.AND.L8S.NE.0)
EQV2(CLANDFD,.NOT.CFDIN1.AND.CFD2.AND.LOC
    FD03.NE.0.OR.CFD4.AND.L8S.NE.0)


MACRO(LOCFD05)

NOT2(LOCFD03,0)
MACRO(CFD42)

OR2(.NOT.(CFD4.AND.L8S.NE.0),.NOT.LOCFD03
    =0)
NOT3(CFD4.AND.L8S.NE.0,LOCFD03=0)

EQV3(CFD42,CFD4.AND.L8S.NE.0.AND.LOCFD03=
    0)


IF4(LOCFD,SET,LOCFD03,CFD42)

EQ4(LOCFD,.IF.CFD42.THEN.SET.ELSE.LOCFD03
    ,LOCFD05)


MACRO(RLFD02)

IF4(RLFD,ROLL,RLFD,CFD42)

EQ4(RLFD,.IF.CFD42.THEN.ROLL.ELSE.RLFD,RL
    FD02)


MACEXP(CCRUZFD)

NOT9AND2(CFD2,LOCFD03=0)
NOT7(CFDIN1,CFD2.AND.LOCFD03=0)


EQV2(CCRUZFD,CFDIN1.OR.CFD2.AND.LOCFD03=0
    )


***** O. E. D. *****
```

```
L2:  .NOT.L8S.EQ.0
H3:  CFD4
L5:  L8S.NE.0
L6:  CFD4.AND.L8S.NE.0

L7:  .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.0
    .OR.CFD4.AND.L8S.NE.0)
L4:  CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND.
    LOCFD03.NE.0.OR.CFD4.AND.L8S.NE.0
NONE

L3:  LOCFD03.NE.0
NONE

L9:  .NOT.LOCFD03.EQ.0

L11:  .NOT.(CFD4.AND.L8S.NE.0).OR..NOT.LOC
    FD03.EQ.0
L10:  CFD42.EQV.CFD4.AND.L8S.NE.0.AND.LOCF
    D03.EQ.0
L12:  .NOT.(CFD4.AND.L8S.NE.0.AND.LOCFD03.
    EQ.0)
H12:  LOCFD.EQ.LOCFD03

L13:  .NOT.CFD42
L14:  LOCFD.EQ..IF.CFD42.THEN.SET.ELSE.LOC
    FD03
L8:  LOCFD05.EQ..IF.CFD42.THEN.SET.ELSE.LO
    CFD03
NONE

A1:  RLFD.EQ.RLFD

L13:  .NOT.CFD42
L16:  RLFD.EQ..IF.CFD42.THEN.ROLL.ELSE.RLF
    D
L15:  RLFD02.EQ..IF.CFD42.THEN.ROLL.ELSE.R
    LFD
NONE

L9:  .NOT.LOCFD03.EQ.0
H19:  .NOT.CFDIN1

L18:  .NOT.(CFD2.AND.LOCFD03.EQ.0)
L17:  CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
L19:  .NOT.(CFDIN1.OR.CFD2.AND.LOCFD03.EQ.
    0)
```

```
    LOCFD03.NE.0.OR.CFD4.AND.L8S.NE.0
L5:  L8S.NE.0
L6:  CFD4.AND.L8S.NE.0

L7:  .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.0
    .OR.CFD4.AND.L8S.NE.0
*C1:  CLANDFD


L8:  LOCFD05.EQ..IF.CFD42.THEN.SET.ELSE.LO
    CFD03
L9:  .NOT.LOCFD03.EQ.0
L10:  CFD42.EQV.CFD4.AND.L8S.NE.0.AND.LOCF
    D03.EQ.0
L11:  .NOT.(CFD4.AND.L8S.NE.0).OR..NOT.LOC
    FD03.EQ.0
L12:  .NOT.(CFD4.AND.L8S.NE.0.AND.LOCFD03.
    EQ.0)
L13:  .NOT.CFD42


L14:  LOCFD.EQ..IF.CFD42.THEN.SET.ELSE.LOC
    FD03

*C2:  LOCFD.EQ.LOCFD05


L15:  RLFD02.EQ..IF.CFD42.THEN.ROLL.ELSE.R
    LFD
L16:  RLFD.EQ..IF.CFD42.THEN.ROLL.ELSE.RLF
    D

*C3:  RLFD.EQ.RLFD02


L17:  CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
L18:  .NOT.(CFD2.AND.LOCFD03.EQ.0)
L19:  .NOT.(CFDIN1.OR.CFD2.AND.LOCFD03.EQ.
    0)

*C4:  .NOT.CCRUZFD
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 14

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CFXITO
H2: SPEC
H3: CFD4
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD03
H13: LOCOC.EQ.LOCOC24
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: YETA.EQ.YETA01
H17: PSIE.EQ.PSIE01
H18: GSFD.EQ.GSFD02
H19: .NOT.CFDIN1
H20: TMFLG.NE.0
H21: EAC1.EQ.L35
H22: EAC1.EQ.0
H23: EAC2.EQ.LOCFD
H24: .NOT.EAC2.NE.0

CONCLUSIONS
C1: CCRUZFD
C2: START.EQ.START04
C3: LOCFD.EQ.LOCFD06
C4: YETA.EQ.YETA02
C5: PSIE.EQ.PSIE02
C6: .NOT.CFD42

THEOREMS USED
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
NOTS(P,Q)=P.EQ.Q.EQV..NOT.(P.NE.Q)
AND4(A,B)=A,B.IMP.A.AND.B
OR1(A,B)=A.IMP.A.OR.B
EQV2(A,B)=B,(A.EQV.B).IMP.A
OR2(A,B)=B.IMP.A.OR.B
IF4(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
EQ4(P,Q,R)=P.EQ.Q.P.EQ.Q.IMP.P.EQ.R
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
EQV3(A,B)=(A.EQV.B),.NOT.B.IMP..NOT.A
IF3(I,J,K,A)=I=J,A.IMP.I=(.IF.A.THEN.J.ELSE.K)
SUBST2(P,Q,R,A(R))=P.EQ.Q,A(Q).IMP.A(P)
SUBST1(P,Q,R,A(R))=P.EQ.Q,A(P).IMP.A(Q)
NOT7(A,B)=.NOT.A,.NOT.B.IMP..NOT.(A.OR.B)
NOTORAND2(A,B)=.NOT.B.IMP..NOT.(A.AND.B)

PROOF

THEOREMS                                HYPOTHESES                    CONCLUSIONS
```

```
NOT5(LOCFD03,0)
EQ3(LBS,&AC1,0)

AND4(CFD4,LBS=0)

OR1(CFD4.AND.LBS=0,CFDIN2.AND..NOT.TFD3.A
    ND.GUID2D.NE.0)
MACEXP(CFD2)

EQV2(CFD2,CFD4.AND.LBS=0.OR.CFDIN2.AND..N
    OT.TFD3.AND.GUID2D.NE.0)


AND4(CFD2,LOCFD03=0)

OR2(CFDIN1,CFD2.AND.LOCFD03=0)
MACEXP(CCRUZFD)

EQV2(CCRUZFD,CFDIN1.OR.CFD2.AND.LOCFD03=0
    )


MACEXP(START04)

IF4(START,0,START03,CFDIN1)


EQ4(START,.IF.CFDIN1.THEN.0.ELSE.START03,
    START04)


MACEXP(LOCFD06)

MACEXP(CLANDFD)

MACEXP(CFD42)

NOT5(LBS,0)
OR2(.NOT.CFD4,.NOT.LBS.NE.0)
NOT3(CFD4,LBS,NE.0)
OR1(.NOT.(CFD4.AND.LBS.NE.0),.NOT.LOCFD03
    =0)
NOT3(CFD4.AND.LBS.NE.0,LOCFD03=0)

EQV3(CFD42,CFD4.AND.LBS.NE.0.AND.LOCFD03=
    0)


NOTORAND2(.NOT.CFDIN1.AND.CFD2,LOCFD03.NE
    .0)
NOT7(.NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.
    0,CFD4.AND.LBS.NE.0)

EQV3(CLANDFD,.NOT.CFDIN1.AND.CFD2.AND.LOC
    FD03.NE.0.OR.CFD4.AND.LBS.NE.0)


IF4(LOCFD,LOCFD05,LOCFD03,CLANDFD)


SUBST2(LOCFD,.IF.CLANDFD.THEN.LOCFD05.ELS
    E.LOCFD03,X,LOCFD06=.IF.CFDIN1.THEN.0
    .ELSE.X)
```

```
H24:  .NOT.&AC2.NE.0
L2:  .NOT.LOCFD03.NE.0
H21:  &AC1.EQ.LBS
H22:  &AC1.EQ.0
H3:  CFD4
L4:  LBS.EQ.0
L5:  CFD4.AND.LBS.EQ.0

NONE

L6:  CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND..NOT.
    TFD3.AND.GUID2D.NE.0
L7:  CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2.
    AND..NOT.TFD3.AND.GUID2D.NE.0
L8:  CFD2
L9:  LOCFD03.EQ.0
L3:  CFD2.AND.LOCFD03.EQ.0
NONE

L10:  CFDIN1.OR.CFD2.AND.LOCFD03.EQ.0

L11:  CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
NONE

H15:  START.EQ.START03

H19:  .NOT.CFDIN1
L13:  START.EQ..IF.CFDIN1.THEN.0.ELSE.STAR
    T03
L12:  START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
NONE

NONE

NONE

L4:  LBS.EQ.0
L17:  .NOT.LBS.NE.0
L18:  .NOT.CFD4.OR..NOT.LBS.NE.0
L19:  .NOT.(CFD4.AND.LBS.NE.0)

L20:  .NOT.(CFD4.AND.LBS.NE.0).OR..NOT.LOC
    FD03.EQ.0
L16:  CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D03.EQ.0
L21:  .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)
L2:  .NOT.LOCFD03.NE.0

L22:  .NOT.(.NOT.CFDIN1.AND.CFD2.AND.LOCFD
    03.NE.0)
L19:  .NOT.(CFD4.AND.LBS.NE.0)
L15:  CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND
    .LOCFD03.NE.0.OR.CFD4.AND.LBS.NE.0
L23:  .NOT.(.NOT.CFDIN1.AND.CFD2.AND.LOCFD
    03.NE.0.OR.CFD4.AND.LBS.NE.0)
H12:  LOCFD.EQ.LOCFD03

L24:  .NOT.CLANDFD
L25:  LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
    SE.LOCFD03
```

```
L3:  LOCFD03.EQ.0
L4:  LBS.EQ.0

L5:  CFD4.AND.LBS.EQ.0

L6:  CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND..NOT.
    TFD3.AND.GUID2D.NE.0
L7:  CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2.
    AND..NOT.TFD3.AND.GUID2D.NE.0
L8:  CFD2


L9:  CFD2.AND.LOCFD03.EQ.0

L10:  CFDIN1.OR.CFD2.AND.LOCFD03.EQ.0
L11:  CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
*C1:  CCRUZFD


L12:  START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
L13:  START.EQ..IF.CFDIN1.THEN.0.ELSE.STAR
    T03

*C2:  START.EQ.START04


L14:  LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
    F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L15:  CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND
    .LOCFD03.NE.0.OR.CFD4.AND.LBS.NE.0
L16:  CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCF
    D03.EQ.0
L17:  .NOT.LBS.NE.0
L18:  .NOT.CFD4.OR..NOT.LBS.NE.0
L19:  .NOT.(CFD4.AND.LBS.NE.0)
L20:  .NOT.(CFD4.AND.LBS.NE.0).OR..NOT.LOC
    FD03.EQ.0
L21:  .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)
*C6:  .NOT.CFD42


L22:  .NOT.(.NOT.CFDIN1.AND.CFD2.AND.LOCFD
    03.NE.0)
L23:  .NOT.(.NOT.CFDIN1.AND.CFD2.AND.LOCFD
    03.NE.0.OR.CFD4.AND.LBS.NE.0)

L24:  .NOT.CLANDFD


L25:  LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
    SE.LOCFD03

L26:  LOCFD05.EQ..IF.CFDIN1.THEN.0.ELSE.LO
    CF)
```

```
IF4(LOCFD,0.,LOCFD,CFDIN1)

EQ4(LOCFD,,IF,CFDIN1,THEN,0.,ELSE,LOCFD,LO
    CFD06)

MACEXP(YETAC2)

IF4(YETA,YETA,YETA01,CFDIN1)

EQ4(YETA,,IF,CFDIN1,THEN,YETA,ELSE,YETA01
    ,YETA02)

MACEXP(PSIEC2)

IF4(PSIE,PSIE,PSIE01,CFDIN1)

EQ4(PSIE,,IF,CFDIN1,THEN,PSIE,ELSE,PSIE01
    ,PSIEC2)

***** O. E. D. *****
```

```
A1: LOCFD,EQ,LOCFD

H19: ,NOT,CFDIN1
L27: LOCFD,EQ,,IF,CFDIN1,THEN,0,FLSE,LOCF
    D
L26: LOCFD06,EQ,,IF,CFDIN1,THEN,0,FLSE,LO
    CFD
NONE

H16: YETA,EQ,YETA01

H19: ,NOT,CFDIN1
L29: YETA,EQ,,IF,CFDIN1,THEN,YETA,ELSE,YE
    TA01
L28: YETA02,EQ,,IF,CFDIN1,THEN,YETA,ELSE,
    YETA01
NONE

H17: PSIE,EQ,PSIE01

H19: ,NOT,CFDIN1
L31: PSIE,EQ,,IF,CFDIN1,THEN,PSIE,ELSE,PS
    IE01
L30: PSIE02,EQ,,IF,CFDIN1,THEN,PSIE,ELSE,
    PSIE01
```

```
L27: LOCFD,EQ,,IF,CFDIN1,THEN,0,ELSE,LOCF
    D

*C3: LOCFD,EQ,LOCFD06


L28: YETA02,EQ,,IF,CFDIN1,THEN,YETA,ELSE,
    YETA01
L29: YETA,EQ,,IF,CFDIN1,THEN,YETA,ELSE,YE
    TA01

*C4: YETA,EQ,YETAC2


L30: PSIE02,EQ,,IF,CFDIN1,THEN,PSIE,ELSE,
    PSIE01
L31: PSIE,EQ,,IF,CFDIN1,THEN,PSIE,ELSE,PS
    IE01

*C5: PSIE,EQ,PSIEC2
```

COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 15

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITC
H2: SPEC
H3: CFD4
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD03
H13: LOCCC.EQ.LOCDC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: YETA.EQ.YETA01
H17: PSIF.EQ.PSIF01
H18: GSFD.EQ.GSFD02
H19: .NOT.CFD1N1
H20: TMFLG.NE.0
H21: &AC1.EQ.LRS
H22: &AC1.EQ.0
H23: &AC2.EQ.LOCFD
H24: &AC3.NE.0

CONCLUSIONS
C1: CLANDFD
C2: LOCFD.EQ.LOCFD05
C3: PLFD.EQ.PLFD02
C4: .NOT.CCRUZFD

THEOREMS USED
OR2(A,B)=B.IMP.A.OR.B
OR1(A,B)=A.IMP.A.OR.B
EQV2(A,B)=B.(A.EQV.B).IMP.A
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
NOTEQ(P,Q)=.NOT.P.EQ.Q.EQV.P.NE.Q
NOR2(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
EQV3(A,B)=(A.EQV.B),.NOT.B,IMP..NOT.A
IF4(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
NOT7(A,B)=.NOT.A,.NOT.B.IMP..NOT.(A.OR.B)
AND4(A,B)=A,B.IMP.A.AND.B

PROOF

THEOREMS	HYPOTHESES	CONCLUSIONS
MACEXP(CFD42)	NONE	L1: CFD42.EQV.CFD4.AND.LRS.NE.0.AND.LOCFD 03.EQ.0
MACEXP(CLANDFD)	NONE	L2: CLANDFD.EQV..NOT.CFD1N1.AND.CFD2.AND. LOCFD03.NE.0.OR.CFD4.AND.LRS.NE.0
MACEXP(LOCFD05)	NONE	L3: LOCFD05.EQ..IF.CFD42.THEN.3.ELSE.LO

```
SUBST1(&AC2,LOCFD03,X,X,NE,0)

NOT2(LOCFD03,0)
MACEXP(CFD03)

EQ3(LBS,&AC1,0)

AND4(CFD4,LBS,EQ,0)

OR1(CFD4.AND.LBS=0.CFDIN2.AND..NOT.TFD3.A
    ND.GUID2D.NE.0)
EQV2(CFD2,CFD4.AND.LBS=0.OR.CFDIN2.AND..N
    OT.TFD3.AND.GUID2D.NE.0)


AND4(.NOT.CFDIN1,CFD2)

AND4(.NOT.CFDIN1.AND.CFD2,LOCFD03.NE.0)


OR1(.NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.0
    .CFD4.AND.LBS.NE.0)
EQV2(CLANDFD,.NOT.CFDIN1.AND.CFD2.AND.LOC
    FD03.NE.0.OR.CFD4.AND.LBS.NE.0)


OR2(.NOT.(CFD4.AND.LBS.NE.0)..NOT.LOCFD03
    =0)
NOT3(CFD4.AND.LBS.NE.0,LOCFD03=0)

EQV3(CFD42,CFD4.AND.LBS.NE.0.AND.LOCFD03=
    0)


IF4(LOCFD,SET,LOCFD03,CFD42)


EQ4(LOCFD,.IF.CFD42.THEN.SET.ELSE.LOCFD03
    .LOCFD05)


MACEXP(RLFD02)

IF4(RLFD,ROLL,RLFD,CFD42)


EQ4(RLFD,.IF.CFD42.THEN.ROLL.ELSE.RLFD.RL
    FD02)


MACEXP(CCRUZFD)

OR2(.NOT.CFD2..NOT.LOCFD03=0)
NOT3(CFD2,LOCFD03=0)
NOT7(CFDIN1.CFD2.AND.LOCFD03=0)


EQV3(CCRUZFD,CFDIN1.OR.CFD2.AND.LOCFD03=0
    )


***** O. E. D. *****
```

```
L4: &AC2.EQ.LOCFD03
H24: &AC2.NE.0
L5: LOCFD03.NE.0
NONE

H21: &AC1.EQ.LBS
H22: &AC1.EQ.0
H3: CFD4
L8: LBS.EQ.0
L9: CFD4.AND.LBS.EQ.0

L10: CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND..NOT
    .TFD3.AND.GUID2D.NE.0
L7: CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2.
    AND..NOT.TFD3.AND.GUID2D.NE.0
H19: .NOT.CFDIN1
L11: CFD2
L12: .NOT.CFDIN1.AND.CFD2

L5: LOCFD03.NE.0
L13: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.
    0
L14: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.
    0.OR.CFD4.AND.LBS.NE.0
L2: CLANDFD.EQV..NOT.CFDIN1.AND.CFD2.AND.
    LOCFD03.NE.0.OR.CFD4.AND.LBS.NE.0
L6: .NOT.LOCFD03.EQ.0

L15: .NOT.(CFD4.AND.LBS.NE.0).OR..NOT.LOC
    FD03.EQ.0
L1: CFD42.EQV.CFD4.AND.LBS.NE.0.AND.LOCFD
    03.EQ.0
L16: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)
H12: LOCFD.EQ.LOCFD03

L17: .NOT.CFD42
L18: LOCFD.EQ..IF.CFD42.THEN.SET.ELSE.LOC
    FD02
L3: LOCFD05.EQ..IF.CFD42.THEN.SET.ELSE.LO
    CFD03
NONE

A1: RLFD.EQ.RLFD

L17: .NOT.CFD42
L20: RLFD.EQ..IF.CFD42.THEN.ROLL.ELSE.RLF
    D
L19: RLFD02.EQ..IF.CFD42.THEN.ROLL.ELSE.R
    LFD
NONE

L6: .NOT.LOCFD03.EQ.0
L22: .NOT.CFD2.OR..NOT.LOCFD03.EQ.0
H19: .NOT.CFDIN1

L23: .NOT.(CFD2.AND.LOCFD03.EQ.0)
L21: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
L24: .NOT.(CFDIN1.OR.CFD2.AND.LOCFD03.EQ.
    0)
```

```
L5: LOCFD03.NE.0

L6: .NOT.LOCFD03.EQ.0
L7: CFD2.EQV.CFD4.AND.LBS.EQ.0.OR.CFDIN2.
    AND..NOT.TFD3.AND.GUID2D.NE.0
L8: LBS.EQ.0

L9: CFD4.AND.LBS.EQ.0

L10: CFD4.AND.LBS.EQ.0.OR.CFDIN2.AND..NOT
    .TFD3.AND.GUID2D.NE.0
L11: CFD2


L12: .NOT.CFDIN1.AND.CFD2

L13: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.
    0

L14: .NOT.CFDIN1.AND.CFD2.AND.LOCFD03.NE.
    0.OR.CFD4.AND.LBS.NE.0
*C1: CLANDFD


L15: .NOT.(CFD4.AND.LBS.NE.0).OR..NOT.LOC
    FD03.EQ.0
L16: .NOT.(CFD4.AND.LBS.NE.0.AND.LOCFD03.
    EQ.0)
L17: .NOT.CFD42


L18: LOCFD.EQ..IF.CFD42.THEN.SET.ELSE.LOC
    FD03

*C2: LOCFD.EQ.LOCFD05


L19: RLFD02.EQ..IF.CFD42.THEN.ROLL.ELSE.R
    LFD
L20: RLFD.EQ..IF.CFD42.THEN.ROLL.ELSE.RLF
    D

*C3: RLFD.EQ.RLFD02


L21: CCRUZFD.EQV.CFDIN1.OR.CFD2.AND.LOCFD
    03.EQ.0
L22: .NOT.CFD2.OR..NOT.LOCFD03.EQ.0
L23: .NOT.(CFD2.AND.LOCFD03.EQ.0)
L24: .NOT.(CFDIN1.OR.CFD2.AND.LOCFD03.EQ.
    0)

*C4: .NOT.CCRUZFD
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 16

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CLANDFD
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LUCFD.EQ.LUCFD05
H13: LUCGC.EQ.LUCGC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFS.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIF.EQ.PSIF01
H19: GSFC.EQ.GSFD02
H20: .NOT.CFD1&1
H21: TMEFLG.NE.0
H22: .NOT.CCNOZFD
H23: &AC1.EQ.LUCGC
H24: .NOT.&AC1.EQ.0
H25: &AC2.EQ.YETA
H26: &M01.EQ.LIMY
H27: &AC3.EQ.SRLMT(&AC2,&M01)
H28: &AC4.EQ.&AC3/PERIOD
H29: &AC5.EQ.&AC4/PERIOD
H30: &M02.EQ.MULTM(&AC5,K5)
H31: &AC6.EQ.MULT(&AC5,K5)
H32: &AC7.EQ.N(&AC6-TP1)
H33: &AC8.EQ.&AC7/TAUI
H34: &M03.EQ.MULTM(&AC8,DELTAT)
H35: &AC9.EQ.MULT(&AC8,DELTAT)
H36: &AC10.EQ.&AC9/2**1
H37: &AC11.EQ.A(&AC10+TP1)
H38: TP11.EQ.&AC11
H39: &AC12.EQ.G5
H40: &AC13.EQ.&AC12/PERIOD
H41: &M04.EQ.MULTM(&AC13,K6)
H42: &AC14.EQ.MULT(&AC13,K6)
H43: &M05.EQ.MULTM(&AC14,PSIE)
H44: &AC15.EQ.MULT(&AC14,PSIE)
H45: &M06.EQ.MULTM(&AC15,KDAMP)
H46: &AC16.EQ.MULT(&AC15,KDAMP)
H47: &AQ1.EQ.(&AC16.AND.&M06)
H48: &AD2.EQ.&AQ1*2**2
H49: &AC17.EQ.A(&AD2)
H50: &M07.EQ.MF(&AD2)
H51: TP21.EQ.&AC17

CONCLUSIONS
C1: A(&AC1,&AC17,&AC16,&M06)
```

```
C4: ABS(&AC12).LT.ABS(PERIOD)
C5: DIK(&AD1**2)
C6: IP11.EQ.IP103
C7: IP21.EQ.IP263

THEOREMS USED
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
ABS6(P,Q)=P.EQ.Q.IMP.ABS(P).EQ.ABS(Q)
SRLMT5(P,Q)=ABS(SRLMT(P,Q)).LE.ABS(Q)
SUBST2(P,Q,P,A(R))=P.EQ.Q.A(Q).IMP.A(P)
ABS10(P,Q)=P.EQ.Q.Q.GE.0.IMP.ABS(P).EQ.Q
LELT2(P,Q,R)=P.LE.Q.Q.LT.R.IMP.P.LT.R
ABS13(P,Q)=Q.NE.0.IMP.ABS(P/Q)=ABS(P)/ABS(Q)
DIV2(P,Q,R,S)=P.LE.Q.P.EQ.S.S.NE.0.IMP.P/R.LE.Q/S
MULTE01(P,Q,S)=P.EQ.MULT(Q,R).IMP.P=Q*R
MULTE02(P,Q,R)=P.EQ.Q*R.IMP.ABS(P).EQ.ABS(Q)*ABS(R)
MLT2(P,Q,R)=P.LT.Q.R.GT.0.IMP.P*R.LT.Q*R
SUBST2(P,Q,R,A(R))=P.EQ.Q.A(Q).IMP.A(P)
LT1(P,Q,R)=P.LT.Q.Q.LT.R.IMP.P.LT.R
NE4(P,Q)=ABS(P).LT.0.500.ABS(Q).LT.0.500.IMP.ABS(N(P-Q)).LE.ABS(P)+ABS(Q)
ALTLE1(P,Q,R,S)=P.LT.Q.R.LE.S.IMP.P+R.LT.Q+S
ABSLTLE1(P,Q,R,S)=ABS(P).LT.Q.ABS(R).LT.S.IMP.ABS(P)*ABS(R).LT.Q*S
AQ1(P,Q,R,S)=P.EQ.(Q,R).ABS(Q)*S.LT.1.80.IMP.DIR(P*S)
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
IF4(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
AQ2(P,Q,R,S,T)=P.EQ.(Q,R)*S.DIR(P).T.LE.AR(P).IMP.T.EQ.Q*S

PROOF

THEOREMS                                    HYPOTHESES                                  CONCLUSIONS
SUBST1(&AC2,YETA,X,&AC3=SRLMT(X,&MQ1))      H25: &AC2.EQ.YETA                           L1: &AC3.EQ.SRLMT(YETA,&MQ1)
                                            H27: &AC3.EQ.SRLMT(&AC2,&MQ1)
SUBST1(&MQ1,LIMY,X,&AC3=SRLMT(YETA,X))      H26: &MQ1.EQ.LIMY                           L2: &AC3.EQ.SRLMT(YETA,LIMY)
                                            L1: &AC3.EQ.SRLMT(YETA,&MQ1)
HYPEXP(SPEC,LIMY=400.823)                   NONE                                        L3: LIMY.EQ.400.823
ABS6(&AC3,SRLMT(YETA,LIMY))                 L2: &AC3.EQ.SRLMT(YETA,LIMY)                L4: ABS(&AC3).EQ.ABS(SRLMT(YETA,LIMY))
SRLMT5(YETA,LIMY)                           NONE                                        L5: ABS(SRLMT(YETA,LIMY)).LE.ABS(LIMY)
HYPEXP(SPEC,PERIOD=35.810)                  NONE                                        L6: PERIOD.EQ.35.810
SUBST2(ABS(&AC3),ABS(SRLMT(YETA,LIMY)),X,   L4: ABS(&AC3).EQ.ABS(SRLMT(YETA,LIMY))      L7: ABS(&AC3).LE.ABS(LIMY)
    X.LE.ABS(LIMY))
                                            L5: ABS(SRLMT(YETA,LIMY)).LE.ABS(LIMY)
ABS19(PERIOD,35.810)                        L6: PERIOD.EQ.35.810                        L8: ABS(PERIOD).EQ.35.810
                                            A1: 35.810.GE.0
SUBST2(ABS(PERIOD),35.810,X,400.823.LT.X)   L8: ABS(PERIOD).EQ.35.810                   L9: 400.823.LT.ABS(PERIOD)

                                            A2: 400.823.LT.35.810
ABS19(LIMY,400.823)                         L3: LIMY.EQ.400.823                         L10: ABS(LIMY).EQ.400.823
                                            A3: 400.823.GE.0
SUBST1(ABS(LIMY),400.823,X,ABS(&AC3).LE.X   L10: ABS(LIMY).EQ.400.823                   L11: ABS(&AC3).LE.400.823
    )
                                            L7: ABS(&AC3).LE.ABS(LIMY)
LELT2(ABS(&AC3),400.823,ABS(PERIOD))        L11: ABS(&AC3).LE.400.823                   *C1: ABS(&AC3).LT.ABS(PERIOD)
                                            L9: 400.823.LT.ABS(PERIOD)
SUBST2(PERIOD,35.810,X,X.NE.0)              L6: PERIOD.EQ.35.810                        L12: PERIOD.NE.0
                                            A4: 35.810.NE.0
ABS10(&AC3,PERIOD)                          L12: PERIOD.NE.0                            L13: ABS(&AC3/PERIOD).EQ.ABS(&AC3)/ABS(PE
                                                                                            RIOD)
SUBST2(&AC4,&AC3/PERIOD,X,ABS(X)=ABS(&AC3   H28: &AC4.EQ.&AC3/PERIOD                    L14: ABS(&AC4).EQ.ABS(&AC3)/ABS(PERIOD)
    )/ABS(PERIOD))
                                            L13: ABS(&AC3/PERIOD).EQ.ABS(&AC3)/ABS(PE
                                                RIOD)
DIV2(ABS(&AC3),400.823,ABS(PERIOD),35.810   L1: ABS(&AC3).LE.400.823                    L15: ABS(&AC3)/ABS(PERIOD).LE.400.823/35.
    )
```

```
SUBST2(ABS(&AC4),ABS(&AC3)/ABS(PERIOD),X,
    X,LE,400.B23/35.B10)

LELT2(ABS(&AC4),400.B23/35.B10,35.B10)

SUBST2(ABS(PERIOD),35.B10,X,ABS(&AC4),LT,
    X)

HYPEXP(SPEC,TAU1=3.33)
HYPEXP(SPEC,K5=0.3980)
HYPEXP(SPEC,ABS(TP1),LE,1.83)
ABS10(&AC4,PERIOD)

SUBST2(&AC5,&AC4/PERIOD,X,ABS(X)=ABS(&AC4
    )/ABS(PERIOD))

DIV2(ABS(&AC4),400.B23/35.B10,ABS(PERIOD)
    ,35.B10)

SUBST2(ABS(&AC5),ABS(&AC4)/ABS(PERIOD),X,
    X,LE,400.B23/35.B10/35.B10)

LELT2(ABS(&AC5),400.B23/35.B10/35.B10,0.4
    B3)

MULTEQ1(&AC6,&AC5,K5)
MULTEQ2(&AC6,&AC5,K5)
MLT2(ABS(&AC5),0.483,0.3980)

ABS19(K5,0.3980)

SUBST2(ABS(K5),0.3980,X,ABS(&AC5)*X,LT,0.
    483*0.3980)

SUBST2(ABS(&AC6),ABS(&AC5)*ABS(K5),X,X,LT
    ,0.483*0.3980)

LT1(ABS(&AC6),0.483*0.3980,1.683)

ABS9(&AC7,N(&AC6-TP1))
LT1(ABS(&AC6),1.683,0.580)

LELT2(ABS(TP1),1.83,0.580)

NE4(&AC6,TP1)

ABS19(TAU1,3.83)

ALTLE1(ABS(&AC6),1.683,ABS(TP1),1.83)

LELT2(ABS(N(&AC6-TP1)),ABS(&AC6)+ABS(TP1)
    ,1.683+1.83)

SUBST2(ABS(&AC7),ABS(N(&AC6-TP1)),X,X,LT,
    1.683+1.83)

LT1(ABS(&AC7),1.683+1.83,3.83)

SUBST2(ABS(TAU1),3.83,X,ABS(&AC7),LT,X)
```

```
L14: ABS(&AC4),EQ,ABS(&AC3)/ABS(PERIOD)

L15: ABS(&AC3)/ABS(PERIOD),LE,400.B23/35.
    B10
L16: ABS(&AC4),LE,400.B23/35.B10
A5: 400.B23/35.B10,LT,35.B10
L8: ABS(PERIOD),EQ,35.B10

L17: ABS(&AC4),LT,35.B10
NONE
NONE
NONE
L12: PERIOD,NE,0

H29: &AC5,EQ,&AC4/PERIOD

L21: ABS(&AC4/PERIOD),EQ,ABS(&AC4)/ABS(PE
    RIOD)
L16: ABS(&AC4),LE,400.B23/35.B10

L9: ABS(PERIOD),EQ,35.B10
A4: 35.B10,NE,0
L22: ABS(&AC5),EQ,ABS(&AC4)/ABS(PERIOD)

L23: ABS(&AC4)/ABS(PERIOD),LE,400.B23/35.
    B10/35.B10
L24: ABS(&AC5),LE,400.B23/35.B10/35.B10

A6: 400.B23/35.B10/35.B10,LT,0.4B3
H31: &AC6,EQ,MULT(&AC5,K5)
L26: &AC6,EQ,&AC5*K5
L25: ABS(&AC5),LT,0.4B3
A7: 0.3980,GT,0
L19: K5,EQ,0.3980
A8: 0.3980,GE,0
L29: ABS(K5),EQ,0.3980

L28: ABS(&AC5)*0.3980,LT,0.4B3*0.3980
L27: ABS(&AC6),EQ,ABS(&AC5)*ABS(K5)

L30: ABS(&AC5)*ABS(K5),LT,0.483*0.3980
L31: ABS(&AC6),LT,0.483*0.3980
A9: 0.483*0.3980,LT,1.683
H32: &AC7,EQ,N(&AC6-TP1)
L32: ABS(&AC6),LT,1.6B3
A10: 1.683,LT,0.580
L20: ABS(TP1),LE,1.83
A11: 1.83,LT,0.580
L34: ABS(&AC6),LT,0.590

L35: ABS(TP1),LT,0.580
L18: TAU1,EQ,3.83
A12: 3.83,GE,0
L32: ABS(&AC6),LT,1.6B3
L20: ABS(TP1),LE,1.83
L36: ABS(N(&AC6-TP1)),LE,ABS(&AC6)+ABS(TP
    1)
L38: ABS(&AC6)+ABS(TP1),LT,1.6B3+1.83
L33: ABS(&AC7),EQ,ABS(N(&AC6-TP1))

L39: ABS(N(&AC6-TP1)),LT,1.6B3+1.83
L40: ABS(&AC7),LT,1.6B3+1.83
A13: 1.6B3+1.83,LT,3.83
L37: ABS(TAU1),EQ,3.83
```

```
L16: ABS(&AC4),LE,400.B23/35.B10

L17: ABS(&AC4),LT,35.B10

*C2: ABS(&AC4),LT,ABS(PERIOD)

L18: TAU1,EQ,3.83
L19: K5,EQ,0.3980
L20: ABS(TP1),LE,1.83
L21: ABS(&AC4/PERIOD),EQ,ABS(&AC4)/ABS(PE
    RIOD)
L22: ABS(&AC5),EQ,ABS(&AC4)/ABS(PERIOD)

L23: ABS(&AC4)/ABS(PERIOD),LE,400.B23/35.
    B10/35.B10

L24: ABS(&AC5),LE,400.B23/35.B10/35.B10

L25: ABS(&AC5),LT,0.4B3

L26: &AC6,EQ,&AC5*K5
L27: ABS(&AC6),EQ,ABS(&AC5)*ABS(K5)
L28: ABS(&AC5)*0.3980,LT,0.4B3*0.3980

L29: ABS(K5),EQ,0.3980

L30: ABS(&AC5)*ABS(K5),LT,0.4B3*0.3980

L31: ABS(&AC5),LT,0.483*0.3980

L32: ABS(&AC6),LT,1.6B3

L33: ABS(&AC7),EQ,ABS(N(&AC6-TP1))
L34: ABS(&AC6),LT,0.580

L35: ABS(TP1),LT,0.580

L36: ABS(N(&AC6-TP1)),LE,ABS(&AC6)+ABS(TP
    1)

L37: ABS(TAU1),EQ,3.83

L38: ABS(&AC6)+ABS(TP1),LT,1.6B3+1.83

L39: ABS(N(&AC6-TP1)),LT,1.6B3+1.83

L40: ABS(&AC7),LT,1.6B3+1.83

L41: ABS(&AC7),LT,3.83

*C3: ABS(&AC7),LT,ABS(TAU1)
```

```
SUBST2(ABS(PERIOD),35.810,X,0.625815,LT,X
    )

LELT2(ABS(GS),0.625815,ABS(PERIOD))

SUBST2(&AC12,GS,X,ABS(X),LT,ABS(PERIOD))

HYPEXP(SPEC,K6=0.65380)
HYPEXP(SPEC,ABS(PSIE),LT,1.80)
HYPEXP(SPEC,KDAMP=0.980)
MULTEQ1(&AC16,&AC15,KDAMP)
MULTEQ1(&AC15,&AC14,PSIE)
MULTEQ1(&AC14,&AC13,K6)
ABS6(&AC12,GS)
ABS10(&AC12,PERIOD)

SUBST2(&AC13,&AC12/PERIOD,X,ABS(X)=ABS(&A
    C12)/ABS(PERIOD))

SUBST2(ABS(&AC12),ABS(GS),X,X,LE,0.625815
    )

DIV2(ABS(&AC12),0.625815,ABS(PERIOD),35.8
    10)

SUBST2(ABS(&AC13),ABS(&AC12)/ABS(PERIOD),
    X,X,LE,0.625815/35.810)

LELT2(ABS(&AC13),0.625315/35.810,0.285)

MULTEQ2(&AC14,&AC13,K6)
MLT2(ABS(&AC13),0.285,0.65380)

ABS10(K6,0.65380)

SUBST2(ABS(K6),0.65380,X,ABS(&AC13)*X,LT,
    0.285*0.65380)

SUBST2(ABS(&AC14),ABS(&AC13)*ABS(K6),X,X,
    LT,0.285*0.65380)

LT1(ABS(&AC14),0.285*0.65380,0.1585)

MULTEQ2(&AC15,&AC14,PSIE)
ABSLTE1(&AC14,0.1585,PSIE,1.80)

SUBST2(ABS(&AC15),ABS(&AC14)*ABS(PSIE),X,
    X,LT,0.1585*1.80)

MULTEQ2(&AC16,&AC15,KDAMP)
ABS10(KDAMP,0.980)

MLT2(ABS(&AC15),0.1585*1.80,0.980)

SUBST2(ABS(KDAMP),0.980,X,ABS(&AC15)*X,LT
    ,0.1585*1.80*0.980)

SUBST2(ABS(&AC16),ABS(&AC15)*ABS(KDAMP),X
```

```
L8: ABS(PERIOD),EQ,35.810

A14: 0.625815,LT,35.810
L42: ABS(GS),LE,0.625815
L43: 0.625315,LT,ABS(PERIOD)
H39: &AC12,EQ,GS
L44: ABS(GS),LT,ABS(PERIOD)
NONE
NONE
NONE
H46: &AC16,EQ,MULT(&AC15,KDAMP)
H44: &AC15,EQ,MULT(&AC14,PSIE)
H42: &AC14,EQ,MULT(&AC13,K6)
H39: &AC12,EQ,GS
L12: PERIOD,NE,0

H43: &AC13,EQ,&AC12/PERIOD

L52: ABS(&AC12/PERIOD),EQ,ABS(&AC12)/ABS(
    PERIOD)
L51: ABS(&AC12),EQ,ABS(GS)

L42: ABS(GS),LE,0.625815
L54: ABS(&AC12),LE,0.625815

L8: ABS(PERIOD),EQ,35.810
A4: 35.810,NE,0
L53: ABS(&AC13),EQ,ABS(&AC12)/ABS(PERIOD)

L55: ABS(&AC12)/ABS(PERIOD),LE,0.625815/3
    5.310
L36: ABS(&AC13),LE,0.625815/35.810
A15: 0.625315/35.810,LT,0.285
L50: &AC14,EQ,&AC13*K6
L57: ABS(&AC13),LT,0.285
A16: 0.65380,GT,0
L45: K6,EQ,0.65380
A17: 0.65380,GE,0
L60: ABS(K6),EQ,0.65380

L59: ABS(&AC13)*0.65380,LT,0.285*0.65380
L58: ABS(&AC14),EQ,ABS(&AC13)*ABS(K6)

L61: ABS(&AC13)*ABS(K6),LT,0.285*0.65380
L62: ABS(&AC14),LT,0.285*0.65380
A18: 0.285*0.65380,LT,0.1585
L49: &AC15,EQ,&AC14*PSIE
L63: ABS(&AC14),LT,0.1585
L46: ABS(PSIE),LT,1.80
L64: ABS(&AC15),EQ,ABS(&AC14)*ABS(PSIE)

L65: ABS(&AC14)*ABS(PSIE),LT,0.1585*1.80

L48: &AC16,EQ,&AC15*KDAMP
L47: KDAMP,EQ,0.980
A19: 0.980,GE,0
L66: ABS(&AC15),LT,0.1585*1.80

A20: 0.980,GT,0
L66: ABS(KDAMP),EQ,0.980

L69: ABS(&AC15)*0.980,LT,0.1585*1.80*0.98
    0
L67: ABS(&AC16),EQ,ABS(&AC15)*ABS(KDAMP)
```

```
L43: 0.625815,LT,ABS(PERIOD))

L44: ABS(GS),LT,ABS(PERIOD)

*C4: ABS(&AC12),LT,ABS(PERIOD)

L45: K6,EQ,0.65380
L46: ABS(PSIE),LT,1.80
L47: KDAMP,EQ,0.980
L48: &AC16,EQ,&AC15*KDAMP
L49: &AC15,EQ,&AC14*PSIE
L50: &AC14,EQ,&AC13*K6
L51: ABS(&AC12),EQ,ABS(GS)
L52: ABS(&AC12/PERIOD),EQ,ABS(&AC12)/ABS(
    PERIOD)
L53: ABS(&AC13),EQ,ABS(&AC12)/ABS(PERIOD)

L54: ABS(&AC12),LE,0.625815

L55: ABS(&AC12)/ABS(PERIOD),LE,0.625815/3
    5.810

L56: ABS(&AC13),LE,0.625815/35.810

L57: ABS(&AC13),LT,0.285

L58: ABS(&AC14),EQ,ABS(&AC13)*ABS(K6)
L59: ABS(&AC13)*0.65380,LT,0.285*0.65380

L60: ABS(K6),EQ,0.65380

L61: ABS(&AC13)*ABS(K6),LT,0.285*0.65380

L62: ABS(&AC14),LT,0.285*0.65380

L63: ABS(&AC14),LT,0.1585

L64: ABS(&AC15),EQ,ABS(&AC14)*ABS(PSIE)
L65: ABS(&AC14)*ABS(PSIE),LT,0.1585*1.80

L66: ABS(&AC15),LT,0.1585*1.80

L67: ABS(&AC16),EQ,ABS(&AC15)*ABS(KDAMP)
L68: ABS(KDAMP),EQ,0.980

L69: ABS(&AC15)*0.980,LT,0.1585*1.80*0.98
    0

L70: ABS(&AC15)*ABS(KDAMP),LT,0.1585*1.80
    *0.980

L71: ABS(&AC16),LT,0.1585*1.80*0.980
```

```
MLT2(ABS(&AC16),0.1585*1.80*0.980,2**2)

LT1(ABS(&AC16)*2**2,0.1585*1.80*0.980*2**2,1.80)

AQ1(&AQ1,&AC16,&MQ6,2**2)

MACEXP(TP103)

MACEXP(TP103B)

EQ3(TP11,&AC11,N(&AC10+TP1))

SUBST1(TP1,TP102,X,TP11=N(&AC10+X))

EQ3(&AC1,LOCOC,LOCOC04)

SUBST1(&AC1,LOCOC04,X,.NOT.X.EQ.0)

SUBST1(&AC4,&AC3/PERIOD,X,&AC5=X/PERIOD)

SUBST1(YETA,YETA01,X,&AC3=SRLMT(X,LIMY))

SUBST1(&AC3,SRLMT(YETA01,LIMY),X,&AC5=X/PERIOD/PERIOD)

SUBST2(&AC5,SRLMT(YETA01,LIMY)/PERIOD/PERIOD,X,TP1033=N(N(X*K5-TP102)/TAU1*DELTAT/2**3+TP102))

SUBST1(&AC6,&AC5*K5,X,&AC7=N(X-TP1))

SUBST1(TP1,TP102,X,&AC7=N(&AC5*K5-X))

MULTEQ1(&AC9,&AC8,DELTAT)
SUBST1(&AC8,&AC7/TAU1,X,&AC9=X*DELTAT)

SUBST1(&AC7,N(&AC5*K5-TP102),X,&AC9=X/TAU1*DELTAT)

SUBST2(&AC9,N(&AC5*K5-TP102)/TAU1*DELTAT,X,TP1038=N(X/2**3+TP102))

SUBST1(&AC10,&AC9/2**3,X,&AC11=N(X+TP1))

SUBST1(TP1,TP102,X,&AC11=N(&AC9/2**3+X))

EQ4(TP103B,N(&AC9/2**3+TP102),&AC11)

EQ4(TP11,&AC11,TP103B)

IF4(TP11,TP103A,TP103B,LOCOC04=0)

EQ4(TP11..IF.LOCOC04=0.THEN.TP103A.ELSE.TP103B,TP103)

MAC(TP103)
```

```
L71: ABS(&AC16).LT.0.1585*1.80*0.980

A21: 2**2.ST.0
L72: ABS(&AC16)*2**2.LT.0.1585*1.80*0.980*2**2
A22: 0.1585*1.80*0.980*2**2.LT.1.80
H47: &AQ1.EQ.(&AC16.AND.&M06)
L73: ABS(&AC16)*2**2.LT.1.80
NONE

NONE

H38: TP11.EQ.&AC11
H37: &AC11.EQ.N(&AC10+TP1)
H5: TP1.EQ.TP102
L76: TP11.EQ.N(&AC10+TP1)
H23: &AC1.EQ.LOCOC
H13: LOCOC.EQ.LOCOC04
L76: &AC1.EQ.LOCOC04
H24: .NOT.&AC1.EQ.0
H28: &AC4.EQ.&AC3/PERIOD
H29: &AC5.EQ.&AC4/PERIOD
H17: YETA.EQ.YETA01
L2: &AC3.EQ.SRLMT(YETA,LIMY)
L81: &AC3.EQ.SRLMT(YETA01,LIMY)

L80: &AC5.EQ.&AC3/PERIOD/PERIOD
L82: &AC5.EQ.SRLMT(YETA01,LIMY)/PERIOD/PERIOD

L75: TP1033.EQ.N(N(SRLMT(YETA01,LIMY)/PERIOD/PERIOD*K5-TP102)/TAU1*DELTAT/2**3+TP102)
L26: &AC6.EQ.&AC5*K5
H32: &AC7.EQ.N(&AC6-TP1)
H5: TP1.EQ.TP102
L84: &AC7.EQ.N(&AC5*K5-TP1)
H35: &AC9.EQ.MULT(&AC8,DELTAT)
H33: &AC8.EQ.&AC7/TAU1
L86: &AC9.EQ.&AC8*DELTAT
L89: &AC7.EQ.N(&AC5*K5-TP102)

L87: &AC9.EQ.&AC7/TAU1*DELTAT
L88: &AC9.EQ.N(&AC5*K5-TP102)/TAU1*DELTAT

L83: TP1038.EQ.N(N(&AC5*K5-TP102)/TAU1*DELTAT/2**3+TP102)
H36: &AC10.EQ.&AC9/2**3
H37: &AC11.EQ.N(&AC10+TP1)
H5: TP1.EQ.TP102
L90: &AC11.EQ.N(&AC9/2**3+TP1)
L89: TP103B.EQ.N(&AC9/2**3+TP102)
L91: &AC11.EQ.N(&AC9/2**3+TP102)
H38: TP11.EQ.&AC11
L92: TP103B.EQ.&AC11
L93: TP11.EQ.TP103B

L79: .NOT.LOCOC04.EQ.0
L94: TP11.EQ..IF.LOCOC04.EQ.0.THEN.TP103A.ELSE.TP103B
L74: TP103.EQ..IF.LOCOC04.EQ.0.THEN.TP103A.ELSE.TP103B
```

```
L72: ABS(&AC16)*2**2.LT.0.1585*1.80*0.980*2**2

L73: ABS(&AC16)*2**2.LT.1.80

*C5: DIR(&AQ1*2**2)

L74: TP103.EQ..IF.LOCOC04.EQ.0.THEN.TP103A.ELSE.TP103B
L75: TP103B.EQ.N(N(SRLMT(YETA01,LIMY)/PERIOD/PERIOD*K5-TP102)/TAU1*DELTAT/2**3+TP102)
L76: TP11.EQ.N(&AC10+TP1)

L77: TP11.EQ.N(&AC10+TP102)

L78: &AC1.EQ.LOCOC04

L79: .NOT.LOCOC04.EQ.0

L80: &AC5.EQ.&AC3/PERIOD/PERIOD

L81: &AC3.EQ.SRLMT(YETA01,LIMY)

L82: &AC5.EQ.SRLMT(YETA01,LIMY)/PERIOD/PERIOD

L83: TP103B.EQ.N(N(&AC5*K5-TP102)/TAU1*DELTAT/2**3+TP102)

L84: &AC7.EQ.N(&AC5*K5-TP1)

L85: &AC7.EQ.N(&AC5*K5-TP102)

L86: &AC9.EQ.&AC8*DELTAT
L87: &AC9.EQ.&AC7/TAU1*DELTAT

L88: &AC9.EQ.N(&AC5*K5-TP102)/TAU1*DELTAT

L89: TP103B.EQ.N(&AC9/2**3+TP102)

L90: &AC11.EQ.N(&AC9/2**3+TP1)

L91: &AC11.EQ.N(&AC9/2**3+TP102)

L92: TP103B.EQ.&AC11

L93: TP11.EQ.TP103B

L94: TP11.EQ..IF.LOCOC04.EQ.0.THEN.TP103A.ELSE.TP103B

*C6: TP11.EQ.TP103
```

```
SUBST1(PSIE,PSIE01,X,&AC15=&AC14*X)

SUBST1(&AC13,GS/PERIOD,X,&AC14=X*K6)

SUBST1(&AC14,GS/PERIOD*K6,X,&AC15=X*PSIE0
    1)

SUBST2(&AC15,GS/PERIOD*K6*PSIE01,X,TP203=
    X*KDAMP**2**2)


SUBST1(&AQ1,(&AC16,&MQ6),X,&AQ2=X**2**2)

SUBST2(&AQ2,&AQ1**2**2,X,DIR(X))

AQ2(&AQ2,&AC16,&MQ6,2**2,&AC17)


EQ3(TP21,&AC17,&AC16**2**2)

SUBST2(&AC16,&AC15*KDAMP,X,TP203=X**2**2)

EQ4(TP21,&AC16**2**2,TP203)

***** Q. E. D. *****
```

```
H40: &AC13.EQ.&AC12/PERIOD
H16: PSIE.EQ.PSIE01
L49: &AC15.EQ.&AC14*PSIE
L96: &AC13.EQ.GS/PERIOD
L50: &AC14.EQ.&AC13*K6
L98: &AC14.EQ.GS/PERIOD*K6

L97: &AC15.EQ.&AC14*PSIE01
L99: &AC15.EQ.GS/PERIOD*K6*PSIE01

L95: TP203.EQ.GS/PERIOD*K6*PSIE01*KDAMP**2
    **2
H47: &AQ1.EQ.(&AC16.AND.&MQ6)
H48: &AQ2.EQ.&AQ1**2**2
H49: &AQ2.EQ.&AQ1**2**2
*C5: DIR(&AQ1**2**2)
L101: &AQ2.EQ.(&AC16.AND.&MQ6)*2**2
L102: DIR(&AQ2)
H49: &AC17.EQ.AR(&AQ2)
H51: TP21.EQ.&AC17
L103: &AC17.EQ.&AC16*2**2
L48: &AC16.EQ.&AC15*KDAMP
L100: TP203.EQ.&AC15*KDAMP**2**2
L104: TP21.EQ.&AC16**2**2
L105: TP203.EQ.&AC16*2**2
```

```
L97: &AC15.EQ.&AC14*PSIE01

L98: &AC14.EQ.GS/PERIOD*K6

L99: &AC15.EQ.GS/PERIOD*K6*PSIE01

L100: TP203.EQ.&AC15*KDAMP*2**2

L101: &AQ2.EQ.(&AC16.AND.&MQ6)*2**2

L102: DIR(&AQ2)

L103: &AC17.EQ.&AC16*2**2

L104: TP21.EQ.&AC16*2**2

L105: TP203.EQ.&AC16*2**2

*C7: TP21.EQ.TP203
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 17

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CLANDFD
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP102
H6: TP2.EQ.TP202
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD05
H13: LOCOC.EQ.LOCOC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TMEFLG.NE.0
H22: .NOT.CCRUZFD
H23: &AC1.EQ.LOCOC
H24: &AC1.EQ.0
H25: &AC2.EQ.YETA
H26: &AC3.EQ.&AC2/PERIOD
H27: &AC4.EQ.&AC3/PERIOD
H28: &M01.EQ.MULTM(&AC4,K5)
H29: &AC5.EQ.MULT(&AC4,K5)
H30: &AC6.EQ.N(&AC5+TP1)
H31: &AC7.EQ.&AC6/TAU1
H32: &M02.EQ.MULTM(&AC7,DELTAT)
H33: &AC8.EQ.MULT(&AC7,DELTAT)
H34: &AC9.EQ.&AC8/2**3
H35: &AC10.EQ.N(&AC9+TP1)
H36: TP11.EQ.&AC10
H37: &AC11.EQ.GS
H38: &AC12.EQ.&AC11/PERIOD
H39: &M03.EQ.MULTM(&AC12,K6)
H40: &AC13.EQ.MULT(&AC12,K6)
H41: &M04.EQ.MULTM(&AC13,PSIE)
H42: &AC14.EQ.MULT(&AC13,PSIE)
H43: &M05.EQ.MULTM(&AC14,KDAMP)
H44: &AC15.EQ.MULT(&AC14,KDAMP)
H45: &A01.EQ.(&AC15.AND.&M05)
H46: &A02.EQ.&A01*2**2
H47: &AC16.EQ.AP(&A02)
H48: &M06.EQ.MP(&A02)
H49: TP21.EQ.&AC16

CONCLUSIONS
C1: ABS(&AC2).LT.ABS(PERIOD)
C2: ABS(&AC3).LT.ABS(PERIOD)
C3: ABS(&AC6).LT.ABS(TAU1)
```

```
C6: TP11.EQ.TP103
C7: TP21.EQ.TP203

THEOREMS USED
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
MULTEQ1(P,Q,R)=P.EQ.MULT(Q,R).IMP.P=Q*R
ABS19(P,Q)=P.EQ.Q.Q.GE.Q.IMP.ABS(P).EQ.Q
MLE1(P,Q,R)=P.LE.Q.R.GT.Q.IMP.P*R.LE.Q*R
SUBST2(P,Q,R,A(P))=P.EQ.Q.A(Q).IMP.A(P)
MULTEQ2(P,Q,R)=P.EQ.Q*R.IMP.ABS(P).EQ.ABS(Q)*ABS(R)
LELT2(P,Q,R)=P.LE.Q.Q.LT.R.IMP.P.LT.R
ABS10(P,Q)=Q.NE.0.IMP.ABS(P/Q)=ABS(P)/ABS(Q)
DIV2(P,Q,R,S)=P.LE.Q.R.EQ.S.S.NE.0.IMP.P/R.LE.Q/S
MLT2(P,Q,R)=P.LT.Q.R.GT.0.IMP.P*R.LT.Q*R
ABS6(P,Q)=P.EQ.Q.IMP.ABS(P).EQ.ABS(Q)
LT1(P,Q,R)=P.LT.Q.Q.LT.R.IMP.P.LT.R
NE4(P,Q)=ABS(P).LT.Q.500.ABS(Q).LT.Q.500.IMP.ABS(N(P-Q)).LE.ABS(P)+ABS(Q)
ALTLE1(P,Q,R,S)=P.LT.Q.R.LE.S.IMP.P+R.LT.Q+S
ABSLTLE1(P,Q,R,S)=ABS(P).LT.Q.ABS(R).LT.S.IMP.ABS(P)*ABS(R).LT.Q*S
MLT1(P,Q,R)=P.GT.Q.R.LT.Q.IMP.P*R.LT.Q*P
AQ1(P,Q,R,S)=P.EQ.(Q.R).ABS(Q)*S.LT.1.80.IMP.DIR(P*S)
SUBST1(P,Q,R,A(P))=P.EQ.Q.A(P).IMP.A(Q)
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
IF3(I,J,K,A)=I=J.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
MULT1(P,Q)=MULT(P,Q).EQ.P*Q
AQ2(P,Q,R,S,T)=P.EQ.(Q.R)*S.DIR(P).T.EQ.AR(P).IMP.T.EQ.Q*S
DIV6(P,Q,R,S)=P.LT.Q.R.EQ.S.S.NE.0.IMP.P/R.LT.Q/S

PROOF

THEOREMS
MACEXP(YETA01)
EQ3(&AC2.YETA.YETA01)

MULTEQ1(YETA01.LOCDEV.K1)
EQ3(&AC2.YETA01.LOCDEV*K1)

HYPEXP(SPEC.K1=700.B11)
ABS19(K1.700.B11)

HYPEXP(SPEC.ABS(LOCDEV).LE.0.01111111186)
MLE1(ABS(LOCDEV).0.01111111186.700.B11)

SUBST2(ABS(K1).700.B11.X.ABS(LOCDEV)*X.LE
    .0.01111111186*700.B11)

MULTEQ2(&AC2.LOCDEV.K1)
SUBST2(ABS(&AC2).ABS(LOCDEV)*ABS(K1).X.X.
    LE.0.01111111186*700.B11)

HYPEXP(SPEC.PERIOD=35.B10)
ABS19(PERIOD.35.B10)

LELT2(ABS(&AC2).0.01111111186*700.B11.35.B
    10)

SUBST2(ABS(PERIOD).35.B10.X.ABS(&AC2).LT.
    X)

SUBST2(PERIOD.35.B10.X.X.NE.0)

HYPOTHESES
NONE
H25: &AC2.EQ.YETA
H17: YETA.EQ.YETA01
L1: YETA01.EQ.MULT(LOCDEV.K1)
L2: &AC2.EQ.YETA01
L3: YETA01.EQ.LOCDEV*K1
NONE
L5: K1.EQ.700.B11
A1: 700.B11.GE.0
NONE
L7: ABS(LOCDEV).LE.0.01111111186

A2: 700.B11.GT.0
L6: ABS(K1).EQ.700.B11

L8: ABS(LOCDEV)*700.B11.LE.0.01111111186*7
    00.B11
L4: &AC2.EQ.LOCDEV*K1
L10: ABS(&AC2).EQ.ABS(LOCDEV)*ABS(K1)

L9: ABS(LOCDEV)*ABS(K1).LE.0.01111111186*7
    00.B11
NONE
L12: PERIOD.EQ.35.B10
A3: 35.B10.GE.0
L11: ABS(&AC2).LE.0.01111111186*700.B11

A4: 0.01111111186*700.B11.LT.35.B10
L13: ABS(PERIOD).EQ.35.B10

L14: ABS(&AC2).LT.35.B10
L12: PERIOD.EQ.35.B10
A5: 35.B10.NE.0

CONCLUSIONS
L1: YETA01.EQ.MULT(LOCDEV.K1)
L2: &AC2.EQ.YETA01

L3: YETA01.EQ.LOCDEV*K1
L4: &AC2.EQ.LOCDEV*K1

L5: K1.EQ.700.B11
L6: ABS(K1).EQ.700.B11

L7: ABS(LOCDEV).LE.0.01111111186
L8: ABS(LOCDEV)*700.B11.LE.0.01111111186*7
    00.B11

L9: ABS(LOCDEV)*ABS(K1).LE.0.01111111186*7
    00.B11

L10: ABS(&AC2).EQ.ABS(LOCDEV)*ABS(K1)
L11: ABS(&AC2).LE.0.01111111186*700.B11

L12: PERIOD.EQ.35.B10
L13: ABS(PERIOD).EQ.35.B10

L14: ABS(&AC2).LT.35.B10

*C1: ABS(&AC2).LT.ABS(PERIOD)

L15: PERIOD.NE.0
```

```
SUBST2(&AC3,&AC2/PERIOD,X,ABS(X)=ABS(&AC2
    )/ABS(PERIOD))

DIV2(ABS(&AC2),0.01111111B6*700.B11,ABS(P
    ERIOD),35.B10)

SUBST2(ABS(&AC3),ABS(&AC2)/ABS(PERIOD),X,
    X,LE.0.01111111B6*700.B11/35.B10)

LELT2(ABS(&AC3),0.01111111B6*700.B11/35.B
    10,35.B10)

SUBST2(ABS(PERIOD),35.B10,X,ABS(&AC3).LT.
    X)

HYPEXP(SPEC,TAU1=3.B3)
HYPEXP(SPEC,K5=0.39B0)
HYPEXP(SPEC,ABS(TP1).LE.1.B3)
ABS10(&AC3,PERIOD)

SUBST2(&AC4,&AC3/PERIOD,X,ABS(X)=ABS(&AC3
    )/ABS(PERIOD))

LELT2(ABS(&AC3),0.01111111B6*700.B11/35.B
    10,1.B9)

DIV5(ABS(&AC3),1.B9,ABS(PERIOD),35.B10)

SUBST2(ABS(&AC4),ABS(&AC3)/ABS(PERIOD),X,
    X,LT.1.B9/35.B10)

MULTF01(&AC5,&AC4,K5)
LT1(ABS(&AC4),1.B9/35.B10,1.B4)

MULTF02(&AC5,&AC4,K5)
MLT2(ABS(&AC4),1.B4,0.39B0)

ABS19(K5,0.39B0)

SUBST2(ABS(K5),0.39B0,X,ABS(&AC4)*X.LT.1.
    B4*0.39B0)

SUBST2(ABS(&AC5),ABS(&AC4)*ABS(K5),X,X,LT
    .1.B4*0.39B0)

LT1(ABS(&AC5),1.B4*0.39B0,1.B3)

ABS6(&AC6,N(&AC5=TP1))
LT1(ABS(&AC5),1.B3,0.5B0)

LELT2(ABS(TP1),1.B3,0.5B0)

NF4(&AC5,TP1)

ALTLF1(ABS(&AC5),1.B3,ABS(TP1),1.B3)
```

```
H26: &AC3.EQ.&AC2/PERIOD

L16: ABS(&AC2/PERIOD).EQ.ABS(&AC2)/ABS(PE
    RIOD)
L11: ABS(&AC2).LE.0.01111111B6*700.B11

L13: ABS(PERIOD).EQ.35.B10
A5: 35.B10.NE.0
L17: ABS(&AC3).EQ.ABS(&AC2)/ABS(PERIOD)

L18: ABS(&AC2)/ABS(PERIOD).LE.0.011111118
    6*700.B11/35.B10
L19: ABS(&AC3).LE.0.01111111B6*700.B11/35
    .B10
A6: 0.01111111B6*700.B11/35.B10.LT.35.B10

L13: ABS(PERIOD).EQ.35.B10

L20: ABS(&AC3).LT.35.B10
NONE
NONE
NONE
L15: PERIOD.NE.0

H27: &AC4.EQ.&AC3/PERIOD

L24: ABS(&AC3/PERIOD).EQ.ABS(&AC3)/ABS(PE
    RIOD)
L19: ABS(&AC3).LE.0.01111111B6*700.B11/35
    .B10
A7: 0.01111111B6*700.B11/35.B10.LT.1.B9
L26: ABS(&AC3).LT.1.B9

L13: ABS(PERIOD).EQ.35.B10
A5: 35.B10.NE.0
L25: ABS(&AC4).EQ.ABS(&AC3)/ABS(PERIOD)

L27: ABS(&AC3)/ABS(PERIOD).LT.1.B9/35.B10

H29: &AC5.EQ.MULT(&AC4,K5)
L28: ABS(&AC4).LT.1.B9/35.B10
A8: 1.B9/35.B10.LT.1.B4
L29: &AC5.EQ.&AC4*K5
L30: ABS(&AC4).LT.1.B4
A9: 0.39B0.GT.0
L22: K5.EQ.0.39B0
A10: 0.39B0.GE.0
L33: ABS(K5).EQ.0.39B0

L32: ABS(&AC4)*0.39B0.LT.1.B4*0.39B0
L31: ABS(&AC5).EQ.ABS(&AC4)*ABS(K5)

L34: ABS(&AC4)*ABS(K5).LT.1.B4*0.39B0
L35: ABS(&AC5).LT.1.B4*0.39B0
A11: 1.B4*0.39B0.LT.1.B3
H30: &AC6.EQ.N(&AC5=TP1)
L36: ABS(&AC5).LT.1.B3
A12: 1.B3.LT.0.5B0
L23: ABS(TP1).LE.1.B3
A12: 1.B3.LT.0.5B0
L38: ABS(&AC5).LT.0.5B0

L39: ABS(TP1).LT.0.5B0
L36: ABS(&AC5).LT.1.B3
```

```
L17: ABS(&AC3).EQ.ABS(&AC2)/ABS(PERIOD)

L18: ABS(&AC2)/ABS(PERIOD).LE.0.011111118
    6*700.B11/35.B10
L19: ABS(&AC3).LE.0.01111111B6*700.B11/35
    .B10

L20: ABS(&AC3).LT.35.B10

*C2: ABS(&AC3).LT.ABS(PERIOD)

L21: TAU1.EQ.3.B3
L22: K5.EQ.0.39B0
L23: ABS(TP1).LE.1.B3
L24: ABS(&AC3/PERIOD).EQ.ABS(&AC3)/ABS(PE
    RIOD)
L25: ABS(&AC4).EQ.ABS(&AC3)/ABS(PERIOD)

L26: ABS(&AC3).LT.1.B9

L27: ABS(&AC3)/ABS(PERIOD).LT.1.B9/35.B10

L28: ABS(&AC4).LT.1.B9/35.B10

L29: &AC5.EQ.&AC4*K5
L30: ABS(&AC4).LT.1.B4

L31: ABS(&AC5).EQ.ABS(&AC4)*ABS(K5)
L32: ABS(&AC4)*0.39B0.LT.1.B4*0.39B0

L33: ABS(K5).EQ.0.39B0

L34: ABS(&AC4)*ABS(K5).LT.1.B4*0.39B0

L35: ABS(&AC5).LT.1.B4*0.39B0

L36: ABS(&AC5).LT.1.B3

L37: ABS(&AC6).EQ.ABS(N(&AC5=TP1))
L38: ABS(&AC5).LT.0.5B0

L39: ABS(TP1).LT.0.5B0

L40: ABS(N(&AC5=TP1)).LE.ABS(&AC5)+ABS(TP
    1)

L41: ABS(&AC5)+ABS(TP1).LT.1.B3+1.B3
```

```
      +1.83+1.83)

      SUBST2(ABS(&AC6).ABS(N(&AC5*TP1)).X.X.LT.
          1.83+1.83)

      LT1(ABS(&AC6).1.83+1.83.3.83)

      ABS19(TAU1.3.83)

      SUBST2(ABS(TAU1).3.83.X.ABS(&AC6).LT.X)

      HYPEXP(SPEC.ABS(GS).LE.0.625815)
      SUBST2(ABS(PERIOD).35.810.X.0.625815.LT.X
          )

      LELT2(ABS(GS).0.625815.ABS(PERIOD))

      SUBST2(&AC11.GS.X.ABS(X).LT.ABS(PERIOD))

      HYPEXP(SPEC.K5=0.65380)
      HYPEXP(SPEC.ABS(PSIE).LT.1.80)
      HYPEXP(SPEC.KDAMP=0.980)
      MULTE01(&AC15.&AC14.KDAMP)
      MULTE01(&AC14.&AC13.PSIE)
      MULTE01(&AC13.&AC12.K6)
      ABS6(&AC11.GS)
      ABS10(&AC11.PERIOD)

      SUBST2(&AC12.&AC11/PERIOD.X.ABS(X)=ABS(&A
          C11)/ABS(PERIOD))


      SUBST2(ABS(&AC11).ABS(GS).X.X.LE.0.625815
          )

      DIV2(ABS(&AC11).0.625815.ABS(PERIOD).35.8
          10)


      SUBST2(ABS(&AC12).ABS(&AC11)/ABS(PERIOD).
          X.X.LE.0.625815/35.810)


      LELT2(ABS(&AC12).0.625815/35.810.0.285)

      MULTE02(&AC13.&AC12.K6)
      MLT2(ABS(&AC12).0.285.0.65380)

      ABS19(K6.0.65380)

      SUBST2(ABS(K6).0.65380.X.ABS(&AC12)*X.LT.
          0.285*0.65380)

      SUBST2(ABS(&AC13).ABS(&AC12)*ABS(K6).X.X.
          LT.0.285*0.65380)

      LT1(ABS(&AC13).0.285*0.65380.0.1585)

      MULTE02(&AC14.&AC13.PSIE)
      ABSLTLF1(&AC13.0.1585.PSIE.1.80)

      SUBST2(ABS(&AC14).ABS(&AC13)*ABS(PSIE).X.
          X.LT.0.1585*1.80)
```

```
          1)
L41:  ABS(&AC5)*ABS(TP1).LT.1.83+1.83
L37:  ABS(&AC6).EQ.ABS(N(&AC5*TP1))

L42:  ABS(N(&AC5*TP1)).LT.1.83+1.83
L43:  ABS(&AC6).LT.1.P3+1.83
A13:  1.83+1.83.LT.3.83
L21:  TAU1.EQ.3.83
A14:  3.83.GE.0
L45:  ABS(TAU1).EQ.3.83
L44:  ABS(&AC6).LT.3.83
NONE
L13:  ABS(PERIOD).EQ.35.810

A15:  0.625815.LT.35.810
L46:  ABS(GS).LE.0.625815
L47:  0.625815.LT.ABS(PERIOD)
H37:  &AC11.EQ.GS
L48:  ABS(GS).LT.ABS(PERIOD)
NONE
NONE
NONE
H44:  &AC15.EQ.MULT(&AC14.KDAMP)
H42:  &AC14.EQ.MULT(&AC13.PSIE)
H40:  &AC13.EQ.MULT(&AC12.K6)
H37:  &AC11.EQ.GS
L15:  PERIOD.NE.0

H38:  &AC12.EQ.&AC11/PERIOD

L56:  ABS(&AC11/PERIOD).EQ.ABS(&AC11)/ABS(
          PERIOD)
L55:  ABS(&AC11).EQ.ABS(GS)

L46:  ABS(GS).LE.0.625815
L58:  ABS(&AC11).LE.0.625815

L13:  ABS(PERIOD).EQ.35.810
A5:   35.810.NE.0
L57:  ABS(&AC12).EQ.ABS(&AC11)/ABS(PERIOD)

L59:  ABS(&AC11)/ABS(PERIOD).LE.0.625815/3
          5.810
L60:  ABS(&AC12).LE.0.625815/35.810
A16:  0.625815/35.810.LT.0.285
L54:  &AC13.EQ.&AC12*K6
L61:  ABS(&AC12).LT.0.285
A17:  0.65380.GT.0
L49:  K6.EQ.0.65380
A18:  0.65380.GE.0
L64:  ABS(K6).EQ.0.65380

L63:  ABS(&AC12)*0.65380.LT.0.285*0.65380
L62:  ABS(&AC13).EQ.ABS(&AC12)*ABS(K6)

L55:  ABS(&AC12)*ABS(K6).LT.0.285*0.65380
L66:  ABS(&AC13).LT.0.285*0.65380
A19:  0.285*0.65380.LT.0.1585
L53:  &AC14.EQ.&AC13*PSIE
L67:  ABS(&AC13).LT.0.1585
L50:  ABS(PSIE).LT.1.80
L68:  ABS(&AC14).EQ.ABS(&AC13)*ABS(PSIE)

L69:  ABS(&AC13)*ABS(PSIE).LT.0.1585*1.80
```

```
L43:  ABS(&AC6).LT.1.83+1.83

L44:  ABS(&AC6).LT.3.83

L45:  ABS(TAU1).EQ.3.83

*C3:  ABS(&AC6).LT.ABS(TAU1)

L46:  ABS(GS).LE.0.625815
L47:  0.625815.LT.ABS(PERIOD)

L48:  ABS(GS).LT.ABS(PERIOD)

*C4:  ABS(&AC11).LT.ABS(PERIOD)

L49:  K6.EQ.0.65380
L50:  ABS(PSIE).LT.1.80
L51:  KDAMP.EQ.0.980
L52:  &AC15.EQ.&AC14*KDAMP
L53:  &AC14.EQ.&AC13*PSIE
L54:  &AC13.EQ.&AC12*K6
L55:  ABS(&AC11).EQ.ABS(GS)
L56:  ABS(&AC11/PERIOD).EQ.ABS(&AC11)/ABS(
          PERIOD)
L57:  ABS(&AC12).EQ.ABS(&AC11)/ABS(PERIOD)


L58:  ABS(&AC11).LE.0.625815

L59:  ABS(&AC11)/ABS(PERIOD).LE.0.625815/3
          5.810


L60:  ABS(&AC12).LE.0.625815/35.810


L61:  ABS(&AC12).LT.0.285

L62:  ABS(&AC13).EQ.ABS(&AC12)*ABS(K6)
L63:  ABS(&AC12)*0.65380.LT.0.285*0.65380

L64:  ABS(K6).EQ.0.65380

L65:  ABS(&AC12)*ABS(K6).LT.0.285*0.65380


L66:  ABS(&AC13).LT.0.285*0.65380


L67:  ABS(&AC13).LT.0.1585

L68:  ABS(&AC14).EQ.ABS(&AC13)*ABS(PSIE)
L69:  ABS(&AC13)*ABS(PSIE).LT.0.1585*1.80

L70:  ABS(&AC14).LT.0.1585*1.80
```

```
MLT2(ABS(&AC14),0.1585*1.80,0.980)

SUBST2(ABS(KDAMP),0.980,X,ABS(&AC14)*X.LT
     .0.1585*1.80*0.980)

SUBST2(ABS(&AC15),ABS(&AC14)*ABS(KDAMP),X
     ,X.LT.0.1585*1.80*0.980)

MLT2(ABS(&AC15),0.1585*1.80*0.980,2**2)

LT1(ABS(&AC15)*2**2,0.1585*1.80*0.980*2**
     2,1.80)

AQ1(&A01,&AC15,&M05,2**2)

MACEXP(TP103)

MACEXP(TP103A)

EQ3(&AC2,YETA,YETA01)

SUBST1(&AC2,YETA01/PERIOD,X,&AC3=X/PERIOD)

SUBST1(&AC3,YETA01/PERIOD,X,&AC4=X/PERIOD
     )

MULTEQ1(&AC5,&AC4,K5)
SUBST1(&AC4,YETA01/PERIOD/PERIOD,X,&AC5=X
     *K5)

SUBST1(TP1,TP102,X,&AC6=N(&AC5=X))

SUBST1(&AC6,N(&AC5=TP102),X,&AC7=X/TAU1)

MULTEQ1(&AC8,&AC7,DELTAT)
SUBST1(&AC8,&AC7*DELTAT,X,&AC9=X/2**3)

SUBST1(TP1,TP102,X,&AC10=N(&AC9+X))

EQ3(TP11,&AC10,N(&AC9+TP102))

SUBST1(&AC9,&AC7*DELTAT/2**3,X,TP11=N(X+T
     P102))

SUBST1(&AC5,YETA01/PERIOD/PERIOD*K5,X,&AC
     7=N(X=TP102)/TAU1)

SUBST2(&AC7,N(YETA01/PERIOD/PERIOD*K5=TP1
     02)/TAU1,X,TP103A=N(X*DELTAT/2**3+TP1
     02))

EQ3(&AC1,LOCOC,LOCOC04)

EQ3(LOCOC04,&AC1,0)

EQ4(TP11,N(&AC7*DELTAT/2**3+TP102),TP103A
     )
```

```
A20: 0.980.GE.0
L70: ABS(&AC14).LT.0.1585*1.80

A21: 0.980.GT.0
L72: ABS(KDAMP).EQ.0.980

L73: ABS(&AC14)*0.980.LT.0.1585*1.80*0.98
     0

L71: ABS(&AC15).EQ.ABS(&AC14)*ABS(KDAMP)

L74: ABS(&AC14)*ABS(KDAMP).LT.0.1585*1.80
     *0.980
L75: ABS(&AC15).LT.0.1585*1.80*0.980

A22: 2**2.GT.0
L76: ABS(&AC15)*2**2.LT.0.1585*1.80*0.980
     *2**2
A23: 0.1585*1.80*0.980*2**2.LT.1.80
H45: &A01.EQ.(&AC15.AND.&M05)
L77: ABS(&AC15)*2**2.LT.1.80
NONE

NONE

H25: &AC2.EQ.YETA
H17: YETA.EQ.YETA01
L2: &AC2.EQ.YETA01
H26: &AC3.EQ.&AC2/PERIOD
L80: &AC3.EQ.YETA01/PERIOD

H27: &AC4.EQ.&AC3/PERIOD
H29: &AC5.EQ.MULT(&AC4.K5)
L81: &AC4.EQ.YETA01/PERIOD/PERIOD

L29: &AC5.EQ.&AC4*K5
H5: TP1.EQ.TP102
H30: &AC6.EQ.N(&AC5=TP1)
L83: &AC6.EQ.N(&AC5=TP102)
H31: &AC7.EQ.&AC6/TAU1
H33: &AC8.EQ.MULT(&AC7.DELTAT)
L85: &AC8.EQ.&AC7*DELTAT
H34: &AC9.EQ.&AC8/2**3
H5: TP1.EQ.TP102
H35: &AC10.EQ.N(&AC9+TP1)
H36: TP11.EQ.&AC10
L87: &AC10.EQ.N(&AC9+TP102)
L86: &AC9.EQ.&AC7*DELTAT/2**3

L88: TP11.EQ.N(&AC9+TP102)
L82: &AC5.EQ.YETA01/PERIOD/PERIOD*K5

L84: &AC7.EQ.N(&AC5=TP102)/TAU1
L90: &AC7.EQ.N(YETA01/PERIOD/PERIOD*K5=TP
     102)/TAU1

L79: TP103A.EQ.N(N(YETA01/PERIOD/PERIOD*K
     5=TP102)/TAU1*DELTAT/2**3+TP102)
H23: &AC1.EQ.LOCOC
H13: LOCOC.EQ.LOCOC04
L92: &AC1.EQ.LOCOC04
H24: &AC1.EQ.0
L89: TP11.EQ.N(&AC7*DELTAT/2**3+TP102)

L91: TP103A.EQ.N(&AC7*DELTAT/2**3+TP102)
```

```
L73: ABS(&AC14)*0.980.LT.0.1585*1.80*0.98
     0

L74: ABS(&AC14)*ABS(KDAMP).LT.0.1585*1.80
     *0.980

L75: ABS(&AC15).LT.0.1585*1.80*0.980

L76: ABS(&AC15)*2**2.LT.0.1585*1.80*0.980
     *2**2

L77: ABS(&AC15)*2**2.LT.1.80

*C5: DIF(&AQ1*2**2)

L78: TP103.EQ..IF.LOCOC04.EQ.0.THEN.TP103
     A.ELSE.TP103B
L79: TP103A.EQ.N(N(YETA01/PERIOD/PERIOD*K
     5=TP102)/TAU1*DELTAT/2**3+TP102)
L2: &AC2.EQ.YETA01

L80: &AC3.EQ.YETA01/PERIOD

L81: &AC4.EQ.YETA01/PERIOD/PERIOD

L29: &AC5.EQ.&AC4*K5
L82: &AC5.EQ.YETA01/PERIOD/PERIOD*K5

L83: &AC6.EQ.N(&AC5=TP102)

L84: &AC7.EQ.N(&AC5=TP102)/TAU1

L85: &AC8.EQ.&AC7*DELTAT
L86: &AC9.EQ.&AC7*DELTAT/2**3

L87: &AC10.EQ.N(&AC9+TP102)

L88: TP11.EQ.N(&AC9+TP102)

L89: TP11.EQ.N(&AC7*DELTAT/2**3+TP102)

L90: &AC7.EQ.N(YETA01/PERIOD/PERIOD*K5=TP
     102)/TAU1

L91: TP103A.EQ.N(&AC7*DELTAT/2**3+TP102)

L92: &AC1.EQ.LOCOC04

L93: LOCOC04.EQ.0

L94: TP11.EQ.TP103A
```

```
E04(TP11,.IF.LOCOC04=0.THEN.TP103A.ELSE.T
    P103B.TP103)

MACEXP(TP203)

SUBST1(&AC11.GS.X.&AC12=X/PERIOD)

SUBST1(PSIE.PSIE01.X.&AC14=&AC13*X)

SUBST1(&AC12.GS/PERIOD.X.&AC13=X*K6)

SUBST1(&AC13.GS/PERIOD*K6.X.&AC14=X*PSIE0
    1)

SUBST2(&AC14.GS/PERIOD*K6*PSIE01.X.TP203=
    X*KDAMP*2**2)

SUBST1(&A01.(&AC15.&MQ5).X.&A02=X*2**2)

SUBST2(&A02.&A01*2**2.X.DIR(X))

A02(&A02.&AC15.&MQ5.2**2.&AC16)

E03(TP21.&AC16.&AC15*2**2)

SUBST2(&AC15.&AC14*KDAMP.X.TP203=X*2**2)

E04(TP21.&AC15*2**2.TP203)

***** O. E. D. *****
```

```
L93: LOCOC04.EQ.0
L95: TP11.EQ..IF.LOCOC04.EQ.0.THEN.TP103A
    .ELSE.TP103B
L78: TP103.EQ..IF.LOCOC04.EQ.0.THEN.TP103
    A.ELSE.TP103B
NONE

H37: &AC11.EQ.GS
H38: &AC12.EQ.&AC11/PERIOD
H18: PSIE.EQ.PSIE01
L53: &AC14.EQ.&AC13*PSIE
L97: &AC12.EQ.GS/PERIOD
L54: &AC13.EQ.&AC12*K6
L99: &AC13.EQ.GS/PERIOD*K6

L98: &AC14.EQ.&AC13*PSIE01
L100: &AC14.EQ.GS/PERIOD*K6*PSIE01

L96: TP203.EQ.GS/PERIOD*K6*PSIE01*KDAMP*2
    **2
H45: &A01.EQ.(&AC15.AND.&MQ5)
H46: &A02.EQ.&A01*2**2
H46: &A02.EQ.&A01*2**2
*C5: DIR(&A01*2**2)
L102: &A02.EQ.(&AC15.AND.&MQ5)*2**2
L103: DIR(&A02)
H47: &AC16.EQ.AR(&A02)
H49: TP21.EQ.&AC16
L104: &AC16.EQ.&AC15*2**2
L52: &AC15.EQ.&AC14*KDAMP
L101: TP203.EQ.&AC14*KDAMP*2**2
L105: TP21.EQ.&AC15*2**2
L106: TP203.EQ.&AC15*2**2
```

```
*C6: TP11.EQ.TP103

L96: TP203.EQ.GS/PERIOD*K6*PSIE01*KDAMP*2
    **2
L97: &AC12.EQ.GS/PERIOD

L98: &AC14.EQ.&AC13*PSIE01

L99: &AC13.EQ.GS/PERIOD*K6

L100: &AC14.EQ.GS/PERIOD*K6*PSIE01

L101: TP203.EQ.&AC14*KDAMP*2**2

L102: &A02.EQ.(&AC15.AND.&MQ5)*2**2

L103: DIR(&A02)

L104: &AC16.EQ.&AC15*2**2

L105: TP21.EQ.&AC15*2**2

L106: TP203.EQ.&AC15*2**2

*C7: TP21.EQ.TP203
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 18

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: CLANDFD
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP103
H6: TP2.EQ.TP203
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD05
H13: LOCOC.EQ.LOCOC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TMEFLG.NE.0
H22: .NOT.CCRUZFD
H23: &AC1.EQ.HRAD
H24: &AC2.EQ.&AC1-K1000
H25: .NOT.&AC2.GE.0
H26: &AC3.EQ.TP2
H27: &AC4.EQ.N(&AC3-TP7)
H28: TP21.EQ.&AC4
H29: &M01.EQ.MULTM(&AC4,DELTAT)
H30: &AC5.EQ.MULT(&AC4,DELTAT)
H31: &AC6.EQ.&AC5/TAU2
H32: &AC7.EQ.&AC6/2**6
H33: &AC8.EQ.N(&AC7+TP7)
H34: TP71.EQ.&AC8

CONCLUSIONS
C1: R(&AC1-K1000)
C2: ABS(&AC5).LT.ABS(TAU2)
C3: CFD6
C4: TP21.EQ.TP205
C5: TP71.EQ.TP704

THEOREMS USED
SUBST2(P,Q,R,A(R))=P.EQ.Q,A(Q).IMP.A(P)
AND8(A,B)=A.AND.B.IMP.A
IRS(P,Q)=P.GE.0,Q.GE.0.IMP.R(P-Q)
MULTEQ1(P,Q,R)=P.EQ.MULT(Q,R).IMP.P=Q*R
N2(P)=ABS(N(P)).LT.1.80
EQORLT1(P,Q,R)=P.EQ.Q.OR.P.EQ.R,Q.LT.R.IMP.ABS(P).LE.R
ABS15(P)=ABS(P).GE.0
LEGE1(P,Q,R,S)=P.LE.Q,R.LE.S,P.GE.0,R.GE.0.IMP.P*R.LE.Q*S
MULTEQ2(P,Q,R)=P.EQ.Q*R.IMP.ABS(P).EQ.ABS(Q)*ABS(R)
LT1(P,Q,R)=P.LT.Q,Q.LT.R.IMP.P.LT.R
ABS19(P,Q)=P.EQ.Q,Q.GE.0.IMP.ABS(P).EQ.Q
```

```
SUBST1(P,Q,R,A(R))=P.EQ.0.A(P).IMP.A(Q)
NOTGE1(P,Q)=.NOT.(P.GE.Q).EQV.P.LT.Q
LT2(P,Q)=P.LT.Q.EQV.P-Q.LT.0
AND4(A,B)=A.B.IMP.A.AND.B
IF3(I,J,K,A)=I=J.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
EQ4(P,Q,R)=P.EQ.Q.P.EQ.0.IMP.P.EQ.R
LTGE1(P,Q,R,S)=P.LT.Q.R.LE.S,P.GE.0.R.GE.0.IMP.P*R.LT.Q*S

PROOF

THEOREMS
HYPEXP(SPEC,K1000=837.823)
HYPEXP(SPEC,TAU2=60.86)
HYPEXP(SPEC,HRAD.GE.0.AND.HRAD.LT.1500.82
    3)
SUBST2(K1000,837.823,X,X.GE.0)

AND6(HRAD.GE.0.HRAD.LT.1500.823)
IF5(HRAD,K1000)

SUBST2(&AC1,HRAD,X,R(X-K1000))

HYPEXP(SPEC,DELTAT=0.0580.OR.DELTAT=0.180
    )
MULTEQ1(&AC5,&AC4,DELTAT)
N2(&AC3-TP7)
SUBST2(&AC4,N(&AC3-TP7),X,ABS(X).LT.1.80)


EQORLT1(DELTAT,0.0580,0.180)

ABS15(&AC4)
ABS15(DELTAT)
LTGE1(ABS(&AC4),1.80,ABS(DELTAT),0.180)



MULTEQ2(&AC5,&AC4,DELTAT)
SUBST2(ABS(&AC5),ABS(&AC4)*ABS(DELTAT),X.
    X.LT.1.80*0.180)

LT1(ABS(&AC5),1.80*0.180,60.86)

HYPEXP(SPEC,TAU2=60.86)
ABS19(TAU2,60.86)

SUBST2(ABS(TAU2),60.86,X,ABS(&AC5).LT.X)

MACEXP(CFD6)
EQV2(CFD6,CLANDFD)

MACEXP(TP205)

EQ3(&AC3,TP2,TP203)

EQ3(TP21,&AC4,N(&AC3-TP7))

SUBST1(&AC3,TP203,X,TP21=N(X-TP7))

SUBST1(TP7,TP702,X,TP21=N(TP203-X))

SUBST1(&AC1,HRAD,X,&AC2=X-K1000)

SUBST1(&AC2,HRAD-K1000,X,.NOT.X.IF.0)
```

```
HYPOTHESES
NONE
NONE
NONE

L1: K1000.EQ.837.823
A1: 837.823.GE.0
L3: HRAD.GE.0.AND.HRAD.LT.1500.823
L5: HRAD.GE.0
L4: K1000.GE.0
H23: &AC1.EQ.HRAD
L6: R(HRAD-K1000)
NONE

H30: &AC5.EQ.MULT(&AC4.DELTAT)
NONE
H27: &AC4.EQ.N(&AC3-TP7)

L9: ABS(N(&AC3-TP7)).LT.1.80
L7: DELTAT.EQ.0.0580.OR.DELTAT.EQ.0.180
A2: 0.0580.LT.0.180
NONE
NONE
L10: ABS(&AC4).LT.1.80
L11: ABS(DELTAT).LE.0.180
L12: ABS(&AC4).GE.0
L13: ABS(DELTAT).GE.0
L8: &AC5.EQ.&AC4*DELTAT
L15: ABS(&AC5).EQ.ABS(&AC4)*ABS(DELTAT)

L14: ABS(&AC4)*ABS(DELTAT).LT.1.80*0.180
L16: ABS(&AC5).LT.1.80*0.180
A3: 1.80*0.180.LT.60.86
NONE
L2: TAU2.EQ.60.86
A4: 60.86.GE.0
L18: ABS(TAU2).EQ.60.86
L17: ABS(&AC5).LT.60.86
NONE
H3: CLANDFD
L19: CFD6.EQV.CLANDFD
NONE

H26: &AC3.EQ.TP2
H6: TP2.EQ.TP203
H28: TP21.EQ.&AC4
H27: &AC4.EQ.N(&AC3-TP7)
L21: &AC3.EQ.TP203
L22: TP21.EQ.N(&AC3-TP7)
H11: TP7.EQ.TP702
L23: TP21.EQ.N(TP203-TP7)
H23: &AC1.EQ.HRAD
H24: &AC2.EQ.&AC1-K1000
L25: &AC2.EQ.HRAD-K1000
```

```
CONCLUSIONS
L1: K1000.EQ.837.823
L2: TAU2.EQ.60.86
L3: HRAD.GE.0.AND.HRAD.LT.1500.823

L4: K1000.GE.0

L5: HRAD.GE.0
L6: R(HRAD-K1000)

*C1: R(&AC1-K1000)

L7: DELTAT.EQ.0.0580.OR.DELTAT.EQ.0.180

L8: &AC5.EQ.&AC4*DELTAT
L9: ABS(N(&AC3-TP7)).LT.1.80
L10: ABS(&AC4).LT.1.80

L11: ABS(DELTAT).LE.0.180

L12: ABS(&AC4).GE.0
L13: ABS(DELTAT).GE.0
L14: ABS(&AC4)*ABS(DELTAT).LT.1.80*0.180

L15: ABS(&AC5).EQ.ABS(&AC4)*ABS(DELTAT)
L16: ABS(&AC5).LT.1.80*0.180

L17: ABS(&AC5).LT.60.86

L2: TAU2.EQ.60.86
L18: ABS(TAU2).EQ.60.86

*C2: ABS(&AC5).LT.ABS(TAU2)

L19: CFD6.EQV.CLANDFD
*C3: CFD6

L20: TP205.EQ..IF.CFD52.THEN.N(TP203-TP70
    2).ELSE.TP203
L21: &AC3.EQ.TP203

L22: TP21.EQ.N(&AC3-TP7)

L23: TP21.EQ.N(TP203-TP7)

L24: TP21.EQ.N(TP203-TP702)

L25: &AC2.EQ.HRAD-K1000
```

```
NUTGE1(HRAD-K1000.0)
LT2(HRAD.K1000)
AND4(CLANDFD.HRAD.LT.K1000)

EQV2(CFD52.CLANDFD.AND.HRAD.LT.K1000)

IF3(TP21.N(TP203-TP702).TP203.CFD52)


EQ4(TP21..IF.CFD52.THEN.N(TP203-TP702).EL
    SE.TP203.TP205)


MACEXP(TP704)

MACEXP(TP703)

MULTEQ1(&AC5.&AC4.DELTAT)
MACEXP(TP204)
EQ4(TP21.N(TP203-TP702).TP204)

SUBST1(&AC6.&AC5/TAU2.X.&AC7=X/2**6)

EQ3(TP71.&AC8.N(&AC7+TP7))

SUBST1(&AC7.&AC5/TAU2/2**6.X.TP71=N(X+TP7
    ))

SUBST1(TP7.TP702.X.TP71=N(&AC5/TAU2/2**6+
    X))

EQ3(&AC4.TP21.TP204)

SUBST1(&AC4.TP204.X.&AC5=X*DELTAT)

SUBST2(&AC5.TP204*DELTAT.X.TP703=N(X/TAU2
    /2**6+TP702))


EQ4(TP71.N(&AC5/TAU2/2**6+TP702).TP703)

IF3(TP71.TP703.TP702.CFD52)


EQ4(TP71..IF.CFD52.THEN.TP703.ELSE.TP702.
    TP704)

***** Q. E. D. *****
```

```
L26: .NOT.HRAD-K1000.GE.0
L28: HRAD-K1000.LT.0
H3: CLANDFD
L29: HRAD.LT.K1000
L30: CLANDFD.AND.HRAD.LT.K1000
L27: CFD52.EQV.CLANDFD.AND.HRAD.LT.K1000
L24: TP21.EQ.N(TP203-TP702)

L31: CFD52
L32: TP21.EQ..IF.CFD52.THEN.N(TP203-TP702
    ).ELSE.TP203
L20: TP205.EQ..IF.CFD52.THEN.N(TP203-TP70
    2).ELSE.TP203
NONE

NONE

H30: &AC5.EQ.MULT(&AC4.DELTAT)
NONE
L24: TP21.EQ.N(TP203-TP702)
L35: TP204.EQ.N(TP203-TP702)
H31: &AC6.EQ.&AC5/TAU2
H32: &AC7.EQ.&AC6/2**6
H34: TP71.EQ.&AC8
H33: &AC8.EQ.N(&AC7+TP7)
L37: &AC7.EQ.&AC5/TAU2/2**6

L38: TP71.EQ.N(&AC7+TP7)
H11: TP7.EQ.TP702

L39: TP71.EQ.N(&AC5/TAU2/2**6+TP7)
H28: TP21.EQ.&AC4
L36: TP21.EQ.TP204
L41: &AC4.EQ.TP204
L8: &AC5.EQ.&AC4*DELTAT
L42: &AC5.EQ.TP204*DELTAT

L34: TP703.EQ.N(TP204*DELTAT/TAU2/2**6+TP
    702)
L40: TP71.EQ.N(&AC5/TAU2/2**6+TP702)
L43: TP703.EQ.N(&AC5/TAU2/2**6+TP702)
L44: TP71.EQ.TP703

L31: CFD52
L45: TP71.EQ..IF.CFD52.THEN.TP703.ELSE.TP
    702
L33: TP704.EQ..IF.CFD52.THEN.TP703.ELSE.T
    P702
```

```
L28: HRAD-K1000.LT.0
L29: HRAD.LT.K1000
L30: CLANDFD.AND.HRAD.LT.K1000

L31: CFD52

L32: TP21.EQ..IF.CFD52.THEN.N(TP203-TP702
    ).ELSE.TP203

*C4: TP21.EQ.TP205


L33: TP704.EQ..IF.CFD52.THEN.TP703.ELSE.T
    P702
L34: TP703.EQ.N(TP204*DELTAT/TAU2/2**6+TP
    702)
L8: &AC5.EQ.&AC4*DELTAT
L35: TP204.EQ.N(TP203-TP702)
L36: TP21.EQ.TP204

L37: &AC7.EQ.&AC5/TAU2/2**6

L38: TP71.EQ.N(&AC7+TP7)

L39: TP71.EQ.N(&AC5/TAU2/2**6+TP7)


L40: TP71.EQ.N(&AC5/TAU2/2**6+TP702)


L41: &AC4.EQ.TP204

L42: &AC5.EQ.TP204*DELTAT

L43: TP703.EQ.N(&AC5/TAU2/2**6+TP702)


L44: TP71.EQ.TP703

L45: TP71.EQ..IF.CFD52.THEN.TP703.ELSE.TP
    702

*C5: TP71.EQ.TP704
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 19

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: CLANDFD
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP103
H6: TP2.EQ.TP203
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP702
H12: LOCFD.EQ.LOCFD05
H13: LOCEC.EQ.LOCOC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TP.FLG.NE.0
H22: .NOT.CCROZFD
H23: &AC1.EQ.HNAD
H24: &AC2.EQ.&AC1-K1000
H25: &AC2.GE.0

CONCLUSIONS
C1: R(&AC1-K1000)
C2: CFD5
C3: TP2.EQ.TP205
C4: TP7.EQ.TP704

THEOREMS USED
IF1(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
EQ4(P,Q,R)=P.EQ.Q,Q.EQ.R.IMP.P.EQ.R
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
NOTLTGE1(P,Q)=.NOT.P.LT.Q.EQV.P.GE.Q
OR2(A,B)=B.IMP.A.OR.B
EQV3(A,B)=(A.EQV.B),.NOT.B.IMP..NOT.A
MULTEQ1(P,Q,R)=P.EQ.MULT(Q,R).IMP.P=Q*R
EQ3(P,Q,R)=P.EQ.Q,Q.EQ.R.IMP.P.EQ.R
SUBST2(P,Q,R,A(R))=P.(Q.EQ.Q,A(Q).IMP.A(P)
IF2(I,J,K,A)=I=J,A.IMP.I=(.IF.A.THEN.J.ELSE.K)
AND8(A,B)=A.AND.B.IMP.A
IRS(P,Q)=P.GE.0,Q.GE.0.IMP.R(P-Q)
EQV2(A,B)=B,(A.EQV.B).IMP.A
GE3(P,Q)=P.GE.Q.EQV.P-Q.GE.0
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)

PROOF

THEOREMS                    HYPOTHESES                  CONCLUSIONS
MACEXP(TP205)               NONE                        C1: TP205.EQ..IF.CFD52.THEN.N(TP203-TP702
```

```
SUBST1(&AC1,HRAD,X,X-K1000.GE.0)

MACEXP(CFD52)
GE3(HRAD,K1000)
NOTLT6L1(HRAD,K1000)
OR2(.NOT.CLANDFD,.NOT.HRAD.LT.K1000)
NOT3(CLANDFD,HRAD.LT.K1000)
EQV3(CFD52,CLANDFD.AND.HRAD.LT.K1000)

MACEXP(TP704)

IF4(TP7,TP703,TP702,CFD52)


EQ4(TP7,.IF.CFD52.THEN.TP703.ELSE.TP702,T
    P704)


IF4(TP2,N(TP203-TP702),TP203,CFD52)


EQ4(TP2,.IF.CFD52.THEN.N(TP203-TP702).ELS
    E.TP203,TP205)


HYPEXP(SPEC,K1000=837,B23)
HYPEXP(SPEC,HRAD.GE.0.AND.HRAD.LT.1500.B2
    3)
SUBST2(K1000,837,B23,X,X.GE.0)

AND8(HRAD.GE.0,HRAD.LT.1500.B23)
IR5(HRAD,K1000)

SUBST2(&AC1,HRAD,X,R(X-K1000))

MACEXP(CFD6)
EQV2(CFD6,CLANDFD)


***** O. E. D. *****
```

```
B23: &AC1.EQ.HRAD
L2: &AC1-K1000.GE.0
NONE
L3: HRAD-K1000.GE.0
L5: HRAD.GE.K1000
L6: .NOT.HRAD.LT.K1000
L7: .NOT.CLANDFD.OR..NOT.HRAD.LT.K1000
L4: CFD52.EQV.CLANDFD.AND.HRAD.LT.K1000
L8: .NOT.(CLANDFD.AND.HRAD.LT.K1000)
NONE

B11: TP7.EQ.TP702

L9: .NOT.CFD52
L11: TP7.EQ..IF.CFD52.THEN.TP703.ELSE.TP7
    02
L10: TP704.EQ..IF.CFD52.THEN.TP703.ELSE.T
    P702
B6: TP2.EQ.TP203

L9: .NOT.CFD52
L12: TP2.EQ..IF.CFD52.THEN.N(TP203-TP702)
    .ELSE.TP203
L1: TP205.EQ..IF.CFD52.THEN.N(TP203-TP702
    ).ELSE.TP203
NONE
NONE

L13: K1000.EQ.837.B23
A1: 837.B23.GE.0
L14: HRAD.GE.0.AND.HRAD.LT.1500.B23
L16: HRAD.GE.0
L15: K1000.GE.0
B23: &AC1.EQ.HRAD
L17: R(HRAD-K1000)
NONE
B3: CLANDFD
L18: CFD6.EQV.CLANDFD
```

```
L3: HRAD-K1000.GE.0

L4: CFD52.EQV.CLANDFD.AND.HRAD.LT.K1000
L5: HRAD.GE.K1000
L6: .NOT.HRAD.LT.K1000
L7: .NOT.CLANDFD.OR..NOT.HRAD.LT.<1000
L8: .NOT.(CLANDFD.AND.HRAD.LT.K1000)
L9: .NOT.CFD52

L10: TP704.EQ..IF.CFD52.THEN.TP703.ELSE.T
    P702
L11: TP7.EQ..IF.CFD52.THEN.TP703.ELSE.TP7
    02

*C4: TP7.EQ.TP704


L12: TP2.EQ..IF.CFD52.THEN.N(TP203-TP702)
    .ELSE.TP203

*C3: TP2.EQ.TP205


L13: K1000.EQ.837.B23
L14: HRAD.GE.0.AND.HRAD.LT.1500.B23

L15: K1000.GE.0

L16: HRAD.GE.0
L17: R(HRAD-K1000)

*C1: R(&AC1-K1000)

L18: CFD6.EQV.CLANDFD
*C2: CFD6
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 20

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CFD6
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP103
H6: TP2.EQ.TP205
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP704
H12: LOCF0.EQ.LOCF005
H13: LOCCC.EQ.LOCOC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TMFLG.NE.0
H22: .NOT.CCRUZFD
H23: &AC1.EQ.TP2
H24: &AC2.EQ.N(&AC1-TP1)
H25: &M01.EQ.LIMIT0
H26: &AC3.EQ.SRLMT(&AC2,&M01)
H27: &AC4.EQ.&AC3**2**3
H28: &AC5.EQ.-&AC4
H29: LOCSER1.EQ.&AC5
H30: &AC6.EQ.YETA
H31: &M02.EQ.MULTM(&AC6,PSIE)
H32: &AC7.EQ.MULT(&AC6,PSIE)
H33: .NOT.&AC7.EQ.0
H34: .NOT.&AC7.GE.0
H35: &AC8.EQ.LOCSTR1
H36: &MC3.EQ.MULTM(&AC8,PSIE)
H37: &AC9.EQ.MULT(&AC8,PSIE)
H38: .NOT.&AC9.LT.0
H39: &AC10.EQ.PSIE
H40: &AC11.EQ.ABS(&AC10)
H41: &AC12.EQ.N(&AC11-DEG20)
H42: .NOT.&AC12.LT.0
H43: CAPTI.EQ.0
H44: &AC13.EQ.A0
H45: &AC14.EQ.N(&AC13-RLFD)
H46: &AC15.EQ.&AC14/2**2
H47: &AC16.EQ.&AC15/TAU3
H48: &M04.EQ.DEG0
H49: &AC17.EQ.SRLMT(&AC16,&M04)
H50: &M05.EQ.MULTM(&AC17,DELTAT)
H51: &AC18.EQ.MULT(&AC17,DELTAT)
H52: &AC19.EQ.N(&AC18+RLFD)
H53: RLFD1.EQ.&AC19
H54: &AC20.EQ.N(&AC19+...)
```

```
H57: RLMD1.EQ.&AC21

CONCLUSIONS
C1: &(-AC34?**3)
    &L(&AC15).LT.ABS(TAU3)
C3: PDIT
C4: START.EQ.START04
C5: LGCFD.EQ.LGCFD05
C6: TP1.EQ.TP104
C7: TP2.EQ.TP206
C8: TP7.EQ.TP705
C9: YETA.EQ.YETA02
C10: PSIE.EQ.PSIE02
C11: LGCSTR1.EQ.LGCSTR02
C12: CAPT1.EQ.CAPT04
C13: RLFD1.EQ.RLFD04
C14: PCMD1.EQ.PCMD01

THEOREMS USED
EQV1(A,B)=A,(A.EQV.B).IMP.B
SUBST1(P,Q,R,A(R))=P.EQ.Q,A(P).IMP.A(Q)
EQ4(P,Q,R)=P.EQ.Q,R.EQ.Q.IMP.P.EQ.R
EQ3(P,Q,R)=P.EQ.Q,Q.EQ.R.IMP.P.EQ.R
IF4(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
NOTGE1(P,Q)=.NOT.(P.GE.Q).EQV.P.LT.Q
MULT1(P,Q)=MULT(P,Q).EQ.P*Q
NOTS(A,B,C)=.NOT.A,.NOT.B,.NOT.C.IMP..NOT.(A.OR.B.OR.C)
EQV3(A,B)=(A.EQV.B),.NOT.B.IMP..NOT.A
AND4(A,B)=A,B.IMP.A.AND.B
EQV2(A,B)=B,(A.EQV.B).IMP.A
OR1(A,B)=A.IMP.A.OR.B
OR2(A,B)=B.IMP.A.OR.B
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
SRLMT5(P,Q)=ABS(SRLMT(P,Q)).LE.ABS(Q)
SUBST2(P,Q,R,A(R))=P.EQ.Q,A(Q).IMP.A(P)
ABS1(P)=P.GE.0.IMP.ABS(P).EQ.P
ABS6(P,Q)=ABS(P*Q)=ABS(P)*ABS(Q)
MLE1(P,Q,R)=P.LE.Q.R.GT.Q.IMP.P*R.LE.Q*R
LELT2(P,Q,R)=P.LE.Q,Q.LT.R.IMP.P.LT.R
IR6(P)=ABS(P).LT.1.B0.IMP.R(P)
ABS8(P,Q)=P.EQ.Q.IMP.ABS(P).EQ.ABS(Q)
NF7(P,Q)=P.EQ.0,ABS(Q).LT.1.B0.IMP.ABS(N(P-Q))=ABS(Q)
DLT1(P,Q,R)=P.LT.Q,R.GT.0.IMP.P/R.LT.Q/R
ABS10(P,Q)=Q.NE.0.IMP.ABS(P/Q).EQ.ABS(P)/ABS(Q)
ABS19(P,Q)=P.EQ.0,Q.GE.0.IMP.ABS(P).EQ.Q
IF3(I,J,K,A)=I=J,A.IMP.I=(.IF.A.THEN.J.ELSE.K)
MULTE01(P,Q,R)=P.EQ.MULT(Q,R).IMP.P=Q*R
NOTGE3(P,Q)=.NOT.P.GE.Q.EQV..NOT.P.GT.Q

PROOF

THEOREMS
HYPEXP(SPEC,TAU3=1.B2)
ABS6(&AC14,N(&AC13-RLFD))
HYPEXP(SPEC,A0=0)
EQ3(&AC13,A0,0)

HYPEXP(SPEC,ABS(RLFD).LT.1.B0)
NF7(&AC13,RLFD)

EQ3(ABS(&AC14),ABS(N(&AC13-RLFD)),ABS(RLF
    D))

SUBST2(ABS(&AC14),A(&AC15),&L(&AC15))

HYPOTHESES
NONE
H45: &AC14.EQ.N(&AC13-RLFD)
NONE
H44: &AC13.EQ.A0
L3: A0.EQ.0
NONE
L4: &AC13.EQ.0
L5: ABS(RLFD).LT.1.B0
L2: ABS(&AC14).EQ.ABS(N(&AC13-RLFD))

L6: ABS(N(&AC13-RLFD)).EQ.ABS(RLFD)

CONCLUSIONS
L1: TAU3.EQ.1.B2
L2: ABS(&AC14).EQ.ABS(N(&AC13-RLFD))
L3: A0.EQ.0
L4: &AC13.EQ.0

L5: ABS(RLFD).LT.1.B0
L6: ABS(N(&AC13-RLFD)).EQ.ABS(RLFD)

L7: ABS(&AC14).EQ.ABS(RLFD)
```

```
ABS0(2**2)
SUBST2(ABS(2**2),2**2,X,ABS(&AC14)/X.LT.1
    .80/2**2)

ABS10(&AC14,2**2)

SUBST2(&AC15,&AC14/2**2,X,ABS(X)=ABS(&AC1
    4)/ABS(2**2))

SUBST2(ABS(&AC15),ABS(&AC14)/ABS(2**2),X,
    X,LT.1.80/2**2)

SUBST1(1.80/2**2,1.82,X,ABS(&AC15)._T.X)

ABS19(TAU3,1.82)

SUBST2(ABS(TAU3),1.82,X,ABS(&AC15).LT.X)

MACEXP(CFD11)

MACEXP(CFD7)
MACEXP(CEXIT1)

MACEXP(CFD6)
EQV1(CFD6,CLANDFD)

MACEXP(START04)

IFA(START.0,START03,CFDIN1)

EQ4(START,.IF.CFDIN1.THEN.0.ELSE.START03,
    START04)

MACEXP(LOCFD06)

IF3(LOCFD,LOCFD05,LOCFD03,CLANDFD)

IFA(LOCFD,0,,IF.CLANDFD.THEN.LOCFD05.ELSE
    .LOCFD03,CFDIN1)

EQ4(LOCFD,.IF.CFDIN1.THEN.0.ELSE..IF.CLAN
    DFD.THEN.LOCFD05.ELSE.LOCFD03,LOCFD06

MACEXP(TP104)

IF4(TP1,TP102,TP103,CCRUZFD)

EQ4(TP1,.IF.CCRUZFD.THEN.TP102.ELSE.TP103
    ,TP104)

MACEXP(TP206)

IF4(TP2,TP202,TP205,CCRUZFD)

EQ4(TP2,.IF.CCRUZFD.THEN.TP202.ELSE.TP205
```

```
A1: 2**2.GT.0
A2: 2**2.GE.0
L10: ABS(2**2).EQ.2**2

L9: ABS(&AC14)/2**2.LT.1.80/2**2
A3: 2**2.NE.0

H46: &AC15.EQ.&AC14/2**2

L12: ABS(&AC14/2**2).EQ.ABS(&AC14)/ABS(2*
    *2)
L13: ABS(&AC15).EQ.ABS(&AC14)/ABS(2**2)

L11: ABS(&AC14)/ABS(2**2).LT.1.80/2**2
A4: 1.80/2**2.EQ.1.82
L14: ABS(&AC15).LT.1.80/2**2
L1: TAU3.EQ.1.82
A5: 1.82.GE.0
L16: ABS(TAU3).EQ.1.82
L15: ABS(&AC15).LT.1.82
NONE

NONE
NONE

NONE
H3: CFD6
L20: CFD6.EQV.CLANDFD
NONE

H19: START.EQ.START03

H20: .NOT.CFDIN1
L23: START.EQ..IF.CFDIN1.THEN.0.ELSE.STAR
    T03
L22: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
NONE

H12: LOCFD.EQ.LOCFD05

L21: CLANDFD
L25: LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
    SE.LOCFD03
H20: .NOT.CFDIN1
L26: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
    CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L24: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
    F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
NONE

H5: TP1.EQ.TP103

H22: .NOT.CCRUZFD
L28: TP1.EQ..IF.CCRUZFD.THEN.TP102.ELSE.T
    P103
L27: TP104.EQ..IF.CCRUZFD.THEN.TP102.ELSE
    .TP103
NONE

H6: TP2.EQ.TP205

H22: .NOT.CCRUZFD
L30: T??.??.IF.CCRUZFD.THEN.TP202.ELSE.T
```

```
L10: ABS(2**2).EQ.2**2
L11: ABS(&AC14)/ABS(2**2).LT.1.80/2**2

L12: ABS(&AC14/2**2).EQ.ABS(&AC14)/ABS(2*
    *2)
L13: ABS(&AC15).EQ.ABS(&AC14)/ABS(2**2)

L14: ABS(&AC15).LT.1.80/2**2

L15: ABS(&AC15).LT.1.82

L16: ABS(TAU3).EQ.1.82

*C2: ABS(&AC15).LT.ABS(TAU3)

L17: CFD11.EQV.CFD62.OR.CFD8.OR.CFD9.OR.C
    FD10
L18: CFD7.EQV.CLANDFD.AND.TFD7
L19: CEXIT1.EQV.TMEFLG.EQ.0.OR.CCRUZFD.AN
    D.GUIDFD.EQ.0
L20: CFD6.EQV.CLANDFD
L21: CLANDFD

L22: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
L23: START.EQ..IF.CFDIN1.THEN.0.ELSE.STAR
    T03

*C4: START.EQ.START04

L24: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
    F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L25: LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
    SE.LOCFD03

L26: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
    CLANDFD.THEN.LOCFD05.ELSE.LOCFD03

*C5: LOCFD.EQ.LOCFD06

L27: TP104.EQ..IF.CCRUZFD.THEN.TP102.ELSE
    .TP103
L28: TP1.EQ..IF.CCRUZFD.THEN.TP102.ELSE.T
    P103

*C6: TP1.EQ.TP104

L29: TP206.EQ..IF.CCRUZFD.THEN.TP202.ELSE
    .TP205
L30: TP2.EQ..IF.CCRUZFD.THEN.TP202.ELSE.T
    P205
```

```
MACEXP(TP705)

IF4(TP7,TP702,TP704,CCRUZFD)

EQ4(TP7,.IF.CCRUZFD.THEN.TP702.ELSE.TP704
    ,TP705)

MACEXP(YETA02)

IF4(YETA,YETA,YETA01,CFDIN1)

EQ4(YETA,.IF.CFDIN1.THEN.YETA.ELSE.YETA01
    ,YETA02)

MACEXP(PSIE02)

IF4(PSIE,PSIE,PSIE01,CFDIN1)

EQ4(PSIE,.IF.CFDIN1.THEN.PSIE.ELSE.PSIE01
    ,PSIE02)

SUBST1(&AC1,TP2,X,&AC2=N(X-TP1))

SUBST1(TP1,TP103,X,&AC2=N(TP2-X))

SUBST1(TP2,TP205,X,&AC2=N(X-TP103))

SUBST1(&MQ1,LIM180,X,&AC3=SRLMT(&AC2,X))

SUBST1(&AC2,N(TP205-TP103),X,&AC3=SRLMT(X
    ,LIM180))

SUBST1(&AC4,&AC3*2**3,X,&AC5=-X)

SUBST1(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,&AC5=-(X*2**3))

MACEXP(LOCSTR01)

EQ4(&AC5,-(SRLMT(N(TP205-TP103),LIM180)*2
    **3),LOCSTR01)

EQ3(LOCSTP1,&AC5,LOCSTR01)

MACEXP(LOCSTR02)

IF4(LOCSTR1,LOCSTR,LOCSTR01,CCRUZFD)

EQ4(LOCSTR1,.IF.CCRUZFD.THEN.LOCSTR.ELSE.
    LOCSTR01,LOCSTR02)

SUBST1(&AC6,YETA,X,&AC7=MULT(X,PSIE))

SUBST1(YETA,YETA01,X,&AC7=MULT(X,PSIE))
    .TP205
NONE

H11: TP7.EQ.TP704

H22: .NOT.CCRUZFD
L32: TP7.EQ..IF.CCRUZFD.THEN.TP702.ELSE.T
    P704
L31: TP705.EQ..IF.CCRUZFD.THEN.TP702.ELSE
    .TP704
NONE

H17: YETA.EQ.YETA01

H20: .NOT.CFDIN1
L34: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
    TA01
L33: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
    YETA01
NONE

H18: PSIE.EQ.PSIE01

H20: .NOT.CFDIN1
L36: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
    IE01
L35: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
    PSIE01
H23: &AC1.EQ.TP2
H24: &AC2.EQ.N(&AC1-TP1)
H5: TP1.EQ.TP103
L37: &AC2.EQ.N(TP2-TP1)
H6: TP2.EQ.TP205
L38: &AC2.EQ.N(TP2-TP103)
H25: &MQ1.EQ.LIM180
H26: &AC3.EQ.SRLMT(&AC2,&MQ1)
L39: &AC2.EQ.N(TP205-TP103)

L40: &AC3.EQ.SRLMT(&AC2,LIM180)
H27: &AC4.EQ.&AC3*2**3
H28: &AC5.EQ.-&AC4
L41: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L42: &AC5.EQ.-(&AC3*2**3)
NONE

L43: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM18
    0)*2**3)
L44: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),L
    IM180)*2**3)
H29: LOCSTR1.EQ.&AC5
L45: &AC5.EQ.LOCSTR01
NONE

L46: LOCSTR1.EQ.LOCSTR01

H22: .NOT.CCRUZFD
L48: LOCSTR1.EQ..IF.CCRUZFD.THEN.LOCSTR.E
    LSE.LOCSTR01
L47: LOCSTR02.EQ..IF.CCRUZFD.THEN.LOCSTR.
    ELSE.LOCSTR01
H30: &AC6.EQ.YETA
H32: &AC7.EQ.MULT(&AC6,PSIE)
H17: YETA.EQ.YETA01

L31: TP705.EQ..IF.CCRUZFD.THEN.TP702.ELSE
    .TP704
L32: TP7.EQ..IF.CCRUZFD.THEN.TP702.ELSE.T
    P704

*C8: TP7.EQ.TP705

L33: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
    YETA01
L34: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
    TA01

*C9: YETA.EQ.YETA02

L35: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
    PSIE01
L36: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
    IE01

*C10: PSIE.EQ.PSIE02

L37: &AC2.EQ.N(TP2-TP1)

L38: &AC2.EQ.N(TP2-TP103)

L39: &AC2.EQ.N(TP205-TP103)

L40: &AC3.EQ.SRLMT(&AC2,LIM180)

L41: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L42: &AC5.EQ.-(&AC3*2**3)

L43: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM18
    0)*2**3)

L44: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),L
    IM180)*2**3)
L45: &AC5.EQ.LOCSTR01

L46: LOCSTR1.EQ.LOCSTR01

L47: LOCSTR02.EQ..IF.CCRUZFD.THEN.LOCSTR.
    ELSE.LOCSTP01
L48: LOCSTR1.EQ..IF.CCRUZFD.THEN.LOCSTR.E
    LSE.LOCSTR01

*C11: LOCSTR1.EQ.LOCSTR02

L49: &AC7.EQ.MULT(YETA,PSIE)
```

```
NOTGE3(&AC7,0)
SUBST1(&AC7,MULT(YETA01,PSIE01),X,.NOT.X.
    GT.0)

SUBST1(&AC8,LOCSTR1,X,&AC9=MULT(X,PSIE))

SUBST1(LOCSTR1,LOCSTR01,X,&AC9=MULT(X,PSI
    E))

SUBST1(PSIE,PSIE01,X,&AC9=MULT(LOCSTR01,X
    ))

SUBST1(&AC9,MULT(LOCSTR01,PSIE01),X,.NOT.
    X.LT.0)

EQ3(&AC10,PSIE,PSIE01)

SUBST1(&AC10,PSIE01,X,&AC11=ABS(X))

SUBST1(&AC11,ABS(PSIE01),X,&AC12=N(X-DEG2
    0))

SUBST1(&AC12,N(ABS(PSIE01)-DEG20),X,.NOT.
    X.LT.0)

MULT1(YETA01,PSIE01)

SUBST1(MULT(YETA01,PSIE01),YETA01*PSIE01,
    X,.NOT.X.GT.0)

MULT1(LOCSTR01,PSIE01)

SUBST1(MULT(LOCSTR01,PSIE01),LOCSTR01*PSI
    E01,X,.NOT.X.LT.0)

NOT6(YETA01*PSIE01.GT.0.LOCSTR01*PSIE01.L
    T.0,N(ABS(PSIE01)-DEG20).LT.0)


MACEXP(TFD7)


EQV3(TFD7,YETA01*PSIE01.GT.0.OR.LOCSTR01*
    PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).L
    T.0)


MACEXP(CFD62)
AND4(CLANDFD,.NOT.TFD7)

EQV2(CFD62,CLANDFD.AND..NOT.TFD7)

MACEXP(RLFD04)

MACEXP(AC02)


IF3(&AC13,A0,.IF.CFD8.THEN.SRLMT(LOCSTR01
    ,DEG15).ELSE.SRLMT(AC01,DEG25),CFD62)
```

```
L50: &AC7.EQ.MULT(YETA01,PSIE)
H34: .NOT.&AC7.GE.0
L51: &AC7.EQ.MULT(YETA01,PSIE01)

L52: .NOT.&AC7.GT.0
H35: &AC8.EQ.LOCSTR1
H37: &AC9.EQ.MULT(&AC8,PSIE)
L46: LOCSTR1.EQ.LOCSTR01

L54: &AC9.EQ.MULT(LOCSTR1,PSIE)
H18: PSIE.EQ.PSIE01

L55: &AC9.EQ.MULT(LOCSTR01,PSIE)
L56: &AC9.EQ.MULT(LOCSTR01,PSIE01)

H38: .NOT.&AC9.LT.0
H39: &AC10.EQ.PSIE
H18: PSIE.EQ.PSIE01
L58: &AC10.EQ.PSIE01
H40: &AC11.EQ.ABS(&AC10)
L59: &AC11.EQ.ABS(PSIE01)

H41: &AC12.EQ.N(&AC11-DEG20)
L60: &AC12.EQ.N(ABS(PSIE01)-DEG20)

H42: .NOT.&AC12.LT.0
NONE

L62: MULT(YETA01,PSIE01).EQ.YETA01*PSIE01

L53: .NOT.MULT(YETA01,PSIE01).GT.0
NONE

L64: MULT(LOCSTR01,PSIE01).EQ.LOCSTR01*PS
    IE01
L57: .NOT.MULT(LOCSTR01,PSIE01).LT.0
L63: .NOT.YETA01*PSIE01.GT.0


L65: .NOT.LOCSTR01*PSIE01.LT.0
L61: .NOT.N(ABS(PSIE01)-DEG20).LT.0
NONE


L67: TFD7.EQV.YETA01*PSIE01.GT.0.OR._OCST
    R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
    0).LT.0
L66: .NOT.(YETA01*PSIE01.GT.0.OR.LOCSTR01
    *PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).
    LT.0)
NONE
L21: CLANDFD
L68: .NOT.TFD7
L70: CLANDFD.AND..NOT.TFD7
L69: CFD62.EQV.CLANDFD.AND..NOT.TFD7
NONE

NONE


H44: &AC13.EQ.A0
```

```
L52: .NOT.&AC7.GT.0
L53: .NOT.MULT(YETA01,PSIE01).GT.0


L54: &AC9.EQ.MULT(LOCSTR1,PSIE)

L55: &AC9.EQ.MULT(LOCSTR01,PSIE)

L56: &AC9.EQ.MULT(LOCSTR01,PSIE01)

L57: .NOT.MULT(LOCSTR01,PSIE01).LT.0


L58: &AC10.EQ.PSIE01

L59: &AC11.EQ.ABS(PSIE01)

L60: &AC12.EQ.N(ABS(PSIE01)-DEG20)


L61: .NOT.N(ABS(PSIE01)-DEG20).LT.0


L62: MULT(YETA01,PSIE01).EQ.YETA01*PSIE01

L63: .NOT.YETA01*PSIE01.GT.0


L64: MULT(LOCSTR01,PSIE01).EQ.LOCSTR01*PS
    IE01
L65: .NOT.LOCSTR01*PSIE01..T.0


L66: .NOT.(YETA01*PSIE01.GT.0.OR._OCSTR01
    *PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).
    LT.0)


L67: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
    R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
    0).LT.0
L68: .NOT.TFD7




L69: CFD62.EQV.CLANDFD.AND..NOT.TFD7
L70: CLANDFD.AND..NOT.TFD7

L71: CFD62

L72: RLFD04.EQ.N(SRLMT(N(AC02-RLFD02)/2**
    2/TAU3,DEG4)*DELTAT+RLFD02)
L73: AC02.EQ..IF.CFD62.THEN.A0.ELSE..IF.C
    FD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.S
    RLMT(AC01,DEG25)
L74: &AC13.EQ..IF.CFD62.THEN.A0.ELSE..IF.
    CFD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.
    SRLMT(AC01,DEG25)
```

```
    .THEN.SRLMT(LOCSTR01,DEG15).ELSE.SRLM
    T(AC01,DEG25),AC02)


SUBST1(&AC13,AC02,X,&AC14=N(X-RLFD))

SUBST1(RLFD,RLFD02,X,&AC14=N(AC02-X))

SUBST1(&AC15,&AC14/2**2,X,&AC16.EQ.X/TAU3
    )

SUBST1(&AC14,N(AC02-RLFD02),X,&AC16=X/2**
    2/TAU3)

SUBST2(&AC16,N(AC02-RLFD02)/2**2/TAU3,X,R
    LFD04=N(SRLMT(X,DEG4)*DELTAT+RLFD02))

SUBST1(&M04,DEG4,X,&AC17.EQ.SRLMT(&AC16,X
    ))

MULTEQ1(&AC18,&AC17,DELTAT)
SUBST1(&AC17,SRLMT(&AC16,DEG4),X,&AC18=X*
    DELTAT)

SUBST2(&AC18,SRLMT(&AC16,DEG4)*DELTAT,X,R
    LFD04=N(X+RLFD02))


EQ3(RLFD1,&AC19,N(&AC18+RLFD))

SUBST1(RLFD,RLFD02,X,RLFD1.EQ.N(&AC18+X))


EQ4(RLFD1,N(&AC18+RLFD02),RLFD04)

MACEXP(RCMD01)

EQ3(&AC19,RLFD1,RLFD04)

SUBST1(&AC19,RLFD04,X,&AC20=N(X-ROLL))

SUBST1(&AC20,N(RLFD04-ROLL),X,&AC21=SRLMT
    (X,&M06))

SUBST1(&M06,DEG25,X,&AC21=SRLMT(N(RLFD04-
    ROLL),X))

EQ3(RCMD1,&AC21,SRLMT(N(RLFD04-ROLL),DEG2
    5))


EQ4(RCMD1,SRLMT(N(RLFD04-ROLL),DEG25),RCM
    D01)


MACEXP(CFDIN1)
MACEXP(CEXITO)
OR1(CFD62,CFD8)
OR1(CFD62.OR.CFD8,CFD9)
OR1(CFD62.OR.CFD8.OR.CFD9,CFD10)
EQV2(CFD11,CFD62.OR.CFD8.OR.CFD9.OR.CFD10
    )
```

```
    CFD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.
    SRLMT(AC01,DEG25)
L73: AC02.EQ..IF.CFD62.THEN.A0.ELSE..IF.C
    FD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.S
    RLMT(AC01,DEG25)
L75: &AC13.EQ.AC02
H45: &AC14.EQ.N(&AC13-RLFD)
H16: RLFD.EQ.RLFD02
L76: &AC14.EQ.N(AC02-RLFD)
H46: &AC15.EQ.&AC14/2**2

H47: &AC16.EQ.&AC15/TAU3
L77: &AC14.EQ.N(AC02-RLFD02)

L78: &AC16.EQ.&AC14/2**2/TAU3
L79: &AC16.EQ.N(AC02-RLFD02)/2**2/TAU3

L72: RLFD04.EQ.N(SRLMT(N(AC02-RLFD02)/2**
    2/TAU3,DEG4)*DELTAT+RLFD02)
H48: &M04.EQ.DEG4

H49: &AC17.EQ.SRLMT(&AC16,&M04)
H51: &AC18.EQ.MULT(&AC17,DELTAT)
L81: &AC17.EQ.SRLMT(&AC16,DEG4)

L82: &AC18.EQ.&AC17*DELTAT
L83: &AC18.EQ.SRLMT(&AC16,DEG4)*DELTAT

L80: RLFD04.EQ.N(SRLMT(&AC16,DEG4)*DELTAT
    +RLFD02)
H53: RLFD1.EQ.&AC19
H52: &AC19.EQ.N(&AC18+RLFD)
H16: RLFD.EQ.RLFD02

L85: RLFD1.EQ.N(&AC18+RLFD)
L86: RLFD1.EQ.N(&AC18+RLFD02)
L84: RLFD04.EQ.N(&AC18+RLFD02)
NONE

H53: RLFD1.EQ.&AC19
*C13: RLFD1.EQ.RLFD04
L88: &AC19.EQ.RLFD04
H54: &AC20.EQ.N(&AC19-ROLL)
L89: &AC20.EQ.N(RLFD04-ROLL)

H56: &AC21.EQ.SRLMT(&AC20,&M06)
H55: &M06.EQ.DEG25

L90: &AC21.EQ.SRLMT(N(RLFD04-ROLL),&M06)
H57: RCMD1.EQ.&AC21

L91: &AC21.EQ.SRLMT(N(RLFD04-ROLL),DEG25)

L92: RCMD1.EQ.SRLMT(N(RLFD04-ROLL),DEG25)

L87: RCMD01.EQ.SRLMT(N(RLFD04-ROLL),DEG25
    )
NONE
NONE
L71: CFD62
L95: CFD62.OR.CFD8
L96: CFD62.OR.CFD8.OR.CFD9
L97: CFD62.OR.CFD8.OR.CFD9.OR.CFD10
```

```
L76: &AC14.EQ.N(AC02-RLFD)

L77: &AC14.EQ.N(AC02-RLFD02)

L78: &AC16.EQ.&AC14/2**2/TAU3


L79: &AC16.EQ.N(AC02-RLFD02)/2**2/TAU3

L80: RLFD04.EQ.N(SRLMT(&AC16,DEG4)*DELTAT
    +RLFD02)


L81: &AC17.EQ.SRLMT(&AC16,DEG4)


L82: &AC18.EQ.&AC17*DELTAT
L83: &AC18.EQ.SRLMT(&AC16,DEG4)*DELTAT


L84: RLFD04.EQ.N(&AC18+RLFD02)


L85: RLFD1.EQ.N(&AC18+RLFD)

L86: RLFD1.EQ.N(&AC18+RLFD02)


*C13: RLFD1.EQ.RLFD04

L87: RCMD01.EQ.SRLMT(N(RLFD04-ROLL),DEG25
    )
L88: &AC19.EQ.RLFD04

L89: &AC20.EQ.N(RLFD04-ROLL)

L90: &AC21.EQ.SRLMT(N(RLFD04-ROLL),&M06)


L91: &AC21.EQ.SRLMT(N(RLFD04-ROLL),DEG25)


L92: RCMD1.EQ.SRLMT(N(RLFD04-ROLL),DEG25)


*C14: RCMD1.EQ.RCMD01


L93: CFDIN1.EQV.TMEFLG.NE.0.AND.TICRUZFD
L94: CEXITO.EQV.CVCRUZ.AND.TEXITD
L95: CFD62.OR.CFD8
L96: CFD62.OR.CFD8.OR.CFD9
L97: CFD62.OR.CFD8.OR.CFD9.OR.CFD10
*C3: CFD11
```

```
MACEXP(CAPT03)
OR2(.NOT.CLANDFD,.NOT.TFD7)
NOT3(CLANDFD,TFD7)
EQV3(CFD7,CLANDFD.AND.TFD7)

IF4(CAPT1,SET,0,CFD7)

EQ4(CAPT1,.IF.CFD7.THEN.SET.ELSE.0,CAPT03
    )

MACEXP(CAPT04)

IF4(CAPT1,CAPT,CAPT03,CCRUZFD)


EQ4(CAPT1,.IF.CCRUZFD.THEN.CAPT.ELSE.CAPT
    03,CAPT04)


HYPEXP(SPEC,LIM180=003777777)
SRLMT5(N(TP205-TP103),LIM180)

SUBST2(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,ABS(X).LE.ABS(LIM180))


SUBST1(LIM180,003777777,X,ABS(&AC3).LE.AB
    S(X))

ABS9(003777777)
SUBST1(ABS(003777777),003777777,X,ABS(&AC
    3).LE.X)

ABS5(&AC3,2**3)

ABS9(2**3)
SUBST1(ABS(2**3),2**3,X,ABS(&AC3*2**3).EQ
    .ABS(&AC3)*X)


MLE1(ABS(&AC3),003777777,2**3)

LELT2(ABS(&AC3)*2**3,003777777*2**3.1.80)


SUBST2(ABS(&AC3*2**3),ABS(&AC3)*2**3.X.X.
    LT.1.80)

IR6(&AC3*2**3)

***** O. E. D. *****
```

```
NONE
L68:  .NOT.TFD7
L99:  .NOT.CLANDFD.OR..NOT.TFD7
L18:  CFD7.EQV.CLANDFD.AND.TFD7
L100:  .NOT.(CLANDFD.AND.TFD7)
H43:  CAPT1.EQ.0
L101:  .NOT.CFD7
L102:  CAPT1.EQ..IF.CFD7.THEN.SET.ELSE.0

L98:  CAPT03.EQ..IF.CFD7.THEN.SET.ELSE.0
NONE

L103:  CAPT1.EQ.CAPT03

H22:  .NOT.CCRUZFD
L105:  CAPT1.EQ..IF.CCRUZFD.THEN.CAPT.ELSE
    .CAPT03
L104:  CAPT04.EQ..IF.CCRUZFD.THEN.CAPT.ELS
    E.CAPT03
NONE
NONE

L41:  &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L107:  ABS(SRLMT(N(TP205-TP103),LIM180)).L
    E.ABS(LIM180)
L106:  LIM180.EQ.003777777

L108:  ABS(&AC3).LE.ABS(LIM180)
A6:  003777777.GE.0
L110:  ABS(003777777).EQ.003777777

L109:  ABS(&AC3).LE.ABS(003777777)
NONE

A7:  2**3.GE.0
L113:  ABS(2**3).EQ.2**3

L112:  ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**
    3)
L111:  ABS(&AC3).LE.003777777
A8:  2**3.GT.0
L115:  ABS(&AC3)*2**3.LE.003777777*2**3

A9:  003777777*2**3.LT.1.80
L114:  ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3

L116:  ABS(&AC3)*2**3.LT.1.80
L117:  ABS(&AC3*2**3).LT.1.80
```

```
L98:  CAPT03.EQ..IF.CFD7.THEN.SET.ELSE.0
L99:  .NOT.CLANDFD.OR..NOT.TFD7
L100:  .NOT.(CLANDFD.AND.TFD7)
L101:  .NOT.CFD7

L102:  CAPT1.EQ..IF.CFD7.THEN.SET.ELSE.0

L103:  CAPT1.EQ.CAPT03


L104:  CAPT04.EQ..IF.CCRUZFD.THEN.CAPT.ELS
    E.CAPT03
L105:  CAPT1.EQ..IF.CCRUZFD.THEN.CAPT.ELSE
    .CAPT03

*C12:  CAPT1.EQ.CAPT04



L106:  LIM180.EQ.003777777
L107:  ABS(SRLMT(N(TP205-TP103),LIM180)).L
    E.ABS(LIM180)
L108:  ABS(&AC3).LE.ABS(LIM180)


L109:  ABS(&AC3).LE.ABS(003777777)


L110:  ABS(003777777).EQ.003777777
L111:  ABS(&AC3).LE.003777777


L112:  ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**
    3)
L113:  ABS(2**3).EQ.2**3
L114:  ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3


L115:  ABS(&AC3)*2**3.LE.003777777*2**3

L116:  ABS(&AC3)*2**3.LT.1.80


L117:  ABS(&AC3*2**3).LT.1.30.

*C1:  R(&AC3*2**3)
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 21

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CFD6
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP103
H6: TP2.EQ.TP205
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP704
H12: LOCFD.EQ.LOCFD05
H13: LOCLC.EQ.LOCDC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TMFLG.NE.0
H22: .NOT.CCRUZFD
H23: &AC1.EQ.TP2
H24: &AC2.EQ.N(&AC1-TP1)
H25: &M01.EQ.LIM180
H26: &AC3.EQ.SRLMT(&AC2,&M01)
H27: &AC4.EQ.&AC3**2**3
H28: &AC5.EQ.-&AC4
H29: LOCSTR1.EQ.&AC5
H30: &AC6.EQ.YETA
H31: &M02.EQ.MULIM(&AC6,PSIE)
H32: &AC7.EQ.MULT(&AC6,PSIE)
H33: .NOT.&AC7.EQ.0
H34: .NOT.&AC7.GE.0
H35: &AC8.EQ.LOCSTR1
H36: &M03.EQ.MULIM(&AC8,PSIE)
H37: &AC9.EQ.MULT(&AC8,PSIE)
H38: .NOT.&AC9.LT.0
H39: &AC10.EQ.PSIE
H40: &AC11.EQ.ABS(&AC10)
H41: &AC12.EQ.N(&AC11-05520)
H42: &AC12.LT.0

CONCLUSIONS
C1: R(&AC3**3)
C2: CFD7
C3: LOCSTR1.EQ.LOCSTR01

THEOREMS USED
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
SUBST1(P,Q,R,A(P))=P.EQ.Q.A(P).IMP.A(Q)
SUBST2(P,Q,R,A(R))=P.EQ.Q.A(Q).IMP.A(P)
OR2(A,B)=B.IMP.A.OR.B
EXV1(A,B)=A,(A.EQV.B).IMP.1
```

```
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
IF4(I,J,K,A)=I=K..NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
SRLMT5(P,Q)=ABS(SRLMT(P,Q)).LE.ABS(Q)
ABS9(P)=P.GE.0.IMP.ABS(P).EQ.P
ABS5(P,Q)=ABS(P*Q)=ABS(P)*ABS(Q)
MLE1(P,Q,R)=P.LE.Q.R.GT.0.IMP.P*R.LE.Q*R
LELT2(P,Q,A)=P.LE.0.Q.LT.A.IMP.P.LT.R
IR6(P)=ABS(P).LT.1.80.IMP.R(P)

PROOF

THEOREM5
EQ3(&AC10,PSIE,PSIE01)

EQ3(&AC1,TP2,TP205)

SUBST1(&AC10,PSIE01,X,&AC11=ABS(X))

SUBST1(&AC11,ABS(PSIE01),X,&AC12=N(X-DEG20))

SUBST1(&AC12,N(ABS(PSIE01)-DEG20),X,X,LT.0)

MACEXP(CFD7)
MACEXP(CFD6)
MACEXP(TFD7)


OR2(YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01.LT.0,N(ABS(PSIE01)-DEG20).LT.0)
EQV2(TFD7,YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0)


EQV1(CFD6,CLANDFD)

AND4(CLANDFD,TFD7)

EQV2(CFD7,CLANDFD.AND.TFD7)

MACEXP(LOCSTR01)

SUBST1(&AC1,TP205,X,&AC2=N(X-TP1))

SUBST1(TP1,TP103,X,&AC2=N(TP205-X))

SUBST2(&AC2,N(TP205-TP103),X,LOCSTR01=-(SRLMT(X,LIM180)*2**3))

SUBST1(&M01,LIM180,X,&AC3=SRLMT(&AC2,X))

SUBST2(&AC3,SRLMT(&AC2,LIM180),X,LOCSTR01=-(X*2**3))


EQ3(LOCSTR1,&AC5,-&AC4)

SUBST1(&AC4,&AC3*2**3,X,LOCSTR1=-X)

EQ4(LOCSTR1,-(&AC3*2**3),LOCSTR01)
```

HYPOTHESES

```
H39: &AC10.EQ.PSIE
H18: PSIE.EQ.PSIE01
H23: &AC1.EQ.TP2
H6: TP2.EQ.TP205
L1: &AC10.EQ.PSIE01
H40: &AC11.EQ.ABS(&AC10)
L3: &AC11.EQ.ABS(PSIE01)

H41: &AC12.EQ.N(&AC11-DEG20)
L4: &AC12.EQ.N(ABS(PSIE01)-DEG20)

H42: &AC12.LT.0
NONE
NONE
NONE


L5: N(ABS(PSIE01)-DEG20).LT.0

L9: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0

L8: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0
H3: CFD6
L7: CFD6.EQV.CLANDFD
L11: CLANDFD
L10: TFD7
L12: CLANDFD.AND.TFD7
L5: CFD7.EQV.CLANDFD.AND.TFD7
NONE

L2: &AC1.EQ.TP205
H24: &AC2.EQ.N(&AC1-TP1)
H5: TP1.EQ.TP103
L14: &AC2.EQ.N(TP205-TP1)
L15: &AC2.EQ.N(TP205-TP103)

L13: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),LIM180)*2**3)
H25: &M01.EQ.LIM180
H26: &AC3.EQ.SRLMT(&AC2,&M01)
L17: &AC3.EQ.SRLMT(&AC2,LIM180)

L16: LOCSTR01.EQ.-(SRLMT(&AC2,LIM180)*2**3)
H29: LOCSTR1.EQ.&AC5
H28: &AC5.EQ.-&AC4
H27: &AC4.EQ.&AC3*2**3
L19: LOCSTR1.EQ.-&AC4
L20: LOCSTR1.EQ.-(&AC3*2**3)
```

CONCLUSIONS

```
L1: &AC10.EQ.PSIE01

L2: &AC1.EQ.TP205

L3: &AC11.EQ.ABS(PSIE01)

L4: &AC12.EQ.N(ABS(PSIE01)-DEG20)

L5: N(ABS(PSIE01)-DEG20).LT.0

L6: CFD7.EQV.CLANDFD.AND.TFD7
L7: CFD6.EQV.CLANDFD
L8: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0
L9: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0
L10: TFD7


L11: CLANDFD

L12: CLANDFD.AND.TFD7

*C2: CFD7

L13: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),LIM180)*2**3)
L14: &AC2.EQ.N(TP205-TP1)

L15: &AC2.EQ.N(TP205-TP103)

L16: LOCSTR01.EQ.-(SRLMT(&AC2,LIM180)*2**3)

L17: &AC3.EQ.SRLMT(&AC2,LIM180)

L18: LOCSTR01.EQ.-(&AC3*2**3)


L19: LOCSTR1.EQ.-&AC4

L20: LOCSTR1.EQ.-(&AC3*2**3)
```

```
IF4(LOCSTR1,LOCSTR,LOCSTR01,CCRUZFD)

EQ4(LOCSTR1,.IF.CCRUZFD.THEN.LOCSTR.ELSE.
    LOCSTR01,LOCSTR02)

HYPEXP(SPEC,LIM180=003777777)
SRLMT5(N(TP205-TP103),LIM180)

SUBST1(&AC2,N(TP205-TP103),X,&AC3=SRLMT(X
    ,LIM180))

SUBST2(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,ABS(X).LE.ABS(LIM180))

ABS9(003777777)
SUBST1(LIM180,003777777,X,ABS(&AC3).LE.AB
    S(X))

SUBST1(ABS(003777777),003777777,X,ABS(&AC
    3).LE.X)

ABS5(&AC3,2**3)

ABS9(2**3)
SUBST1(ABS(2**3),2**3,X,ABS(&AC3*2**3)=AB
    S(&AC3)*X)

MLE1(ABS(&AC3),003777777,2**3)

LELT2(ABS(&AC3)*2**3,003777777*2**3,1.80)

SUBST2(ABS(&AC3*2**3),ABS(&AC3)*2**3,X,X.
    LT.1.80)

IR5(&AC3*2**3)

***** Q. F. D. *****
```

```
#C3: LOCSTR1.EQ.LOCSTR01

H22: .NOT.CCRUZFD
L22: LOCSTR1.EQ..IF.CCRUZFD.THEN.LOCSTR.E
    LSE.LOCSTR01
L21: LOCSTR02.EQ..IF.CCRUZFD.THEN.LOCSTR.
    ELSE.LOCSTR01
NONE
NONE

L15: &AC2.EQ.N(TP205-TP103)

L17: &AC3.EQ.SRLMT(&AC2,LIM180)
L26: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L25: ABS(SRLMT(N(TP205-TP103),LIM180)).LE
    .ABS(LIM180)
A1: 003777777.GE.0
L24: LIM180.EQ.003777777

L27: ABS(&AC3).LE.ABS(LIM180)
L28: ABS(003777777).EQ.003777777

L29: ABS(&AC3).LE.ABS(003777777)
NONE

A2: 2**3.GE.0
L32: ABS(2**3).EQ.2**3

L31: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L30: ABS(&AC3).LE.003777777
A3: 2**3.GT.0
L34: ABS(&AC3)*2**3.LE.003777777*2**3

A4: 003777777*2**3.LT.1.80
L33: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3

L35: ABS(&AC3)*2**3.LT.1.80
L36: ABS(&AC3*2**3).LT.1.80
```

```
    ELSE.LOCSTR01
L22: LOCSTR1.EQ..IF.CCRUZFD.THEN.LOCSTR.E
    LSE.LOCSTR01

L23: LOCSTR1.EQ.LOCSTR02

L24: LIM180.EQ.003777777
L25: ABS(SRLMT(N(TP205-TP103),LIM180)).LE
    .ABS(LIM180)
L26: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L27: ABS(&AC3).LE.ABS(LIM180)

L28: ABS(003777777).EQ.003777777
L29: ABS(&AC3).LE.ABS(003777777)

L30: ABS(&AC3).LE.003777777

L31: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L32: ABS(2**3).EQ.2**3
L33: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3

L34: ABS(&AC3)*2**3.LE.003777777*2**3

L35: ABS(&AC3)*2**3.LT.1.80

L36: ABS(&AC3*2**3).LT.1.80

*C1: R(&AC3*2**3)
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 22

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: CFD6
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP103
H6: TP2.EQ.TP205
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP704
H12: LOCFD.EQ.LOCFD05
H13: LOCDC.EQ.LOCDC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TMEFLG.NE.0
H22: .NOT.CCRU2FD
H23: &AC1.EQ.TP2
H24: &AC2.EQ.N(&AC1-TP1)
H25: &M01.EQ.LIMIT0
H26: &AC3.EQ.SHLMT(&AC2,&M01)
H27: &AC4.EQ.&AC3*2**3
H28: &AC5.EQ.-&AC4
H29: LOCSTR1.EQ.&AC5
H30: &AC6.EQ.YETA
H31: &M02.EQ.MULTM(&AC6,PSIE)
H32: &AC7.EQ.MULT(&AC6,PSIE)
H33: .NOT.&AC7.EQ.0
H34: .NOT.&AC7.GE.0
H35: &AC8.EQ.LOCSTR1
H36: &M03.EQ.MULTM(&AC8,PSIE)
H37: &AC9.EQ.MULT(&AC8,PSIE)
H38: &AC9.LT.0

CONCLUSIONS
C1: R(&AC3*2**3)
C2: CFD7
C3: LOCSTR1.EQ.LOCSTR01

THEOREMS USED
EQ3(P,Q,R)=P.EC.Q,Q.EQ.R.IMP.P.EQ.R
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
EQ4(P,Q,R)=P.EC.Q,R.EQ.Q.IMP.P.EQ.R
MULTE01(P,Q,R)=P.EQ.MULT(Q,R).IMP.P=Q*R
OR2(A,B)=B.IMP.A.OR.B
OR1(A,B)=A.IMP.A.OR.B
EQV2(A,B)=B.(A.EQV.B).IMP.A
EQV1(A,B)=A.(A.EQV.B).IMP.B
```

```
ABS2(P)=P.GE.0.IMP.ABS(P).EQ.P
ABS5(P,Q)=ABS(P*Q)=ABS(P)*ABS(Q)
MLE1(P,Q,R)=P.LE.0.R.GT.0.IMP.P*R.LE.Q*R
LELT2(P,Q,R)=P.LE.Q.Q.LT.R.IMP.P.LT.R
IR6(P)=ABS(P).LT.1.30.IMP.R(P)

PROOF

THEOREMS
MACEXP(LOCSTR01)

MACEXP(CFD7)
EQ3(&AC1,TP2,TP205)

SUBST1(&AC1,TP205,X,&AC2=N(X-TP1))

SUBST1(TP1,TP103,X,&AC2=N(TP205-X))

SUBST1(&M01,LIM180,X,&AC3=SRLMT(&AC2,X))

SUBST1(&AC2,N(TP205-TP103),X,&AC3=SRLMT(X
    ,LIM180))

SUBST1(&AC4,&AC3*2**3,X,&AC5=-X)

SUBST1(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,&AC5=-(X*2**3))

EQ4(&AC5,-(SRLMT(N(TP205-TP103),LIM180)*2
    **3),LOCSTR01)


EQ3(LOCSTR1,&AC5,LOCSTR01)

SUBST1(PSIE,PSIE01,X,&AC9=MULT(&AC8,X))

MULTE01(&AC9,&AC8,PSIE01)
EQ3(&AC8,LOCSTR1,LOCSTR01)

SUBST1(&AC8,LOCSTR01,X,&AC9=X*PSIE01)

SUBST1(&AC9,LOCSTR01*PSIE01,X,X,LT,0)

OR2(YETA01*PSIE01.GT.0,LOCSTR01*PSIE01.LT
    .0)
OR1(YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01
    .LT.0.N(ABS(PSIE01)-DEG20).LT.0)
MACEXP(TFD7)


EQV2(TFD7,YETA01*PSIE01.GT.0.OR.LOCSTR01*
    PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).L
    T.0)


MACEXP(CFD6)
EQV1(CFD6,CLANDFD)

AND4(CLANDFD,TFD7)

MACEXP(CFD7)
EQV2(CFD7,CLANDFD.AND.TFD7)
```

```
HYPOTHESES
NONE

NONE
H23: &AC1.EQ.TP2
H6: TP2.EQ.TP205
L3: &AC1.EQ.TP205
H24: &AC2.EQ.N(&AC1-TP1)
H5: TP1.EQ.TP103
L4: &AC2.EQ.N(TP205-TP1)
H25: &M01.EQ.LIM180
H26: &AC3.EQ.SRLMT(&AC2,&M01)
L5: &AC2.EQ.N(TP205-TP103)

L6: &AC3.EQ.SRLMT(&AC2,LIM180)
H27: &AC4.EQ.&AC3*2**3
H28: &AC5.EQ.-&AC4
L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L8: &AC5.EQ.-(&AC3*2**3)
L9: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM180
    )*2**3)
L1: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),LI
    M180)*2**3)
H29: LOCSTR1.EQ.&AC5
L10: &AC5.EQ.LOCSTR01
H18: PSIE.EQ.PSIE01
H37: &AC9.EQ.MULT(&AC8,PSIE)
L11: &AC9.EQ.MULT(&AC8,PSIE01)
H35: &AC8.EQ.LOCSTR1
*C3: LOCSTR1.EQ.LOCSTR01
L13: &AC8.EQ.LOCSTR01
L12: &AC9.EQ.&AC8*PSIE01
L14: &AC9.EQ.LOCSTR01*PSIE01
H38: &AC9.LT.0
L15: LOCSTR01*PSIE01.LT.0

L16: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0
NONE


L17: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0

L18: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
    R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
    0).LT.0
NONE
H3: CFD6
L20: CFD6.EQV.CLANDFD
L21: CLANDFD
L19: TFD7
NONE
L22: CLANDFD.AND.TFD7
L2: CFD7.EQV.CLANDFD.AND.TFD7
*C2: CFD7
```

```
CONCLUSIONS
L1: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),LI
    M180)*2**3)
L2: CFD7.EQV.CLANDFD.AND.TFD7
L3: &AC1.EQ.TP205

L4: &AC2.EQ.N(TP205-TP1)

L5: &AC2.EQ.N(TP205-TP103)

L6: &AC3.EQ.SRLMT(&AC2,LIM180)

L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)


L8: &AC5.EQ.-(&AC3*2**3)

L9: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM180
    )*2**3)

L10: &AC5.EQ.LOCSTR01


*C3: LOCSTR1.EQ.LOCSTR01

L11: &AC9.EQ.MULT(&AC8,PSIE01)

L12: &AC9.EQ.&AC8*PSIE01
L13: &AC8.EQ.LOCSTR01

L14: &AC9.EQ.LOCSTR01*PSIE01

L15: LOCSTR01*PSIE01.LT.0

L16: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0
L17: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0
L18: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
    R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
    0).LT.0
L19: TFD7



L20: CFD6.EQV.CLANDFD
L21: CLANDFD

L22: CLANDFD.AND.TFD7

L2: CFD7.EQV.CLANDFD.AND.TFD7
*C2: CFD7
```

```
SUBST2(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,ABS(X).LE.ABS(LIM180))

ABS9(003777777)
SUBST1(LIM180,003777777,X,ABS(&AC3).LE.AB
    S(X))

SUBST1(ABS(003777777),003777777,X,ABS(&AC
    3).LE.X)

ABS5(&AC3,2**3)

ABS9(2**3)
SUBST1(ABS(2**3),2**3,X,ABS(&AC3*2**3)=AB
    S(&AC3)*X)

MLE1(ABS(&AC3),003777777,2**3)

LELT2(ABS(&AC3)*2**3,003777777*2**3,1.B0)

SUBST2(ABS(&AC3*2**3),ABS(&AC3)*2**3,X,X,
    LT.1.B0)

IR6(&AC3*2**3)

***** Q. E. D. *****
```

```
L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L24: ABS(SRLMT(N(TP205-TP103),LIM180)).LE
    .ABS(LIM180)
A1: 003777777.GE.0
L23: LIM180.EQ.003777777

L25: ABS(&AC3).LE.ABS(LIM180)
L26: ABS(003777777).EQ.003777777

L27: ABS(&AC3).LE.ABS(003777777)
NONE

A2: 2**3.GE.0
L30: ABS(2**3).EQ.2**3

L29: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L28: ABS(&AC3).LE.003777777
A3: 2**3.GT.0
L32: ABS(&AC3)*2**3.LE.003777777*2**3

A4: 003777777*2**3.LT.1.B0
L31: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3

L33: ABS(&AC3)*2**3.LT.1.B0
L34: ABS(&AC3*2**3).LT.1.B0
```

```
    .ABS(LIM180)
L25: ABS(&AC3).LE.ABS(LIM180)

L26: ABS(003777777).EQ.003777777
L27: ABS(&AC3).LE.ABS(003777777)

L28: ABS(&AC3).LE.003777777

L29: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L30: ABS(2**3).EQ.2**3
L31: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3

L32: ABS(&AC3)*2**3.LE.003777777*2**3

L33: ABS(&AC3)*2**3.LT.1.B0

L34: ABS(&AC3*2**3).LT.1.B0

*C1: R(&AC3*2**3)
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 23

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: CFD6
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP103
H6: TP2.EQ.TP205
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP704
H12: LOCFD.EQ.LOCFD05
H13: LOCDC.EQ.LOCDC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TMEFLG.NE.0
H22: .NOT.CCRUZFD
H23: &AC1.EQ.TP2
H24: &AC2.EQ.N(&AC1-TP1)
H25: &MD1.EQ.LIM180
H26: &AC3.EQ.SRLMT(&AC2,&MD1)
H27: &AC4.EQ.&AC3*2**3
H28: &AC5.EQ.-&AC4
H29: LOCSTR1.EQ.&AC5
H30: &AC6.EQ.YETA
H31: &MD2.EQ.MULTM(&AC6,PSIE)
H32: &AC7.EQ.MULT(&AC6,PSIE)
H33: .NOT.&AC7.EQ.0
H34: &AC7.GE.0

CONCLUSIONS
C1: R(&AC3*2**3)
C2: CFD7
C3: LOCSTR1.EQ.LOCSTR01

THEOREMS USED
EQ3(P,Q,R)=P.EQ.Q,Q.EQ.R.IMP.P.EQ.R
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
EQ4(P,Q,R)=P.EQ.Q,R.EQ.Q.IMP.P.EQ.R
MULTEQ1(P,Q,R)=P.EQ.MULT(Q,R).IMP.P=Q*R
NOTGETI(P,Q)=.NOT.(P.EQ.Q).P.GE.Q.IMP.P.GT.Q
ORI(A,B)=A.IMP.A.OR.B
EQV2(A,B)=B,(A.EQV.B).IMP.A
EQV1(A,B)=A,(A.EQV.B).IMP.B
AND4(A,B)=A.B.IMP.A.AND.B
SRLMTS(P,Q)=ABS(SRLMT(P,Q)).LE.ABS(Q)
SUBST2(P,Q,R,A(R))=P.EQ.Q.A(Q).IMP.A(P)
```

```
LELT2(P,0,R)=P.LE.0.0.LT.R.IMP.P.LT.R
IR&(P)=ABS(P).LT.1-H0.IMP.R(P)

PROOF

THEOREMS
MACEXP(LOCSTR01)

MACEXP(CFD7)
EQ3(&AC1,TP2,TP205)

SUBST1(&AC1,TP205,X,&AC2=N(X-TP1))

SUBST1(TP1,TP103,X,&AC2=N(TP205-X))

SUBST1(&MQ1,LIM180,X,&AC3=SRLMT(&AC2,X))

SUBST1(&AC2,N(TP205-TP103),X,&AC3=SRLMT(X
    ,LIM180))

SUBST1(&AC4,&AC3*2**3,X,&AC5=-X)

SUBST1(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,&AC5=-(X*2**3))

EQ4(&AC5,-(SRLMT(N(TP205-TP103),LIM180)*2
    **3),LOCSTR01)


EQ3(LOCSTR1,&AC5,LOCSTR01)

SUBST1(PSIE,PSIE01,X,&AC7=MULT(&AC6,X))

MULTEQ1(&AC7,&AC6,PSIE0:)
EQ3(&AC6,YETA,YETA01)

SUBST1(&AC6,YETA01,X,&AC7=X*PSIE01)

NOTGEGT1(&AC7,0)

SUBST1(&AC7,YETA01*PSIE01,X,X,GT.0)

OR1(YETA01*PSIE01.GT.0.LOCSTR01*PSIE01.LT
    .0)
OR1(YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01
    .LT.0,N(ABS(PSIE01)-DEG2)).LT.0)
MACEXP(TFD7)


EQV2(TFD7,YETA01*PSIE01.GT.0.OR.LOCSTR01*
    PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).L
    T.0)



MACEXP(CFD6)
EQV1(CFD6,CLANDFD)

AND4(CLANDFD,TFD7)

MACEXP(CFD7)
EQV2(CFD7,CLANDFD.AND.TFD7)
```

```
HYPOTHESES
NONE

NONE
H23: &AC1.EQ.TP2
H6: TP2.EQ.TP205
L3: &AC1.EQ.TP205
H24: &AC2.EQ.N(&AC1-TP1)
H5: TP1.EQ.TP103
L4: &AC2.EQ.N(TP205-TP1)
H25: &MQ1.EQ.LIM180
H26: &AC3.EQ.SRLMT(&AC2,&MQ1)
L5: &AC2.EQ.N(TP205-TP103)

L6: &AC3.EQ.SRLMT(&AC2,LIM180)
H27: &AC4.EQ.&AC3*2**3
H28: &AC5.EQ.-&AC4
L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L8: &AC5.EQ.-(&AC3*2**3)
L9: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM180
    )*2**3)
L1: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),LI
    M180)*2**3)
H29: LOCSTR1.EQ.&AC5
L10: &AC5.EQ.LOCSTR01
H18: PSIE.EQ.PSIE01
H32: &AC7.EQ.MULT(&AC6,PSIE)
L11: &AC7.EQ.MULT(&AC6,PSIE01)
H30: &AC6.EQ.YETA
H17: YETA.EQ.YETA01
L13: &AC6.EQ.YETA01
L12: &AC7.EQ.&AC6*PSIE01
H33: .NOT.&AC7.EQ.0
H34: &AC7.GE.0
L14: &AC7.EQ.YETA01*PSIE01
L15: &AC7.GT.0
L16: YETA01*PSIE01.GT.0

L17: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0
NONE


L18: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0

L19: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
    R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
    0).LT.0
NONE
H3: CFD6
L21: CFD6.EQV.CLANDFD
L22: CLANDFD
L20: TFD7
NONE
L23: CLANDFD.AND.TFD7
L2: CFD7.EQV.CLANDFD.AND.TFD7
```

```
CONCLUSIONS
L1: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),LI
    M180)*2**3)
L2: CFD7.EQV.CLANDFD.AND.TFD7
L3: &AC1.EQ.TP205

L4: &AC2.EQ.N(TP205-TP1)

L5: &AC2.EQ.N(TP205-TP103)

L6: &AC3.EQ.SRLMT(&AC2,LIM180)

L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)


L8: &AC5.EQ.-(&AC3*2**3)

L9: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM180
    )*2**3)

L10: &AC5.EQ.LOCSTR01


*C3: LOCSTR1.EQ.LOCSTR01

L11: &AC7.EQ.MULT(&AC6,PSIE01)

L12: &AC7.EQ.&AC6*PSIE01
L13: &AC6.EQ.YETA01

L14: &AC7.EQ.YETA01*PSIE01

L15: &AC7.GT.0

L16: YETA01*PSIE01.GT.0

L17: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0
L18: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0
L19: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
    R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
    0).LT.0
L20: TFD7



L21: CFD6.EQV.CLANDFD
L22: CLANDFD

L23: CLANDFD.AND.TFD7

L2: CFD7.EQV.CLANDFD.AND.TFD7
*C2: CFD7
```

```
SUBST2(ξAC3,SRLMT(N(TP205-TP103),LIM180),
    X,ABS(X).LE.ABS(LIM180))

ABS9(003777777)
SUBST1(LIM180.003777777,X,ABS(ξAC3).LE.AB
    S(X))

SUBST1(ABS(003777777),003777777,X,ABS(ξAC
    3).LE.X)

ABS5(ξAC3,2**3)

ABS9(2**3)
SUBST1(ABS(2**3),2**3,X,ABS(ξAC3*2**3)=AB
    S(ξAC3)*X)

MLE1(ABS(ξAC3).003777777,2**3)

LELT2(ABS(ξAC3)*2**3,003777777*2**3,1.80)

SUBST2(ABS(ξAC3*2**3),ABS(ξAC3)*2**3,X,X,
    LT.1.80)

IR6(ξAC3*2**3)

***** O. E. D. *****
```

```
L7: ξAC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L25: ABS(SRLMT(N(TP205-TP103),LIM180)).LE
    .ABS(LIM180)
A1: 003777777.GE.0
L24: LIM180.EQ.003777777

L26: ABS(ξAC3).LE.ABS(LIM180)
L27: ABS(003777777).EQ.003777777

L28: ABS(ξAC3).LE.ABS(003777777)
NONE

A2: 2**3.GE.0
L31: ABS(2**3).EQ.2**3

L30: ABS(ξAC3*2**3).EQ.ABS(ξAC3)*ABS(2**3
    )
L29: ABS(ξAC3).LE.003777777
A3: 2**3.GT.0
L33: ABS(ξAC3)*2**3.LE.003777777*2**3

A4: 003777777*2**3.LT.1.80
L32: ABS(ξAC3*2**3).EQ.ABS(ξAC3)*2**3

L34: ABS(ξAC3)*2**3.LT.1.80
L35: ABS(ξAC3*2**3).LT.1.80
```

```
L26: ABS(ξAC3).LE.ABS(LIM180)

L27: ABS(003777777).EQ.003777777
L28: ABS(ξAC3).LE.ABS(003777777)

L29: ABS(ξAC3).LE.003777777

L30: ABS(ξAC3*2**3).EQ.ABS(ξAC3)*ABS(2**3
    )
L31: ABS(2**3).EQ.2**3
L32: ABS(ξAC3*2**3).EQ.ABS(ξAC3)*2**3

L33: ABS(ξAC3)*2**3.LE.003777777*2**3

L34: ABS(ξAC3)*2**3.LT.1.80

L35: ABS(ξAC3*2**3).LT.1.80

*C1: R(ξAC3*2**3)
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 24

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CFXIT0
H2: SPEC
H3: CFD6
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP103
H6: TP2.EQ.TP205
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP704
H12: LOCFD.EQ.LOCFD05
H13: LOCCC.EQ.LOCCC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TMRFLG.NE.0
H22: .NOT.CGRUZFD
H23: &AC1.EQ.TP2
H24: &AC2.EQ.N(&AC1-TP1)
H25: &MG1.EQ.1.1M180
H26: &AC3.EQ.SPL.F((&AC2,&MG1)
H27: &AC4.EQ.&AC3**2**3
H28: &AC5.EQ.-&AC4
H29: LOCSTR1.EQ.&AC5
H30: &AC6.EQ.YETA
H31: &MG2.EQ.MULTM(&AC6,PSIE)
H32: &AC7.EQ.MULT(&AC6,PSIE)
H33: &AC7.EQ.0
H34: &AC8.EQ.LOCSTR1
H35: &MG3.EQ.MULTM(&AC8,PSIE)
H36: &AC9.EQ.MULT(&AC8,PSIE)
H37: .NOT.(&AC9.LT.)
H38: &AC10.EQ.PSIE
H39: &AC11.EQ.ASS(&AC10)
H40: &AC12.EQ.N(&AC11-DEG20)
H41: .NOT.(&AC12.LT.0
H42: CAPTI.EQ.0
H43: &AC13.EQ.A0
H44: &AC14.EQ.N(&AC13-RLFD)
H45: &AC15.EQ.&AC14/2**2
H46: &AC16.EQ.&AC15/TAU3
H47: &MG4.EQ.DEG0
H48: &AC17.EQ.SELMT(&AC16,&MG4)
H49: &MG5.EQ.MULTM(&AC17,DELTAT)
H50: &AC18.EQ.MULT(&AC17,DELTAT)
H51: &AC19.EQ.N(&AC18+RLFD)
H52: RLFD1.EQ.&AC19
H53: &AC20.EQ.N(&AC19-RLL)
```

```
CONCLUSIONS
C1: R(&AC3*2**3)
C2: ABS(&AC15).LT.ABS(TAU3)
C3: CFD11
C4: START.EQ.START04
C5: LOCFD.EQ.LOCFD06
C6: TP1.EQ.TP104
C7: TP2.EQ.TP206
C8: TP7.EQ.TP705
C9: YETA.EQ.YETA02
C10: PSIE.EQ.PSIE02
C11: LOCSTR1.EQ.LOCSTR02
C12: CAPT1.EQ.CAPT04
C13: RLFD1.EQ.RLFD04
C14: RCMD1.EQ.RCMD01

THEOREMS USED
EQV1(A,B)=A.(A.EQV.B).IMP.B
SUBST1(P,Q,R,A(R))=P.EQ.Q,A(P).IMP.A(Q)
EQ4(P,Q,R)=P.EQ.Q,R.EQ.Q.IMP.P.EQ.R
EQ3(P,Q,R)=P.EQ.Q,Q.EQ.R.IMP.P.EQ.R
IF4(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
MULTEQ1(P,Q,R)=P.EQ.MULT(Q,R).IMP.P=Q*R
NOTEQGT1(P,Q)=P.EQ.Q.IMP..NOT.(P.GT.Q)
NOT6(A,B,C)=.NOT.A,.NOT.B,.NOT.C.IMP..NOT.(A.OR.B.OR.C)
EQV3(A,B)=(A.EQV.B),.NOT.B.IMP..NOT.A
AND4(A,B)=A.B.IMP.A.AND.B
EQV2(A,B)=B,(A.EQV.B).IMP.A
OR1(A,B)=A.IMP.A.OR.B
OR2(A,B)=B.IMP.A.OR.B
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
SRLMT5(P,Q)=ABS(SRLMT(P,Q)).LE.ABS(Q)
SUBST2(P,Q,R,A(R))=P.EQ.Q,A(Q).IMP.A(P)
ABS9(P)=P.GE.0.IMP.ABS(P).EQ.P
ABS5(P,Q)=ABS(P*Q)=ABS(P)*ABS(Q)
MLE1(P,Q,R)=P.LE.Q,R.GT.0.IMP.P*R.LE.Q*R
LELT2(P,Q,R)=P.LE.Q,Q.LT.R.IMP.P.LT.R
IR6(P)=ABS(P).LT.1.80.IMP.R(P)
ABS6(P,Q)=P.EQ.Q.IMP.ABS(P).EQ.ABS(Q)
NE7(P,Q)=P.EQ.0,ABS(Q).LT.1.80.IMP.ABS(N(P-Q))=ABS(Q)
ABS10(P,Q)=P.EQ.Q,Q.GE.0.IMP.ABS(P).EQ.Q
DLT1(P,Q,R)=P.LT.Q,R.GT.Q.IMP.P/R.LT.Q/R
ABS10(P,Q)=Q.NE.0.IMP.   )(P/Q).EQ.ABS(P)/ABS(Q)
IF3(I,J,K,A)=I=J.A.IMP..=(.IF.A.THEN.J.ELSE.K)

PROOF

THEOREMS                                HYPOTHESES                  CONCLUSIONS
MACEXP(CFD11)                           NONE                        L1: CFD11.EQV.CFD62.OR.CFD8.OR.CFD9.OR.CF
                                                                        D10
MACEXP(CEXIT1)                          NONE                        L2: CEXIT1.EQV.TMEFLG.EQ.0.OR.CCRUZFD.AND
                                                                        .GUID2D.EQ.0
MACEXP(CFD6)                            NONE                        L3: CFD6.EQV.CLANDFD
EQV1(CFD6,CLANDFD)                      H3: CFD6                    L4: CLANDFD
                                        L3: CFD6.EQV.CLANDFD
SUBST1(&AC1,TP2,X,&AC2=N(X-TP1))        H23: &AC1.EQ.TP2            L5: &AC2.EQ.N(TP2-TP1)
                                        H24: &AC2.EQ.N(&AC1-TP1)
SUBST1(TP1,TP103,X,&AC2=N(TP2-X))       H5: TP1.EQ.TP103            L6: &AC2.EQ.N(TP2-TP103)
                                        L5: &AC2.EQ.N(TP2-TP1)
SUBST1(TP2,TP205,X,&AC2=N(X-TP103))     H6: TP2.EQ.TP205            L7: &AC2.EQ.N(TP205-TP103)
                                        L6: &AC2.EQ.N(TP2-TP103)
SUBST1(&M01,LIM180,X,&AC3=SRLMT(&AC2,X))  H25: &M01.EQ.LIM180       L8: &AC3.EQ.SRLMT(&AC2,LIM180)
                                        [illegible]
```

```
SUBST1(&AC4,&AC3*2**3,X,&AC5=-X)

SUBST1(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,&AC5=-(X*2**3))

MACEXP(LOCSTR01)

EQ4(&AC5,-(SRLMT(N(TP205-TP103),LIM180)*2
    **3),LOCSTR01)


FQ3(LOCSTR1,&AC5,LOCSTR01)

MACEXP(LOCSTR02)

IF4(LOCSTR1,LOCSTR,LOCSTR01,CCRUZFD)


EQ4(LOCSTR1,.IF.CCRUZFD.THEN.LOCSTR.ELSE.
    LOCSTR01,LOCSTR02)


MULTEQ1(&AC7,&AC6,PSIE)
EQ3(&AC6,YETA,YETA01)

SUBST1(&AC6,YETA01,X,&AC7,EQ,X*PSIE)

SUBST1(PSIE,PSIE01,X,&AC7=YETA01*X)

SUBST1(&AC7,YETA01*PSIE01,X,X,EQ,0)

NOTEQGT1(YETA01*PSIE01,0)
MULTEQ1(&AC9,&AC8,PSIE)
EQ3(&AC8,LOCSTR1,LOCSTR01)

SUBST1(&AC8,LOCSTR01,X,&AC9=X*PSIE)

SUBST1(PSIE,PSIE01,X,&AC9=LOCSTR01*X)

SUBST1(&AC9,LOCSTR01*PSIE01,X,.NOT.X.LT.0
    )

EQ3(&AC10,PSIE,PSIE01)

EQ3(&AC8,LOCSTR1,LOCSTR01)

SUBST1(&AC10,PSIE01,X,&AC11=ABS(X))

SUBST1(&AC11,ABS(PSIE01),X,&AC12=N(X-DEG2
    0))

SUBST1(&AC12,N(ABS(PSIE01)-DEG20),X,.NOT.
    X.LT.0)

NOT6(YETA01*PSIE01.GT.0.LOCSTR01*PSIE01.L
    T.0.N(ABS(PSIE01)-DEG20).LT.0)



MACEXP(TFD7)


EQV(TFD7,YETA01*PSIE01.GT.0.OR.LOCSTR01*
```

```
L8: &AC3.EQ.SRLMT(&AC2,LIM180)
H27: &AC4.EQ.&AC3*2**3
H28: &AC5.EQ.-&AC4
L9: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L10: &AC5.EQ.-(&AC3*2**3)
NONE

L11: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM18
    0)*2**3)
L12: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),L
    IM180)*2**3)
H29: LOCSTR1.EQ.&AC5
L13: &AC5.EQ.LOCSTR01
NONE

L14: LOCSTR1.EQ.LOCSTR01

H22: .NOT.CCRUZFD
L16: LOCSTR1.EQ..IF.CCRUZFD.THEN.LOCSTR.E
    LSE.LOCSTR01
L15: LOCSTR02.EQ..IF.CCRUZFD.THEN.LOCSTR.
    ELSE.LOCSTR01
H32: &AC7.EQ.MULT(&AC6,PSIE)
H30: &AC6.EQ.YETA
H17: YETA.EQ.YETA01
L18: &AC6.EQ.YETA01
L17: &AC7.EQ.&AC6*PSIE
H18: PSIE.EQ.PSIE01
L19: &AC7.EQ.YETA01*PSIE
L20: &AC7.EQ.YETA01*PSIE01
H33: &AC7.EQ.0
L21: YETA01*PSIE01.EQ.0
H36: &AC9.EQ.MULT(&AC8,PSIE)
H34: &AC8.EQ.LOCSTR1
L14: LOCSTR1.EQ.LOCSTR01
L24: &AC8.EQ.LOCSTR01
L23: &AC9.EQ.&AC8*PSIE
H18: PSIE.EQ.PSIE01
L25: &AC9.EQ.LOCSTR01*PSIE
L26: &AC9.EQ.LOCSTR01*PSIE01

H37: .NOT.&AC9.LT.0
H38: &AC10.EQ.PSIE
H18: PSIE.EQ.PSIE01
H34: &AC8.EQ.LOCSTR1
L14: LOCSTR1.EQ.LOCSTR01
L28: &AC10.EQ.PSIE01
H39: &AC11.EQ.ABS(&AC10)
L29: &AC11.EQ.ABS(PSIE01)

H40: &AC12.EQ.N(&AC11-DEG20)
L30: &AC12.EQ.N(ABS(PSIE01)-DEG20)

H41: .NOT.&AC12.LT.0
L22: .NOT.YETA01*PSIE01.GT.0

L27: .NOT.LOCSTR01*PSIE01.LT.0
L31: .NOT.N(ABS(PSIE01)-DEG20).LT.0
NONE

L32: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
```

```
L10: &AC5.EQ.-(&AC3*2**3)

L11: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM18
    0)*2**3)

L12: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),L
    IM180)*2**3)
L13: &AC5.EQ.LOCSTR01


L14: LOCSTR1.EQ.LOCSTR01

L15: LOCSTR02.EQ..IF.CCRUZFD.THEN.LOCSTR.
    ELSE.LOCSTR01
L16: LOCSTR1.EQ..IF.CCRUZFD.THEN..OCSTR.E
    LSE.LOCSTR01

*C11: LOCSTR1.EQ.LOCSTR02


L17: &AC7.EQ.&AC6*PSIE
L18: &AC6.EQ.YETA01

L19: &AC7.EQ.YETA01*PSIE

L20: &AC7.EQ.YETA01*PSIE01

L21: YETA01*PSIE01.EQ.0

L22: .NOT.YETA01*PSIE01.GT.0
L23: &AC9.EQ.&AC8*PSIE
L24: &AC8.EQ.LOCSTR01

L25: &AC9.EQ.LOCSTR01*PSIE

L26: &AC9.EQ.LOCSTR01*PSIE01

L27: .NOT.LOCSTR01*PSIE01.LT.0


L28: &AC10.EQ.PSIE01

L24: &AC8.EQ.LOCSTR01

L29: &AC11.EQ.ABS(PSIE01)

L30: &AC12.EQ.N(ABS(PSIE01)-DEG20)


L31: .NOT.N(ABS(PSIE01)-DEG20).LT.0


L32: .NOT.(YETA01*PSIE01.GT.0.OR.LOCSTR01
    *PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).
    LT.0)


L33: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
    R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
    0).LT.0
```

```
MACEXP(CFD62)
MACEXP(CFD7)
AND4(CLANDFD,.NOT.TFD7)

EQV2(CFD62,CLANDFD.AND..NOT.TFD7)

MACEXP(CFDIN1)
MACEXP(CEXIT0)
OR1(CFD62,CFD8)
OR1(CFD62.OR.CFD8,CFD9)
OR1(CFD62.OR.CFD8.OR.CFD9,CFD10)
EQV2(CFD11,CFD62.OR.CFD8.OR.CFD9.OR.CFD10
    )


MACEXP(CAPT03)
OR2(.NOT.CLANDFD,.NOT.TFD7)
NOT3(CLANDFD,TFD7)
EQV3(CFD7,CLANDFD.AND.TFD7)

IF4(CAPT1,SET.0,CFD7)

EQ4(CAPT1,.IF.CFD7.THEN.SET.ELSE.0,CAPT03
    )

MACEXP(CAPT04)

IF4(CAPT1,CAPT,CAPT03,CCRUZFD)


EQ4(CAPT1,.IF.CCRUZFD.THEN.CAPT.ELSE.CAPT
    03,CAPT04)


HYPEXP(SPEC,LIM180=003777777)
SRLMTS(N(TP205-TP103),LIM180)

SUBST2(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,ABS(X).LE.ABS(LIM180))


SUBST1(LIM180,003777777,X,ABS(&AC3).LE.AB
    S(X))

ABS9(003777777)
SUBST1(ABS(003777777),003777777,X,ABS(&AC
    3).LE.X)

ABS5(&AC3,2**3)

ABS9(2**3)
SUBST1(ABS(2**3),2**3,X,ABS(&AC3*2**3).EQ
    .ABS(&AC3)*X)


MLE1(ABS(&AC3),003777777,2**3)

SUBST1(003777777*2**3,1.80,X,ABS(&AC3)*2*
    *3.LE.X)

SUBST1(ABS(&AC3)**2**3,003777777*2**3,1.80)
```

```
L32: .NOT.(YETA01*PSIE01.GT.0.OR.LOCSTR01
    *PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).
    LT.0)
NONE
NONE
L4: CLANDFD
L34: .NOT.TFD7
L37: CLANDFD.AND..NOT.TFD7
L35: CFD62.EQV.CLANDFD.AND..NOT.TFD7
NONE
NONE
L38: CFD62
L41: CFD62.OR.CFD8
L42: CFD62.OR.CFD8.OR.CFD9
L43: CFD62.OR.CFD8.OR.CFD9.OR.CFD10

L1: CFD11.EQV.CFD62.OR.CFD8.OR.CFD9.OR.CF
    D10
NONE
L34: .NOT.TFD7
L45: .NOT.CLANDFD.OR..NOT.TFD7
L36: CFD7.EQV.CLANDFD.AND.TFD7
L46: .NOT.(CLANDFD.AND.TFD7)
H42: CAPT1.EQ.0
L47: .NOT.CFD7
L48: CAPT1.EQ..IF.CFD7.THEN.SET.ELSE.0

L44: CAPT03.EQ..IF.CFD7.THEN.SET.ELSE.0
NONE

L49: CAPT1.EQ.CAPT03


H22: .NOT.CCRUZFD
L51: CAPT1.EQ..IF.CCRUZFD.THEN.CAPT.ELSE.
    CAPT03
L50: CAPT04.EQ..IF.CCRUZFD.THEN.CAPT.ELSE
    .CAPT03
NONE
NONE

L9: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L53: ABS(SRLMT(N(TP205-TP103),LIM180)).LE
    .ABS(LIM180)
L52: LIM180.EQ.003777777

L54: ABS(&AC3).LE.ABS(LIM180)
A1: 003777777.GE.0
L56: ABS(003777777).EQ.003777777

L55: ABS(&AC3).LE.ABS(003777777)
NONE

A2: 2**3.GE.0
L59: ABS(2**3).EQ.2**3

L58: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L57: ABS(&AC3).LE.003777777
A3: 2**3.GT.0
A4: 003777777*2**3.EQ.1.80

L61: ABS(&AC3)*2**3.LE.003777777*2**3
L61: ABS(&AC3)*2**3.LE.003777777*2**3
```

```
L35: CFD62.EQV.CLANDFD.AND..NOT.TFD7
L36: CFD7.EQV.CLANDFD.AND.TFD7
L37: CLANDFD.AND..NOT.TFD7

L38: CFD62

L39: CFDIN1.EQV.TMEFLG.NE.0.AND.TICRUZFD
L40: CEXIT0.EQV.CVCRUZ.AND.TEXIT0
L41: CFD62.OR.CFD8
L42: CFD62.OR.CFD8.OR.CFD9
L43: CFD62.OR.CFD8.OR.CFD9.OR.CFD10
*C3: CFD11


L44: CAPT03.EQ..IF.CFD7.THEN.SET.ELSE.0
L45: .NOT.CLANDFD.OR..NOT.TFD7
L46: .NOT.(CLANDFD.AND.TFD7)
L47: .NOT.CFD7

L48: CAPT1.EQ..IF.CFD7.THEN.SET.ELSE.0

L49: CAPT1.EQ.CAPT03


L50: CAPT04.EQ..IF.CCRUZFD.THEN.CAPT.ELSE
    .CAPT03
L51: CAPT1.EQ..IF.CCRUZFD.THEN.CAPT.ELSE.
    CAPT03

*C12: CAPT1.EQ.CAPT04


L52: LIM180.EQ.003777777
L53: ABS(SRLMT(N(TP205-TP103),LIM180)).LE
    .ABS(LIM180)
L54: ABS(&AC3).LE.ABS(LIM180)


L55: ABS(&AC3).LE.ABS(003777777)


L56: ABS(003777777).EQ.003777777
L57: ABS(&AC3).LE.003777777


L58: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L59: ABS(2**3).EQ.2**3
L60: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3


L61: ABS(&AC3)*2**3.LE.003777777*2**3

L62: ABS(&AC3)*2**3.LE.1.80
```

```
SUBST2(ABS(&AC3*2**3),ABS(&AC3)*2**3,X,X.
    LT.1.B0)

IR6(&AC3*2**3)
HYPEXP(SPEC,TAU3=1.B2)
ABS6(&AC14,N(&AC13-RLFD))
HYPEXP(SPEC,A0=0)
EQ3(&AC13,A0,0)

HYPEXP(SPEC,ABS(RLFD).LT.1.B0)
NF7(&AC13,RLFD)

ABS19(TAU3,1.B2)

EQ3(ABS(&AC14),ABS(N(&AC13-RLFD)),ABS(RLF
    D))

SUBST2(ABS(&AC14),ABS(RLFD),X,X.LT.1.B0)

DLT1(ABS(&AC14),1.B0,2**2)

ABS9(2**2)
SUBST2(ABS(2**2),2**2,X,ABS(&AC14)/X.LT.1
    .B0/2**2)

ABS10(&AC14,2**2)

SUBST2(&AC15,&AC14/2**2,X,ABS(X)=ABS(&AC1
    4)/ABS(2**2))


SUBST2(ABS(&AC15),ABS(&AC14)/ABS(2**2),X,
    X.LT.1.B0/2**2)

SUBST1(1.B0/2**2,1.B2,X,ABS(&AC15).LT.X)

SUBST1(1.B2,ABS(TAU3),X,ABS(&AC15).LT.X)

MACEXP(START04)

IF4(START,0,START03,CFDIN1)


EQ4(START,.IF.CFDIN1.THEN.0.ELSE.START03,
    START04)


MACEXP(LOCFD06)

IF3(LOCFD,LOCFD05,LOCFD03,CLANDFD)


IF4(LOCFD,0,.IF.CLANDFD.THEN.LOCFD05.ELSE
    .LOCFD03,CFDIN1)

EQ4(LOCFD,.IF.CFDIN1.THEN.0.ELSE..IF.CLAN
    DFD.THEN.LOCFD05.ELSE.LOCFD03,LOCFD06


MACEXP(TP104)

IF4(TP1,TP102,TP103,CCRUZFD)
```

```
L60: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3

L63: ABS(&AC3)*2**3.LT.1.B0
L64: ABS(&AC3*2**3).LT.1.B0
NONE
H44: &AC14.EQ.N(&AC13-RLFD)
NONE
H43: &AC13.EQ.A0
L67: A0.EQ.0
NONE
L68: &AC13.EQ.0
L69: ABS(RLFD).LT.1.B0
L65: TAU3.EQ.1.B2
A6: 1.B2.GE.0
L66: ABS(&AC14).EQ.ABS(N(&AC13-RLFD))

L70: ABS(N(&AC13-RLFD)).EQ.ABS(RLFD)
L72: ABS(&AC14).EQ.ABS(RLFD)
L69: ABS(RLFD).LT.1.B0
L73: ABS(&AC14).LT.1.B0
A7: 2**2.GT.0
A8: 2**2.GE.0
L75: ABS(2**2).EQ.2**2

L74: ABS(&AC14)/2**2.LT.1.B0/2**2
A9: 2**2.NE.0

H45: &AC15.EQ.&AC14/2**2

L77: ABS(&AC14/2**2).EQ.ABS(&AC14)/ABS(2*
    *2)
L78: ABS(&AC15).EQ.ABS(&AC14)/ABS(2**2).

L76: ABS(&AC14)/ABS(2**2).LT.1.B0/2**2
A10: 1.B0/2**2.EQ.1.B2
L79: ABS(&AC15).LT.1.B0/2**2
L71: ABS(TAU3).EQ.1.B2
L80: ABS(&AC15).LT.1.B2
NONE

H15: START.EQ.START03

H20: .NOT.CFDIN1
L82: START.EQ..IF.CFDIN1.THEN.0.ELSE.STAR
    T03
L81: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
NONE

H12: LOCFD.EQ.LOCFD05

L4: CLANDFD
L84: LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
    SE.LOCFD03
H20: .NOT.CFDIN1
L85: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
    CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L83: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
    F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
NONE

H5: TP1.EQ.TP103
```

```
L64: ABS(&AC3*2**3).LT.1.B0


*C1: R(&AC3*2**3)
L65: TAU3.EQ.1.B2
L66: ABS(&AC14).EQ.ABS(N(&AC13-RLFD))
L67: A0.EQ.0
L68: &AC13.EQ.0

L69: ABS(RLFD).LT.1.B0
L70: ABS(N(&AC13-RLFD)).EQ.ABS(RLFD)

L71: ABS(TAU3).EQ.1.B2

L72: ABS(&AC14).EQ.ABS(RLFD)


L73: ABS(&AC14).LT.1.B0

L74: ABS(&AC14)/2**2.LT.1.B0/2**2

L75: ABS(2**2).EQ.2**2
L76: ABS(&AC14)/ABS(2**2).LT.1.B0/2**2


L77: ABS(&AC14/2**2).EQ.ABS(&AC14)/ABS(2*
    *2)
L78: ABS(&AC15).EQ.ABS(&AC14)/ABS(2**2)


L79: ABS(&AC15).LT.1.B0/2**2


L80: ABS(&AC15).LT.1.B2

*C2: ABS(&AC15).LT.ABS(TAU3)

L81: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
    ART03
L82: START.EQ..IF.CFDIN1.THEN.0.ELSE.STAR
    T03

*C4: START.EQ.START04


L83: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
    F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L84: LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
    SE.LOCFD03

L85: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
    CLANDFD.THEN.LOCFD05.ELSE.LOCFD03

*C5: LOCFD.EQ.LOCFD06


L86: TP104.EQ..IF.CCRUZFD.THEN.TP102.ELSE
    .TP103
L87: TP1.EQ..IF.CCRUZFD.THEN.TP102.ELSE.T
    P103
```

```
                                        L86: TP104.EQ..IF.CCRUZFD.THEN.TP102.ELSE
                                             .TP103
MACEXP(TP206)                           NONE                                    L88: TP206.EQ..IF.CCRUZFD.THEN.TP202.ELSE
                                                                                     .TP205
IF4(TP2,TP202,TP205,CCRUZFD)            H6: TP2.EQ.TP205                        L89: TP2.EQ..IF.CCRUZFD.THEN.TP202.ELSE.T
                                                                                     P205
                                        H22: .NOT.CCRUZFD
EQ4(TP2,.IF.CCRUZFD.THEN.TP202.ELSE.TP205 L89: TP2.EQ..IF.CCRUZFD.THEN.TP202.ELSE.T *C7: TP2.EQ.TP205
     .TP206)                                 P205
                                        L88: TP206.EQ..IF.CCRUZFD.THEN.TP202.ELSE
                                             .TP205
MACEXP(TP705)                           NONE                                    L90: TP705.EQ..IF.CCRUZFD.THEN.TP702.ELSE
                                                                                     .TP704
IF4(TP7,TP702,TP704,CCRUZFD)            H11: TP7.EQ.TP704                       L91: TP7.EQ..IF.CCRUZFD.THEN.TP702.ELSE.T
                                                                                     P704
                                        H22: .NOT.CCRUZFD
EQ4(TP7,.IF.CCRUZFD.THEN.TP702.ELSE.TP704 L91: TP7.EQ..IF.CCRUZFD.THEN.TP702.ELSE.T *C8: TP7.EQ.TP705
     .TP705)                                 P704
                                        L90: TP705.EQ..IF.CCRUZFD.THEN.TP702.ELSE
                                             .TP704
MACEXP(YETA02)                          NONE                                    L92: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
                                                                                     YETA01
IF4(YETA,YETA,YETA01,CFDIN1)            H17: YETA.EQ.YETA01                     L93: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
                                                                                     TA01
                                        H20: .NOT.CFDIN1
EQ4(YETA..IF.CFDIN1.THEN.YETA.ELSE.YETA01 L93: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE *C9: YETA.EQ.YETA02
     .YETA02)                                TA01
                                        L92: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
                                             YETA01
MACEXP(PSIE02)                          NONE                                    L94: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
                                                                                     PSIE01
IF4(PSIE,PSIE,PSIE01,CFDIN1)            H18: PSIE.EQ.PSIE01                     L95: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
                                                                                     IE01
                                        H20: .NOT.CFDIN1
EQ4(PSIE..IF.CFDIN1.THEN.PSIE.ELSE.PSIE01 L95: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS *C10: PSIE.EQ.PSIE02
     .PSIE02)                                IE01
                                        L94: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
                                             PSIE01
MACEXP(RLFD04)                          NONE                                    L96: RLFD04.EQ.N(SRLMT(N(AC02-RLFD02)/2**
                                                                                     2/TAU3,DEG4)*DELTAT+RLFD02)
MACEXP(AC02)                            NONE                                    L97: AC02.EQ..IF.CFD62.THEN.A0.ELSE..IF.C
                                                                                     FD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.S
                                                                                     RLMT(AC01,DEG25)
IF3(&AC13,A0,..IF.CFD8.THEN.SRLMT(LOCSTR01 H43: &AC13.EQ.A0                     L98: &AC13.EQ..IF.CFD62.THEN.A0.ELSE..IF.
     .DEG15).ELSE.SRLMT(AC01,DEG25),CFD62)                                           CFD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.
                                                                                     SRLMT(AC01,DEG25)
                                        L38: CFD62
EQ4(&AC13,..IF.CFD62.THEN.A0.ELSE..IF.CFD8 L98: &AC13.EQ..IF.CFD62.THEN.A0.ELSE..IF. L99: &AC13.EQ.AC02
     .THEN.SRLMT(LOCSTR01,DEG15).ELSE.SRLM      CFD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.
     T(AC01,DEG25),AC02)                        SRLMT(AC01,DEG25)
                                        L97: AC02.EQ..IF.CFD62.THEN.A0.ELSE..IF.C
                                             FD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.S
                                             RLMT(AC01,DEG25)
SUBST1(&AC13,AC02,X,&AC14=N(X-RLFD))    L99: &AC13.EQ.AC02                      L100: &AC14.EQ.N(AC02-RLFD)
                                        H44: &AC14.EQ.N(&AC13-RLFD)
SUBST1(RLFD,RLFD02,X,&AC14=N(AC02-X))   H16: RLFD.EQ.RLFD02                      L101: &AC14.EQ.N(AC02-RLFD02)
                                        L100: &AC14.EQ.N(AC02-RLFD)
SUBST1(&AC15,&AC14/2**2,X,&AC16.EQ.X/TAU3 H45: &AC15.EQ.&AC14/2**2               L102: &AC16.EQ.&AC14/2**2/TAU3
     )
                                        H46: &AC16.EQ.&AC15/TAU3
SUBST1(&AC14,N(AC02-RLFD02),X,&AC16=X/2** L101: &AC14.EQ.N(AC02-RLFD02)          L103: &AC16.EQ.N(AC02-RLFD02)/2**2/TAU3
     2/TAU3)
                                        L102: &AC16.EQ.&AC14/2**2/TAU3
SUBST2(&AC1...N(AC02-RLFD02)/2**2/TA)*,X,...                                     ...
```

```
SUBST1(&M04,DEG4,X,&AC17=EQ=SRLMT(&AC16,X
    ))

MULTEQ1(&AC18,&AC17,DELTAT)
SUBST1(&AC17,SRLMT(&AC16,DEG4),X,&AC18=X*
    DELTAT)

SUBST2(&AC18,SRLMT(&AC16,DEG4)*DELTAT,X,R
    LFD04=N(X+RLFD02))


EQ3(RLFD1,&AC19,N(&AC18+RLFD))

SUBST1(RLFD,RLFD02,X,RLFD1=EQ=N(&AC18+X))


EQ4(RLFD1,N(&AC18+RLFD02),RLFD04)

***** O. E. D. *****
```

```
          2/TAU3,DEG4)*DELTAT+RLFD02)
H47:  &M04=EQ=DEG4

H48:  &AC17=EQ=SRLMT(&AC16,&M04)
H50:  &AC18=EQ=MULT(&AC17,DELTAT)
L105: &AC17=EQ=SRLMT(&AC16,DEG4)

L106: &AC18=EQ=&AC17*DELTAT
L107: &AC18=EQ=SRLMT(&AC16,DEG4)*DELTAT

L104: RLFD04=EQ=N(SRLMT(&AC16,DEG4)*DELTA
    T+RLFD02)
H52:  RLFD1=EQ=&AC19
H51:  &AC19=EQ=N(&AC18+RLFD)
H16:  RLFD=EQ=RLFD02

L109: RLFD1=EQ=N(&AC18+RLFD)
L110: RLFD1=EQ=N(&AC18+RLFD02)
```

```
L105: &AC17=EQ=SRLMT(&AC16,DEG4)


L106: &AC18=EQ=&AC17*DELTAT
L107: &AC18=EQ=SRLMT(&AC16,DEG4)*DELTAT

L108: RLFD04=EQ=N(&AC18+RLFD02)


L109: RLFD1=EQ=N(&AC18+RLFD)

L110: RLFD1=EQ=N(&AC18+RLFD02)


*C13: RLFD1=EQ=RLFD04
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 25

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CFD6
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP103
H6: TP2.EQ.TP205
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP704
H12: LOCFD.EQ.LLCFD05
H13: LOCOC.EQ.LOCOC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TMEFLG.NE.0
H22: .NOT.CCRUZFD
H23: &AC1.EQ.TP2
H24: &AC2.EQ.N(&AC1-TP1)
H25: &M01.EQ.LIM180
H26: &AC3.EQ.SRLMT(&AC2,&M01)
H27: &AC4.EQ.&AC3*2**3
H28: &AC5.EQ.-&AC4
H29: LOCSTR1.EQ.&AC5
H30: &AC6.EQ.YETA
H31: &M02.EQ.MULTM(&AC6,PSIC)
H32: &AC7.EQ.MULT(&AC6,PSIE)
H33: &AC7.EQ.0
H34: &AC8.EQ.LLCSTR1
H35: &M03.EQ.MULTM(&AC8,PSIE)
H36: &AC9.EQ.MULT(&AC8,PSIE)
H37: .NOT.&AC9.LT.0
H38: &AC10.EQ.PSIE
H39: &AC11.EQ.ABS(&AC10)
H40: &AC12.EQ.N(&AC11-DEG20)
H41: &AC12.LT.0

CONCLUSIONS
C1: R(&AC3*2**3)
C2: CFD7
C3: LOCSTR1.EQ.LOCSTR01

THEOREMS USED
EQ3(P,Q,R)=P.EQ.Q,Q.EQ.R.IMP.P.EQ.R
SUBST1(P,Q,R,A(R))=P.EQ.Q.A(P).IMP.A(Q)
EQ4(P,Q,R)=P.EQ.Q,R.EQ.Q.IMP.P.EQ.R
OR2(A,B)=B.IMP.A.OR.B
EQV2(A,B)=B.(A.EQV.B).IMP.A
EQV1(A,B)=A.(A.EQV.B).IMP.
```

```
SUBST2(P,Q,R,A(R))=P.EQ.Q.A(Q).IMP.A(P)
ABS1(P)=P.GE.0.IMP.ABS(P).EQ.P
ABS2(P,Q)=ABS(P*Q)=ABS(P)*ABS(Q)
MLE1(P,Q,R)=P.LE.0.R.GT.0.IMP.P*R.LE.Q*R
LELT2(P,Q,R)=P.LE.Q.Q.LT.R.IMP.P.LT.R
IR6(P)=ABS(P).LT.1.80.IMP.R(P)

PROOF

THEOREMS
MACEXP(LOCSTR01)

MACEXP(CFD7)
EQ3(&AC1,TP2,TP205)

SUBST1(&AC1,TP205,X,&AC2=N(X-TP1))

SUBST1(TP1,TP103,X,&AC2=N(TP205-X))

SUBST1(&MQ1,LIM180,X,&AC3=SRLMT(&AC2,X))

SUBST1(&AC2=N(TP205-TP103),X,&AC3=SRLMT(X
    ,LIM180))

SUBST1(&AC4,&AC3*2**3,X,&AC5=-X)

SUBST1(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,&AC5=-(X**2**3))

EQ4(&AC5,-(SRLMT(N(TP205-TP103),LIM180)*2
    **3),LOCSTR01)


EQ3(LOCSTR1,&AC5,LOCSTR01)

EQ3(&AC10,PSIE,PSIE01)

SUBST1(&AC10,PSIE01,X,&AC11=ABS(X))

SUBST1(&AC11,ABS(PSIE01),X,&AC12=N(X-DEG2
    0))

SUBST1(&AC12,N(ABS(PSIE01)-DEG20),X,X,LT.
    0)

OR2(YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01
    .LT.0,N(ABS(PSIE01)-DEG20).LT.0)
MACEXP(TFD7)


EQV2(TFD7,YETA01*PSIE01.GT.0.OR.LOCSTR01*
    PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).L
    T.0)



MACEXP(CFD6)
EQV1(CFD6,CLANDFD)

AND4(CLANDFD,TFD7)

EQV2(CFD7,CLANDFD.AND.TFD7)

HYPOTHESES
NONE

NONE
H23: &AC1.EQ.TP2
H6: TP2.EQ.TP205
L3: &AC1.EQ.TP205
H24: &AC2.EQ.N(&AC1-TP1)
H5: TP1.EQ.TP103
L4: &AC2.EQ.N(TP205-TP1)
H25: &MQ1.EQ.LIM180
H26: &AC3.EQ.SRLMT(&AC2,&MQ1)
L5: &AC2.EQ.N(TP205-TP103)

L6: &AC3.EQ.SRLMT(&AC2,LIM180)
H27: &AC4.EQ.&AC3*2**3
H28: &AC5.EQ.-&AC4
L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L8: &AC5.EQ.-(&AC3*2**3)
L9: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM180
    )*2**3)
L10: &AC5.EQ.LOCSTR01
H29: LOCSTR1.EQ.&AC5
L10: &AC5.EQ.LOCSTR01
H38: &AC10.EQ.PSIE
H18: PSIE.EQ.PSIE01
L11: &AC10.EQ.PSIE01
H39: &AC11.EQ.ABS(&AC10)
L12: &AC11.EQ.ABS(PSIE01)

H40: &AC12.EQ.N(&AC11-DEG20)
L13: &AC12.EQ.N(ABS(PSIE01)-DEG20)

H41: &AC12.LT.0
L14: N(ABS(PSIE01)-DEG20).LT.0

NONE


L15: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0

L16: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
    R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
    0).LT.0
NONE
H3: CFD6
L18: CFD6.EQV.CLANDFD
L19: CLANDFD
L17: TFD7
L20: CLANDFD.AND.TFD7
L2: CFD7.EQV.CLANDFD.AND.TFD7

CONCLUSIONS
L1: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),LI
    M180)*2**3)
L2: CFD7.EQV.CLANDFD.AND.TFD7
L3: &AC1.EQ.TP205

L4: &AC2.EQ.N(TP205-TP1)

L5: &AC2.EQ.N(TP205-TP103)

L6: &AC3.EQ.SRLMT(&AC2,LIM180)

L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)


L8: &AC5.EQ.-(&AC3*2**3)

L9: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM180
    )*2**3)

L10: &AC5.EQ.LOCSTR01


*C3: LOCSTR1.EQ.LOCSTR01

L11: &AC10.EQ.PSIE01

L12: &AC11.EQ.ABS(PSIE01)

L13: &AC12.EQ.N(ABS(PSIE01)-DEG20)


L14: N(ABS(PSIE01)-DEG20).LT.0


L15: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
    1.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0
L16: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
    R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
    0).LT.0
L17: TFD7



L18: CFD6.EQV.CLANDFD
L19: CLANDFD

L20: CLANDFD.AND.TFD7

*C2: CFD7
```

```
SUBST2(&AC3,SRLMT(N(TP20S-TP103),LIM180),
    X,ABS(X).LE.ABS(LIM180))


ABS9(003777777)
SUBST1(LIM180,003777777,X,ABS(&AC3).LE.AB
    S(X))

SUBST1(ABS(003777777),003777777,X,ABS(&AC
    3).LE.X)

ABS5(&AC3,2**3)

ABS9(2**3)
SUBST1(ABS(2**3),2**3,X,ABS(&AC3*2**3)=AB
    S(&AC3)*X)


MLE1(ABS(&AC3),003777777,2**3)

LELT2(ABS(&AC3)*2**3,003777777*2**3,1.80)


SUBST2(ABS(&AC3*2**3),ABS(&AC3)*2**3,X,X.
    LT.1.80)

IR6(&AC3*2**3)

***** U. E. D. *****
```

```
L7: &AC3.EQ.SRLMT(N(TP20S-TP103),LIM180)

L22: ABS(SRLMT(N(TP20S-TP103),LIM180)).LE
    .ABS(LIM180)
A1: 003777777.GE.0
L21: LIM180.EQ.003777777

L23: ABS(&AC3).LE.ABS(LIM180)
L24: ABS(003777777).EQ.003777777

L25: ABS(&AC3).LE.ABS(003777777)
NONE

A2: 2**3.GE.0
L28: ABS(2**3).EQ.2**3

L27: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L26: ABS(&AC3).LE.003777777
A3: 2**3.GT.0
L30: ABS(&AC3)*2**3.LE.003777777*2**3

A4: 003777777*2**3.LT.1.80
L29: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3

L31: ABS(&AC3)*2**3.LT.1.80
L32: ABS(&AC3*2**3).LT.1.80
```

```
L23: ABS(&AC3).LE.ABS(LIM180)


L24: ABS(003777777).EQ.003777777
L25: ABS(&AC3).LE.ABS(003777777)


L26: ABS(&AC3).LE.003777777

L27: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L28: ABS(2**3).EQ.2**3
L29: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3


L30: ABS(&AC3)*2**3.LE.003777777*2**3

L31: ABS(&AC3)*2**3.LT.1.80

L32: ABS(&AC3*2**3).LT.1.80

*C1: R(&AC3*2**3)
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE'S CONTROL PATH ***

DERIVATION OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CENTER
H2: SPEC
H3: CEND
H4: ABILS.EQ.ABIL501
H5: TP1.EQ.TP103
H6: TP2.EQ.TP255
H7: TP3.EQ.TP402
H8: TP4.EQ.TP403
H9: TP5.EQ.TP512
H10: TP6.EQ.TP602
H11: TP7.EQ.TP704
H12: LOCD.EQ.LOCD025
H13: LOCC.EQ.LOC504
H14: FLAG.EQ.FLA502
H15: STAT.EQ.STA703
H16: RET.EQ.RET00
H17: BETA.EQ.BETA01
H18: PSIE.EQ.PSIE01
H19: GAMA.EQ.GAMA03
H20: ANGT.EQ.ANG1
H21: TAILG.EQ.0
H22: ANG1.EQ.ANG2
H23: EXIT.EQ.0
H24: BAC3.EQ.BAC1-TP1
H25: BAC1.EQ.LIM100
H26: BAC3.EQ.MULT(BAC2,BAC3)
H27: BAC4.EQ.ADD(BAC2,BAC3)
H28: BAC5.EQ.BAC4
H29: LOCETR1.EQ.BAC5
H30: BAC6.EQ.BETA
H31: BAC7.EQ.MULT(BAC6,PSIE)
H32: BAC7.EQ.MULT(BAC6,PSIE)
H33: BAC7.EQ.0
H34: BAC7.EQ.LOCETR1
H35: BAC8.EQ.MULT(BAC6,PSIE)
H36: BAC9.EQ.MULT(BAC8,PSIE)
H37: BAC9.LT.0

CONCLUSIONS
C1: -(BAL3<=3)
C2: EXIT
C3: LOCETR1.EQ.LOCETR01

THEORIES USED
LOG(A,B)=B.LT.0.AND.A.EQ.B.LT.0
SUBTR(A,B)=A(B)=B.EQ.0.A(B).IMP.A(0)
EQ50(A,B)=B.EQ.0.A.EQ.B.IMP.B.EQ.A
MULT(A,B)=B.EQ.0.MULT(A,B).IMP.B=0*R
DIV1(A,B)=B.EQ.0.A.NE.0.B
DIV2(A,B)=B.EQ.0.(A/B).IMP.A
EQV1(A,B)=A.EQ.(A/B).IMP.B
ANDR(A,B)=A.EQ.B.AND.B
```

```
ABS(P,Q)=ABS(P#Q)=ABS(P)#ABS(Q)
MLEI(P,Q,R)=P#L#Q.GT.0.AND.P#R.LE.0#R
LELT(P,Q,R)=Q.LE.0.AND.Q.LT.P#R.LT.P
IRR(P)=AND(P).LT.1.0.IMP. (P)
NOT4(A)=A.EQV.(.NOT.(.NOT.A)
NOTOR2(A,B)=(.NOT.(A.OR.B).IMP.(.NOT.A.AND.B)
NOTAND(A,B)=(.NOT.A.OR..NOT.B).EQV..NOT.(A.AND.B)
EQV3(A,B)=(A.EQV.B).AND.B.OR..NOT.A.AND..NOT.B
NOTZ(A,B)=(.NOT.A).NOT.B.IMP.NOT.(A.OR.B)
IFA(I,J,K,A)=I.EQ.0.AND.A.IMP.I=(.IF.A.THEN.J.ELSE.K)

FROM
```

THESES

MAC:XP(LLOSTR01)

MAC:XP(CFD7)
EQ3(&AC1,TP2,TP205)

SUBST1(&AC1,TP205,X,&AC2=N(X-TP1))

SUBST1(TP1,TP103,X,&AC2=N(TP205-X))

SUBST1(&AC2,LIM180,X,&AC3=SRLMT(&AC2,X))

SUBST1(&AC2,N(TP205-TP103),X,&AC3=SRLMT(X
,LIM180))

SUBST1(&AC3,&AC3**2**3,X,&AC5=-X)

SUBST1(&AC3,-SRLMT(N(TP205-TP103),LIM180),
X,&AC5=-(X**3))

EQ4(&AC5,-(SRLMT(N(TP205-TP103),LIM180)**2
**3),LOCSTR01)

EQ3(LOCSTR1,&AC5,LOCSTR01)

SUBST1(PSIE,PSIE01,X,&AC9=MULT(&AC8,X))

MULT:Q1(&AC9,&AC8,PSIE01)
EQ3(&AC8,LOCSTR1,LOCSTR01)

SUBST1(&AC9,LOCSTR01,X,&AC9=X*PSIE01)

SUBST1(&AC9,LOCSTR01*PSIE01,X,X.LT.0)

OR2(YETA01*PSIE01.GT.0,LOCSTR01*PSIE01.LT
.0)
ORITY(YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE01
.LT.0.N(ABS(PSIE01)-DEG20).LT.0)
MAC:XP(CFD7)

EQV2(TFD7,YETA01*PSIE01.GT.0.OR.LOCSTR01*
PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0)

MAC:XP(CFD6)
EQV1(CFD6,CLANDFD)

HYPOTHESES
NONE

NONE
H23: &AC1.EQ.TP2
H6: TP2.EQ.TP205
L3: &AC1.EQ.TP205
H24: &AC2.EQ.N(&AC1-TP1)
H5: TP1.EQ.TP103
L4: &AC2.EQ.N(TP205-TP1)
H25: &AC1.EQ.LIM180
H26: &AC3.EQ.SRLMT(&AC2,&AC1)
L5: &AC2.EQ.N(TP205-TP103)

L6: &AC3.EQ.SRLMT(&AC2,LIM180)
H27: &AC5.EQ.&AC3**3
H28: &AC5.EQ.-&AC4
L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L8: &AC5.EQ.-(&AC3**2**3)
L9: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM180
)**2**3)
L10: &AC5.EQ.LOCSTR01
L11: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),LI
M180)**2**3)
H29: LOCSTR1.EQ.&AC5
L10: &AC5.EQ.LOCSTR01
H10: PSIE.EQ.PSIE01
H30: &AC8.EQ.MULT(&AC8,PSIE)
L11: &AC9.EQ.MULT(&AC8,PSIE01)
H34: &AC8.EQ.LOCSTR1
*C8: LOCSTR1.EQ.LOCSTR01
L13: &AC9.EQ.LOCSTR01
L12: &AC9.EQ.&AC8*PSIE01
L14: &AC9.EQ.LOCSTR01*PSIE01
H37: &AC9.LT.0
L15: LOCSTR01*PSIE01.LT.0

L16: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
1.LT.0
L17: YETA01*PSIE01.GT.0.OR.N(ABS(PSIE01)-DEG20).LT.0

L18: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
0).LT.0
NONE
H31: CFD6

CONCLUSIONS
L1: LOCSTR01.EQ.-(SRLMT(N(TP205-TP103),LI
M180)*2**3)
L2: CFD7.EQV.CLANDFD.AND.TFD7
L3: &AC1.EQ.TP205

L4: &AC2.EQ.N(TP205-TP1)

L5: &AC2.EQ.N(TP205-TP103)

L6: &AC3.EQ.SRLMT(&AC2,LIM180)

L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L8: &AC5.EQ.-(&AC3*2**3)

L9: &AC5.EQ.-(SRLMT(N(TP205-TP103),LIM180
)*2**3)
L10: &AC5.EQ.LOCSTR01

*C3: LOCSTR1.EQ.LOCSTR01

L11: &AC9.EQ.MULT(&AC8,PSIE01)

L12: &AC9.EQ.&AC8*PSIE01
L13: &AC9.EQ.LOCSTR01

L14: &AC9.EQ.LOCSTR01*PSIE01

L15: LOCSTR01*PSIE01.LT.0

L16: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
1.LT.0
L17: YETA01*PSIE01.GT.0.OR.LOCSTR01*PSIE0
1.LT.0.OR.N(ABS(PSIE01)-DEG20).LT.0
L18: TFD7.EQV.YETA01*PSIE01.GT.0.OR.LOCST
R01*PSIE01.LT.0.OR.N(ABS(PSIE01)-DEG2
0).LT.0
L19: TFD7

L20: CFD6.EQV.CLANDFD
L21: CLANDFD
```
```

```
MACEX0(CFD7)
EQV2(CFD7,CLANDFD.AND.TFD7)

HYPE01(SRLMT(N(TP205-TP103),LIM180)

SUBST3(&AC3,SRLMT(N(TP205-TP103),LIM180),
    X,ABS(X).LE.ABS(LIM180))


ABS9(003777777)
SUBST1(LIM180,003777777,X,ABS(&AC3).LE.AB
    S(X))

SUBST1(ABS(003777777),003777777,X,ABS(&AC
    3).LE.X)

ABS0(&AC3,2**3)

ABS0(2**3)
SUBST1(ABS(2**3),2**3,X,ABS(&AC3/2**3)=AB
    S(&AC3)*X)


MLE1(ABS(&AC3),003777777,2**3)

LELT2(ABS(&AC3)*2**3,003777777*2**3,1.80)


SUBST2(ABS(&AC3*2**3),ABS(&AC3)*2**3,X,X.
    LT.1.80)

IN0(&AC3*2**3)

***** C. E. D. *****
```

```
NONE
L22: CLANDFD.AND.TFD7
L3: CFD7.EQV.CLANDFD.AND.TFD7
NONE
NONE

L7: &AC3.EQ.SRLMT(N(TP205-TP103),LIM180)

L24: ABS(SRLMT(N(TP205-TP103),LIM180)).LE
    .ABS(LIM180)
A1: 003777777.GE.0
L23: LIM180.EQ.003777777

L25: ABS(&AC3).LE.ABS(LIM180)
L26: ABS(003777777).EQ.003777777

L27: ABS(&AC3).LE.ABS(003777777)
NONE

A2: 2**3.GE.0
L30: ABS(2**3).EQ.2**3

L29: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L28: ABS(&AC3).LE.003777777
A3: 2**3.GT.0
L32: ABS(&AC3)*2**3.LE.003777777*2**3

A4: 003777777*2**3.LT.1.80
L31: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3

L33: ABS(&AC3)*2**3.LT.1.80
L34: ABS(&AC3*2**3).LT.1.80
```

```
L2: CFD7.EQV.CLANDFD.AND.TFD7
*C2: CFD7

L23: LIM180.EQ.003777777
L24: ABS(SRLMT(N(TP205-TP103),LIM180)).LE
    .ABS(LIM180)
L25: ABS(&AC3).LE.ABS(LIM180)


L26: ABS(003777777).EQ.003777777
L27: ABS(&AC3).LE.ABS(003777777)


L28: ABS(&AC3).LE.003777777

L29: ABS(&AC3*2**3).EQ.ABS(&AC3)*ABS(2**3
    )
L30: ABS(2**3).EQ.2**3
L31: ABS(&AC3*2**3).EQ.ABS(&AC3)*2**3


L32: ABS(&AC3)*2**3.LE.003777777*2**3

L33: ABS(&AC3)*2**3.LT.1.80


L34: ABS(&AC3*2**3).LT.1.80

*C1: R(&AC3*2**3)
```

COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 27

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CFXITC
H2: SPCC
H3: CFD7
H4: MPILS.EQ.MPIL301
H5: TP1.EQ.TP103
H6: TP2.EQ.TP205
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP704
H12: LOCFD.EQ.LOCFD05
H13: LOCCC.EQ.LOCC1C04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFD151
H21: TAGFLG.NE.0
H22: LOCSTR.EQ.LOCSTR01
H23: .NOT.CCRUZFD
H24: &AC1.EQ.SPT
H25: CAPT1.EQ.&AC1
H26: &AC2.EQ.HRAD
H27: &AC3.EQ.&AC2-A1200
H28: .NOT.&AC3.LT.0
H29: &AC4.EQ.LECSTR
H30: &M01.EQ.DEG05
H31: &AC5.EQ.SRLMT(&AC4,&M01)
H32: &AC6.EQ.N(&AC5-RLFD)
H33: &AC7.EQ.&AC6/2**2
H34: &AC8.EQ.&AC7/TAU3
H35: &M02.EQ.DEG0
H36: &AC9.EQ.SRLMT(&AC1,&M02)
H37: &M03.EQ.MULT1(&AC9,DELTAT)
H38: &AC11.EQ.MULT(&AC9,DELTAT)
H39: &AC11.EQ.N(&AC10+RLFD)
H40: RLFD1.EQ.&AC11
H41: &AC12.EQ.N(&AC11-ROLL)
H42: &M04.EQ.DEG05
H43: &AC13.EQ.SRLMT(&AC12,&M04)
H44: *C3D1.EQ.&AC13

CONCLUSIONS
C1: N(&AC2-A1200)
C2: ABS(&AC7).LT.ABS(TAU3)
C3: CF911
C4: START.EQ.STAGT04
C5: LOCFD.EQ.LOCFD05
C6: TP1.EQ.TP104
C7: TP2.EQ.TP206
C8: TP3.EQ.TP303

```
C11: CCCSTR.EQ.LOCSTR02
C12: CAPT1.EQ.CAPT04
C13: RLFD1.EQ.RLFD04
C14: RCMD1.EQ.RCMD31

THEORY: NSLD
N2(P)=ABS(N(P)).LT.1.B0
SUBST2(P,J,N,A(R))=P.EQ.Q.A(J).IMP.A(P)
ABS*(P)=P.GE.0.IMP.ABS(P).EQ.P
DIVA(P,Q,R,S)=P.LT.0.IMP.DIVA(P,Q,R,S).NE.0.IMP.P/R.LT.0/S
ABS1(P,Q)=Q.GE.0.IMP.ABS(P/Q).EQ.ABS(P)/ABS(Q)
ABS1P(P,J)=P.EQ.0.0.GE.0.IMP.ABS(P).EQ.0
NOTLTSE1(P,Q)=.NOT.P.LT.Q.EQV.P.GE.Q
AND4(A,B)=A.B.IMP.A.AND.B
OR2(A,B)=B.IMP.A.OR.B
SUBST1(P,J,R,A(R))=P.EQ.Q.A(J).IMP.A(Q)
EQV2(A,B)=B.(A.EQV.B).IMP.A
NOTLTSE3(P,Q)=.NOT.P=0.LT.0.EQV.P.GE.0
NOT3(A,B)=.NOT.A.OR..NOT.B.EQV..NOT.(A.AND.B)
EQV3(A,B)=(A.EQV.B).NOT.B.IMP..NOT.A
EQV1(A,B)=A.(A.EQV.B).IMP.B
AND3(A,B)=A.AND.B.IMP.A
IF3(I,J,K,A)=I=J.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
EQ3(P,J,R)=P.EQ.Q.R.EQ.R.IMP.P.EQ.R
IF4(I,J,K,A)=I=K..NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
EQ3(P,Q,R)=P.EQ.Q.OR.Q.R.IMP.P.EQ.R
OR1(A,B)=A.IMP.A.OR.B
ANDNOT1(A,B)=A.AND.B.IMP..NOT.(A.AND..NOT.B)
ANDB(A,B)=A.AND.B.IMP.A
APT1(X,Y)=X.GE.0.Y.GE.0.IMP.R(X-Y)

PROOF

THEOREMS
MACRXP(CAPT04)

MACRXP(CAPT03)
EQ3(CAPT1,&AC1,SET)

IF3(CAPT1,SET,Q,CFD7)

EQ4(CAPT1,.IF.CFD7.THEN.SET.ELSE.Q.CAPT03
    )

IF4(CAPT1,CAPT,CAPT03,CCRUZFD)

EQ4(CAPT1,.IF.CCRUZFD.THEN.CAPT.ELSE.CAPT
    03,CAPT04)

HYPEXP(SPEC,TAU1=1.02)
N2(&AC5-RLFD)
SUBST1(&AC6,N(&AC5-RLFD),X,ABS(X).LT.1.B0
    )

ABS1(2**2)
DIVA(ABS(&AC6).1.B0,ABS(2**2),2**2)

ABS1P(&AC6,2**2)

SUBST2(ABS(&AC6/2**2),ABS(&AC6)/ABS(2**2)
    ,X,Y,X.LT.1.B0/Y**2)
```

```
HYPOTHESES
NONE

NONE
H25: CAPT1.EQ.&AC1
H24: &AC1.EQ.SET
L3: CAPT1.EQ.SET
H3: CFD7
L4: CAPT1.EQ..IF.CFD7.THEN.SET.ELSE.Q

L2: CAPT03.EQ..IF.CFD7.THEN.SET.ELSE.Q
L5: CAPT1.EQ.CAPT03

H23: .NOT.CCRUZFD
L6: CAPT1.EQ..IF.CCRUZFD.THEN.CAPT.ELSE.C
    APT03
L1: CAPT04.EQ..IF.CCRUZFD.THEN.CAPT.ELSE.
    CAPT03
NONE
NONE
H3: &AC5-RLFD.EQ.N(&AC5-RLFD)

L4: ABS(N(&AC5-RLFD)).LT.1.B0
A1: 2**2.GE.0
L9: ABS(&AC5).LT.1.B0
L10: ABS(2**2).EQ.2**2
A2: 2**2.NE.0
A3: 2**2.NE.0

L12: ABS(&AC6/2**2).EQ.ABS(&AC6)/ABS(2**2
    )
```

```
CONCLUSIONS
L1: CAPT04.EQ..IF.CCRUZFD.THEN.CAPT.ELSE.
    CAPT03
L2: CAPT03.EQ..IF.CFD7.THEN.SET.ELSE.Q
L3: CAPT1.EQ.SET

L4: CAPT1.EQ..IF.CFD7.THEN.SET.ELSE.Q

L5: CAPT1.EQ.CAPT03

L6: CAPT1.EQ..IF.CCRUZFD.THEN.CAPT.ELSE.C
    APT03

*C12: CAPT1.EQ.CAPT04

L7: TAU3.EQ.1.B2
L8: ABS(N(&AC5-RLFD)).LT.1.B0
L9: ABS(&AC6).LT.1.B0

L10: ABS(2**2).EQ.2**2
L11: ABS(&AC6)/ABS(2**2).LT.1.B0/2**2

L12: ABS(&AC6/2**2).EQ.ABS(&AC6)/ABS(2**2
    )
L13: ABS(&AC6/2**2).LT.1.B0/2**2
```

C2

```
      *2)

      SUBST1(1.80/2**2,1.32,X,ABS(&AC7).LT.X)

      ABS19(TAU3,1.82)

      SUBST2(ABS(TAU3),1.32,X,ABS(&AC7).LT.X)

      SUBST1(&AC2,HRAD,X,&AC3=X-A1200)

      SUBST1(&AC3,HRAD-A1200,X,.NOT.X.LT.0)

      NOTLTGE3(HRAD,A1200)
      AND4(CFD7,HRAD.GE.A1200)

      OR2(CFD9.CFD7.AND.HRAD.GE.A1200)
      MACEXP(CFD10)

      EQV2(CFD10,CFD9.OR.CFD7.AND.HRAD.GE.A1200
           )


      OR2(CFD62.OR.CFD8.OR.CFD9.CFD10)
      MACEXP(CFD11)

      EQV2(CFD11,CFD62.OR.CFD8.OR.CFD9.OR.CFD10
           )


      MACEXP(CFD8)
      NOTLTGE1(HRAD,A1200)
      OR2(.NOT.CFD7,.NOT.HRAD.LT.A1200)
      NOT3(CFD7,HRAD.LT.A1200)
      EQV3(CFD8,CFD7.AND.HRAD.LT.A1200)

      MACEXP(LOCSTR02)

      MACEXP(CFD7)
      EQV1(CFD7,CLANDFD.AND.TFD7)

      AND8(CLANDFD,TFD7)
      MACEXP(LOCFD05)

      IF3(LOCFD,LOCFD05,LOCFD03,CLANDFD)


      IF4(LOCFD,0,.IF.CLANDFD.THEN.LOCFD05.ELSE
           .LOCFD03,CFDIN1)

      EQ4(LOCFD,.IF.CFDIN1.THEN.0.ELSE..IF.CLAN
           DFD.THEN.LOCFD05.ELSE.LOCFD03,LOCFD06


      MACEXP(CFD6)
      EQV2(CFD6,CLANDFD)

      IF4(LOCSTR,LOCSTR,LOCSTR01,CCRUZFD)


      EQ4(LOCSTR,.IF.CCRUZFD.THEN.LOCSTR.ELSE.L
           OCSTR01,LOCSTR02)


      MACEXP(CFD4)
```

```
      L13: ABS(&AC6/2**2).LT.1.80/2**2
      A3: 1.80/2**2.EQ.1.82
      L14: ABS(&AC7).LT.1.80/2**2
      L7: TAU3.EQ.1.82
      A4: 1.82.GE.0
      L16: ABS(TAU3).EQ.1.82
      L15: ABS(&AC7).LT.1.82
      H26: &AC2.EQ.HRAD
      H27: &AC3.EQ.&AC2-A1200
      L17: &AC3.EQ.HRAD-A1200
      H28: .NOT.&AC3.LT.0
      L18: .NOT.HRAD-A1200.LT.0
      H3: CFD7
      L19: HRAD.GE.A1200
      L20: CFD7.AND.HRAD.GE.A1200
      NONE

      L21: CFD9.OR.CFD7.AND.HRAD.GE.A1200

      L22: CFD10.EQV.CFD9.OR.CFD7.AND.HRAD.GE.A
           1200
      L23: CFD10
      NONE

      L24: CFD62.OR.CFD8.OR.CFD9.OR.CFD10

      L25: CFD11.EQV.CFD62.OR.CFD8.OR.CFD9.OR.C
           FD10
      NONE
      L19: HRAD.GE.A1200
      L27: .NOT.HRAD.LT.A1200
      L28: .NOT.CFD7.OR..NOT.HRAD.LT.A1200
      L26: CFD8.EQV.CFD7.AND.HRAD.LT.A1200
      L29: .NOT.(CFD7.AND.HRAD.LT.A1200)
      NONE

      NONE
      H3: CFD7
      L32: CFD7.EQV.CLANDFD.AND.TFD7
      L33: CLANDFD.AND.TFD7
      NONE

      H12: LOCFD.EQ.LOCFD05

      L34: CLANDFD
      L36: LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
           SE.LOCFD03
      H20: .NOT.CFDIN1
      L37: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
           CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
      L35: LOCFD05.EQ..IF.CFDIN1.THEN.0.ELSE..I
           F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
      NONE
      L34: CLANDFD
      L38: CFD6.EQV.CLANDFD
      H22: LOCSTR.EQ.LOCSTR01

      H23: .NOT.CCRUZFD
      L40: LOCSTR.EQ..IF.CCRUZFD.THEN.LOCSTR.EL
           SE.LOCSTR01
      L31: LOCSTR02.EQ..IF.CCRUZFD.THEN.LOCSTR.
           ELSE.LOCSTR01
```

```
      L15: ABS(&AC7).LT.1.82

      L16: ABS(TAU3).EQ.1.82

      *C2: ABS(&AC7).LT.ABS(TAU3)

      L17: &AC3.EQ.HRAD-A1200

      L18: .NOT.HRAD-A1200.LT.0

      L19: HRAD.GE.A1200
      L20: CFD7.AND.HRAD.GE.A1200

      L21: CFD9.OR.CFD7.AND.HRAD.GE.A1200
      L22: CFD10.EQV.CFD9.OR.CFD7.AND.HRAD.GE.A
           1200
      L23: CFD10


      L24: CFD62.OR.CFD8.OR.CFD9.OR.CFD10
      L25: CFD11.EQV.CFD62.OR.CFD8.OR.CFD9.OR.C
           FD10
      *C3: CFD11


      L26: CFD8.EQV.CFD7.AND.HRAD.LT.A1200
      L27: .NOT.HRAD.LT.A1200
      L28: .NOT.CFD7.OR..NOT.HRAD.LT.A1200
      L29: .NOT.(CFD7.AND.HRAD.LT.A1200)
      L30: .NOT.CFD8

      L31: LOCSTR02.EQ..IF.CCRUZFD.THEN.LOCSTR.
           ELSE.LOCSTR01
      L32: CFD7.EQV.CLANDFD.AND.TFD7
      L33: CLANDFD.AND.TFD7

      L34: CLANDFD
      L35: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
           F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
      L36: LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
           SE.LOCFD03

      L37: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
           CLANDFD.THEN.LOCFD05.ELSE.LOCFD03

      *C5: LOCFD.EQ.LOCFD06


      L38: CFD6.EQV.CLANDFD
      L39: CFD6

      L40: LOCSTR.EQ..IF.CCRUZFD.THEN.LOCSTR.EL
           SE.LOCSTR01

      *C11: LOCSTR.EQ.LOCSTR02
```

```
EQ4(START..IF.CFDIN1.THEN.1.ELSE.START03,
    START04)

MACEXP(TP104)

IF4(TP1,TP102,TP103,CCRUZFD)

EQ4(TP1..IF.CCRUZFD.THEN.TP102.ELSE.TP103
    .TP104)

MACEXP(TP206)

IF4(TP2,TP202,TP205,CCRUZFD)

EQ4(TP2..IF.CCRUZFD.THEN.TP202.ELSE.TP205
    .TP206)

MACEXP(TP705)

IF4(TP7,TP702,TP704,CCRUZFD)

EQ4(TP7,.IF.CCRUZFD.THEN.TP702.ELSE.TP704
    .TP705)

MACEXP(YETA02)

IF4(YETA,YETA,YETA01,CFDIN1)

EQ4(YETA..IF.CFDIN1.THEN.YETA.ELSE.YETA01
    .YETA02)

MACEXP(PSIE02)

IF4(PSIE,PSIE,PSIE01,CFDIN1)

EQ4(PSIE..IF.CFDIN1.THEN.PSIE.ELSE.PSIE01
    .PSIE02)

EQ3(RLFD1,&AC11,N(&AC10+RLFD))

SUBST1(RLFD,RLFD02,X,RLFD1=N(&AC10+X))

MULTEQ1(&AC10,&AC9,DELTAT)
SUBST1(&M02,DEG4,X,&AC9=SRLMT(&AC8,X))

SUBST1(&AC7,&AC6/2**2,X,&AC8=X/TAU3)

EQ3(&AC4,LOCSTR,LOCSTR01)

SUBST1(&AC4,LOCSTR01,X,&AC5=SRLMT(X,&M01)
    )
```

```
H20:  .NOT.CFDIN1
L42:  START.EQ..IF.CFDIN1.THEN.0.ELSE.STAR
      T03
L41:  START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
      ART03
NONE

H5:  TP1.EQ.TP103

H23:  .NOT.CCRUZFD
L44:  TP1.EQ..IF.CCRUZFD.THEN.TP102.ELSE.T
      P103
L43:  TP104.EQ..IF.CCRUZFD.THEN.TP102.ELSE
      .TP103
NONE

H6:  TP2.EQ.TP205

H23:  .NOT.CCRUZFD
L45:  TP2.EQ..IF.CCRUZFD.THEN.TP202.ELSE.T
      P205
L45:  TP206.EQ..IF.CCRUZFD.THEN.TP202.ELSE
      .TP205
NONE

H11:  TP7.EQ.TP704

H23:  .NOT.CCRUZFD
L48:  TP7.EQ..IF.CCRUZFD.THEN.TP702.ELSE.T
      P704
L47:  TP705.EQ..IF.CCRUZFD.THEN.TP702.ELSE
      .TP704
NONE

H17:  YETA.EQ.YETA01

H20:  .NOT.CFDIN1
L50:  YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
      TA01
L49:  YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
      YETA01
NONE

H18:  PSIE.EQ.PSIE01

H20:  .NOT.CFDIN1
L52:  PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
      IE01
L51:  PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
      PSIE01
H40:  RLFD1.EQ.&AC11
H39:  &AC11.EQ.N(&AC10+RLFD)
H16:  RLFD.EQ.RLFD02
L53:  RLFD1.EQ.N(&AC10+RLFD)
H38:  &AC10.EQ.MULT(&AC9,DELTAT)
H35:  &M02.EQ.DEG4
H36:  &AC9.EQ.SRLMT(&AC8,&M02)
H33:  &AC7.EQ.&AC6/2**2
H34:  &AC8.EQ.&AC7/TAU3
H29:  &AC4.EQ.LOCSTR
H22:  LOCSTR.EQ.LOCSTR01
L58:  &AC4.EQ.LOCSTR01
```

```
      T03
*C4:  START.EQ.START04

L43:  TP104.EQ..IF.CCRUZFD.THEN.TP102.ELSE
      .TP103
L44:  TP1.EQ..IF.CCRUZFD.THEN.TP102.ELSE.T
      P103
*C6:  TP1.EQ.TP104

L45:  TP206.EQ..IF.CCRUZFD.THEN.TP202.ELSE
      .TP205
L46:  TP2.EQ..IF.CCRUZFD.THEN.TP202.ELSE.T
      P205
*C7:  TP2.EQ.TP206

L47:  TP705.EQ..IF.CCRUZFD.THEN.TP702.ELSE
      .TP704
L48:  TP7.EQ..IF.CCRUZFD.THEN.TP702.ELSE.T
      P704
*C8:  TP7.EQ.TP705

L49:  YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
      YETA01
L50:  YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
      TA01
*C9:  YETA.EQ.YETA02

L51:  PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
      PSIE01
L52:  PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
      IE01
*C10:  PSIE.EQ.PSIE02

L53:  RLFD1.EQ.N(&AC10+RLFD)

L54:  RLFD1.EQ.N(&AC10+RLFD02)

L55:  &AC10.EQ.&AC9*DELTAT
L56:  &AC9.EQ.SRLMT(&AC8,DEG4)

L57:  &AC8.EQ.&AC6/2**2/TAU3

L58:  &AC4.EQ.LOCSTR01

L59:  &AC5.EQ.SRLMT(LOCSTR01,&M01)
```

```
    ))

MACEXP(AC01)

MACEXP(CFD9)
OR1(.NOT.CCRUZFD..NOT.GUID2D.NE.0)
NOT3(CCRUZFD.GUID2D.NE.0)
EQV3(CFD9,CCRUZFD.AND.GUID2D.NE.0)

IF4(LOCSTR01,LATSTR,LOCSTR01,CFD9)


EQ4(LOCSTR01,.IF.CFD9.THEN.LATSTR.ELSE.LO
    CSTR01,AC01)


EQV2(CFD7,CLANDFD.AND.TFD7)

SUBST1(LOCSTR01,AC01,X,&AC5=SRLMT(X,DEG25
    ))

MACEXP(AC02)


MACEXP(CFD62)
MACEXP(RLFD04)

ANONOT1(CLANDFD,TFD7)
EQV3(CFD62,CLANDFD.AND..NOT.TFD7)

IF4(&AC5,SRLMT(LOCSTR01,DEG15),SRLMT(AC01
    ,DEG25),CFD8)

IF4(&AC5,AC..IF.CFD8.THEN.SRLMT(LOCSTR01,
    DEG15).ELSE.SRLMT(AC01,DEG25),CFD62)


EQ4(&AC5..IF.CFD62.THEN.A0.ELSE..IF.CFD8.
    THEN.SRLMT(LOCSTR01,DEG15).ELSE.SRLMT
    (AC01,DEG25),AC02)


SUBST1(&AC5,AC02,X,&AC6=N(X-RLFD))

SUBST1(RLFD,RLFD02,X,&AC6=N(AC02-X))

SUBST1(&AC6,N(AC02-RLFD02),X,&AC8=X/2**2/
    TAU3)

SUBST2(&AC8,N(AC02-RLFD02)/2**2/TAU3,X,RL
    FD04=N(SRLMT(X,DEG4)*DELTAT+RLFD02))


SUBST2(&AC9,SRLMT(&AC8,DEG4),X,RLFD04=N(X
    *DELTAT+RLFD02))


SUBST2(&AC10,&AC9*DELTAT,X,RLFD04=N(X+RLF
    D02))

EQ4(RLFD1,N(&AC10+RLFD02),RLFD04)

MACEXP(
```

```
L59: &AC5.EQ.SRLMT(LOCSTR01,&M01)
NONE

NONE
H23: .NOT.CCRUZFD
L63: .NOT.CCRUZFD.OR..NOT.GUID2D.NE.0
L62: CFD9.EQV.CCRUZFD.AND.GUID2D.NE.0
L64: .NOT.(CCRUZFD.AND.GUID2D.NE.0)
A5: LOCSTR01.EQ.LOCSTR01

L65: .NOT.CFD9
L66: LOCSTR01.EQ..IF.CFD9.THEN.LATSTR.ELS
    E.LOCSTR01
L61: AC01.EQ..IF.CFD9.THEN.LATSTR.ELSE.LO
    CSTR01
L33: CLANDFD.AND.TFD7
L32: CFD7.EQV.CLANDFD.AND.TFD7
L57: LOCSTR01.EQ.AC01

L60: &AC5.EQ.SRLMT(LOCSTR01,DEG25)
NONE


NONE
NONE

L33: CLANDFD.AND.TFD7
L70: CFD62.EQV.CLANDFD.AND..NOT.TFD7
L72: .NOT.(CLANDFD.AND..NOT.TFD7)
L68: &AC5.EQ.SRLMT(AC01,DEG25)

L30: .NOT.CFD8
L74: &AC5.EQ..IF.CFD8.THEN.SRLMT(LOCSTR01
    ,DEG15).ELSE.SRLMT(AC01,DEG25)

L73: .NOT.CFD62
L75: &AC5.EQ..IF.CFD62.THEN.A0.ELSE..IF.C
    FD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.S
    RLMT(AC01,DEG25)
L69: AC02.EQ..IF.CFD62.THEN.A0.ELSE..IF.C
    FD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.S
    RLMT(AC01,DEG25)
L76: &AC5.EQ.AC02
H32: &AC6.EQ.N(&AC5-RLFD)
H16: RLFD.EQ.RLFD02
L77: &AC6.EQ.N(AC02-RLFD)
L78: &AC6.EQ.N(AC02-RLFD02)

L79: &AC8.EQ.N(AC02-RLFD02)/2**2/TAU3
L79: &AC8.EQ.N(AC02-RLFD02)/2**2/TAU3

L71: RLFD04.EQ.N(SRLMT(N(AC02-RLFD02)/2**
    2/TAU3,DEG4)*DELTAT+RLFD02)
L55: &AC9.EQ.SRLMT(&AC8,DEG4)

L80: RLFD04.EQ.N(SRLMT(&AC8,DEG4)*DELTAT+
    RLFD02)
L55: &AC10.EQ.&AC9*DELTAT

L81: RLFD04.EQ.N(&AC9*DELTAT+RLFD02)
L94: RLFD1.EQ.N(&AC10+RLFD02)
L82: RLFD04.EQ.N(&AC10+RLFD02)
```

```
L61: AC01.EQ..IF.CFD9.THEN.LATSTR.ELSE.LO
    CSTR01
L62: CFD9.EQV.CCRUZFD.AND.GUID2D.NE.0
L63: .NOT.CCRUZFD.OR..NOT.GUID2D.NE.0
L64: .NOT.(CCRUZFD.AND.GUID2D.NE.0)
L65: .NOT.CFD9

L66: LOCSTR01.EQ..IF.CFD9.THEN.LATSTR.ELS
    E.LOCSTR01

L67: LOCSTR01.EQ.AC01


H3: CFD7

L68: &AC5.EQ.SRLMT(AC01,DEG25)


L69: AC02.EQ..IF.CFD62.THEN.A0.ELSE..IF.C
    FD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.S
    RLMT(AC01,DEG25)
L70: CFD62.EQV.CLANDFD.AND..NOT.TFD7
L71: RLFD04.EQ.N(SRLMT(N(AC02-RLFD02)/2**
    2/TAU3,DEG4)*DELTAT+RLFD02)
L72: .NOT.(CLANDFD.AND..NOT.TFD7)
L73: .NOT.CFD62

L74: &AC5.EQ..IF.CFD8.THEN.SRLMT(LOCSTR01
    ,DEG15).ELSE.SRLMT(AC01,DEG25)

L75: &AC5.EQ..IF.CFD62.THEN.A0.ELSE..IF.C
    FD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.S
    RLMT(AC01,DEG25)

L76: &AC5.EQ.AC02



L77: &AC6.EQ.N(AC02-RLFD)

L78: &AC6.EQ.N(AC02-RLFD02)

L79: &AC8.EQ.N(AC02-RLFD02)/2**2/TAU3


L80: RLFD04.EQ.N(SRLMT(&AC8,DEG4)*DELTAT+
    RLFD02)


L81: RLFD04.EQ.N(&AC9*DELTAT+RLFD02)


L82: RLFD04.EQ.N(&AC10+RLFD02)


#C13: RLFD1.EQ.RLFD04
```

```
SUBST1(&AC11,RLFD04,X,&AC12=N(X-ROLL))

SUBST1(&AC12,N(RLFD04-ROLL),X,&AC13=SRLMT
    (X,&M04))

SUBST1(&M04,DEG25,X,&AC13=SRLMT(N(RLFD04-
    ROLL),X))

EQ3(RCMD1,&AC13,SRLMT(N(RLFD04-ROLL),DEG2
    5))


EQ4(RCMD1,SRLMT(N(RLFD04-ROLL),DEG25),RCM
    D01)


HYPEXP(SPEC,HRAD,GE,0,AND,HRAD,LT,1500,B2
    3)
HYPEXP(SPEC,A1200=1200,B23)
SUBST2(A1200,1200,B23,X,X,GE,0)

AND9(HRAD,GE,0,HRAD,LT,1500,B23)
APT1(HRAD,A1200)

SUBST2(&AC2,HRAD,X,R(X-A1200))


***** O. F. D. *****
```

```
*C13: RLFD1.EQ.RLFD04
L84: &AC11.EQ.RLFD04
H41: &AC12.EQ.N(&AC11-ROLL)
L85: &AC12.EQ.N(RLFD04-ROLL)

H43: &AC13.EQ.SRLMT(&AC12,&M04)
H42: &M04.EQ.DEG25

L86: &AC13.EQ.SRLMT(N(RLFD04-ROLL),&M04)
H44: RCMD1.EQ.&AC13

L87: &AC13.EQ.SRLMT(N(RLFD04-ROLL),DEG25)

L88: RCMD1.EQ.SRLMT(N(RLFD04-ROLL),DEG25)

L83: RCMD01.EQ.SRLMT(N(RLFD04-ROLL),DEG25
    )
NONE

NONE
L90: A1200.EQ.1200.B23
A6: 1200.B23.GE.0
L89: HRAD.GE.0.AND.HRAD.LT.1500.B23
L92: HRAD.GE.0
L91: A1200.GE.0
H26: &AC2.EQ.HRAD
L93: R(HRAD-A1200)
```

```
L85: &AC12.EQ.N(RLFD04-ROLL)

L86: &AC13.EQ.SRLMT(N(RLFD04-ROLL),&M04)

L87: &AC13.EQ.SRLMT(N(RLFD04-ROLL),DEG25)

L88: RCMD1.EQ.SRLMT(N(RLFD04-ROLL),DEG25)


*C14: RCMD1.EQ.RCMD01


L89: HRAD.GE.0.AND.HRAD.LT.1500.B23

L90: A1200.EQ.1200.B23
L91: A1200.GE.0

L92: HRAD.GE.0
L93: R(HRAD-A1200)

*C1: R(&AC2-A1200)
```

```
COMMENTS
*** FLIGHT DIRECTOR ROUTINE: CONTROL PATH 28

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXIT0
H2: SPEC
H3: CFD7
H4: MPILS.EQ.MPILS01
H5: TP1.EQ.TP103
H6: TP2.EQ.TP205
H7: TP3.EQ.TP302
H8: TP4.EQ.TP402
H9: TP5.EQ.TP502
H10: TP6.EQ.TP602
H11: TP7.EQ.TP704
H12: LOCFD.EQ.LOCFD05
H13: LOCDC.EQ.LOCDC04
H14: FLARE.EQ.FLARE02
H15: START.EQ.START03
H16: RLFD.EQ.RLFD02
H17: YETA.EQ.YETA01
H18: PSIE.EQ.PSIE01
H19: GSFD.EQ.GSFD02
H20: .NOT.CFDIN1
H21: TMEFLG.NE.0
H22: LOCSTR.EQ.LOCSTR01
H23: .NOT.CCRUZFD
H24: &AC1.EQ.SET
H25: CAPT1.EQ.&AC1
H26: &AC2.EQ.HRAD
H27: &AC3.EQ.&AC2-A1200
H28: &AC3.LT.0
H29: &AC4.EQ.LOCSTR
H30: &M01.EQ.DEG15
H31: &AC5.EQ.SRLMT(&AC4,&M01)
H32: &AC6.EQ.N(&AC5-RLFD)
H33: &AC7.EQ.&AC6/2**2
H34: &AC8.EQ.&AC7/TAU3
H35: &M02.EQ.DEG4
H36: &AC9.EQ.SRLMT(&AC8,&M02)
H37: &M03.EQ.MULTM(&AC9,DELTAT)
H38: &AC10.EQ.MULT(&AC9,DELTAT)
H39: &AC11.EQ.N(&AC10+RLFD)
H40: RLFD1.EQ.&AC11
H41: &AC12.EQ.N(&AC11-ROLL)
H42: &M04.EQ.DEG25
H43: &AC13.EQ.SRLMT(&AC12,&M04)
H44: RCMD1.EQ.&AC13

CONCLUSIONS
C1: (&AC2-A1200)
C2: ABS(&AC7).LT.ABS(TAU3)
C3: CFD11
C4: START.EQ.START04
C5: LOCFD.EQ.LOCFD06
C6: TP1.EQ.TP104
C7: TP2.EQ.TP206
C8: TP7.EQ.TP705
```

```
C11: LOCSTR.EQ.LOCSTR02
C12: CAPT1.EQ.CAPT04
C13: RLFD1.EQ.RLFD04
C14: RCMD1.EQ.RCMD01

THEOREMS USED
EQ3(P,Q,R)=P.EQ.Q.Q.EQ.R.IMP.P.EQ.R
IF3(I,J,K,A)=I=J.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
EQ4(P,Q,R)=P.EQ.Q.R.EQ.Q.IMP.P.EQ.R
IF4(I,J,K,A)=I=K,.NOT.A.IMP.I=(.IF.A.THEN.J.ELSE.K)
EQV2(A,B)=B,(A.EQV.B).IMP.A
EQV1(A,B)=A,(A.EQV.B).IMP.B
ANDB(A,B)=A.AND.B.IMP.A
SUBST1(P,Q,R,A(R))=P.EQ.Q,A(P).IMP.A(Q)
LT2(P,Q)=P.LT.Q.EQV.P-Q.LT.0
AND4(A,B)=A,B.IMP.A.AND.B
OR2(A,B)=B.IMP.A.OR.B
OR1(A,B)=A.IMP.A.OR.B
MULTE01(P,Q,R)=P.EQ.MULT(Q,R).IMP.P=Q*R
ANDNOT1(A,B)=A.AND.B.IMP..NOT.(A.AND..NOT.B)
EQV3(A,B)=(A.EQV.B),.NOT.B.IMP..NOT.A
SUBST2(P,Q,R,A(R))=P.EQ.Q,A(Q).IMP.A(P)
APT1(X,Y)=X.GE.0,Y.GE.0.IMP.R(X-Y)
N2(P)=ABS(N(P)).LT.1.B0
ABS19(P,Q)=P.EQ.0,Q.GE.0.IMP.ABS(P).EQ.Q
DIV6(P,Q,R,S)=P.LT.Q.R.EQ.S,S.NE.0.IMP.P/R.LT.Q/S
ABS10(P,Q)=Q.NE.0.IMP.ABS(P/Q).EQ.ABS(P)/ABS(Q)
ABS9(P)=P.GE.0.IMP.ABS(P).EQ.P

PROOF

THEOREMS
HYPEXP(SPEC,TAU3=1.B2)
N2(&AC5-RLFD)
SUBST2(&AC6,N(&AC5-RLFD),X,ABS(X).LT.1.B0
    )

ABS9(2**2)
DIV6(ABS(&AC6),1.B0,ABS(2**2),2**2)


ABS10(&AC6,2**2)

SUBST2(ABS(&AC6/2**2),ABS(&AC6)/ABS(2**2)
    ,X,X.LT.1.B0/2**2)

SUBST2(&AC7,&AC6/2**2,X,ABS(X).LT.1.B0/2*
    *2)

SUBST1(1.B0/2**2,1.B2,X,ABS(&AC7).LT.X)

ABS19(TAU3,1.B2)

SUBST2(ABS(TAU3),1.B2,X,ABS(&AC7).LT.X)

EQ3(CAPT1,&AC1,SET)

MACEXP(CAPT03)
IF3(CAPT1,SET,0,CFD7)

EQ4(CAPT1,.IF.CFD7.THEN.SET.ELSE.0,CAPT03
    )

MACEXP(CAPT04)

HYPOTHESES
NONE
NONE
H32: &AC6.EQ.N(&AC5-RLFD)

L2: ABS(N(&AC5-RLFD)).LT.1.B0
A1: 2**2.GE.0
L3: ABS(&AC6).LT.1.B0
L4: ABS(2**2).EQ.2**2
A2: 2**2.NE.0
A2: 2**2.NE.0

L6: ABS(&AC6/2**2).EQ.ABS(&AC6)/ABS(2**2)

L5: ABS(&AC6)/ABS(2**2).LT.1.B0/2**2
H33: &AC7.EQ.&AC6/2**2

L7: ABS(&AC6/2**2).LT.1.B0/2**2
A3: 1.B0/2**2.EQ.1.B2
L8: ABS(&AC7).LT.1.B0/2**2
L1: TAU3.EQ.1.B2
A4: 1.B2.GE.0
L10: ABS(TAU3).EQ.1.B2
L9: ABS(&AC7).LT.1.B2
H25: CAPT1.EQ.&AC1
H24: &AC1.EQ.SET
NONE
L11: CAPT1.EQ.SET
H3: CFD7
L13: CAPT1.EQ..IF.CFD7.THEN.SET.ELSE.0

L12: CAPT03.EQ..IF.CFD7.THEN.SET.ELSE.0

CONCLUSIONS
L1: TAU3.EQ.1.B2
L2: ABS(N(&AC5-RLFD)).LT.1.B0
L3: ABS(&AC6).LT.1.B0

L4: ABS(2**2).EQ.2**2
L5: ABS(&AC6)/ABS(2**2).LT.1.B0/2**2

L6: ABS(&AC6/2**2).EQ.ABS(&AC6)/ABS(2**2)

L7: ABS(&AC6/2**2).LT.1.B0/2**2

L8: ABS(&AC7).LT.1.B0/2**2

L9: ABS(&AC7).LT.1.B2

L10: ABS(TAU3).EQ.1.B2

*C2: ABS(&AC7).LT.ABS(TAU3)

L11: CAPT1.EQ.SET

L12: CAPT03.EQ..IF.CFD7.THEN.SET.ELSE.0
L13: CAPT1.EQ..IF.CFD7.THEN.SET.ELSE.0

L14: CAPT1.EQ.CAPT03
```

```
EQ4(CAPT1,.IF.CCRUZFD.THEN.CAPT.ELSE.CAPT
    03,CAPT04)

MACEXP(LOCFD06)

MACEXP(CFD7)
EQV1(CFD7,CLANDFD.AND.TFD7)

AND8(CLANDFD,TFD7)
IF3(LOCFD,LOCFD05,LOCFD03,CLANDFD)

IF4(LOCFD,0,.IF.CLANDFD.THEN.LOCFD05.ELSE
    .LOCFD03,CFDIN1)

EQ4(LOCFD,.IF.CFDIN1.THEN.0.ELSE..IF.CLAN
    DFD.THEN.LOCFD05.ELSE.LOCFD03,LOCFD06

MACEXP(LOCSTR02)

MACEXP(CFD6)
EQV2(CFD6,CLANDFD)

IF4(LOCSTR,LOCSTR,LOCSTR01,CCRUZFD)

EQ4(LOCSTR,.IF.CCRUZFD.THEN.LOCSTR.ELSE.L
    OCSTR01,LOCSTR02)

SUBST1(&AC2,HRAD,X,&AC3=X-A1200)

SUBST1(&AC3,HRAD-A1200,X,X,LT,0)

LT2(HRAD,A1200)
MACEXP(CFD8)
AND4(CFD7,HRAD,LT,A1200)

EQV2(CFD8,CFD7.AND.HRAD.LT.A1200)

MACEXP(CFD11)

OR2(CFD62,CFD8)
OR1(CFD62.OR.CFD8,CFD9)
OR1(CFD62.OR.CFD8.OR.CFD9,CFD10)
EQV2(CFD11,CFD62.OR.CFD8.OR.CFD9.OR.CFD10
    )

MACEXP(START04)

IF4(START,0,START03,CFDIN1)

EQ4(START,.IF.CFDIN1.THEN.0.ELSE.START03,
    START04)

MACEXP(TP104)
```

```
H23: .NOT.CCRUZFD
L16: CAPT1.EQ..IF.CCRUZFD.THEN.CAPT.ELSE.
     CAPT03
L15: CAPT04.EQ..IF.CCRUZFD.THEN.CAPT.ELSE
     .CAPT03
NONE

NONE
H3: CFD7
L18: CFD7.EQV.CLANDFD.AND.TFD7
L19: CLANDFD.AND.TFD7
H12: LOCFD.EQ.LOCFD05

L20: CLANDFD
L21: LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
     SE.LOCFD03
H20: .NOT.CFDIN1
L22: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
     CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L17: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
     F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
NONE

NONE
L20: CLANDFD
L24: CFD6.EQV.CLANDFD
H22: LOCSTR.EQ.LOCSTR01

H23: .NOT.CCRUZFD
L26: LOCSTR.EQ..IF.CCRUZFD.THEN.LOCSTR.EL
     SE.LOCSTR01
L23: LOCSTR02.EQ..IF.CCRUZFD.THEN.LOCSTR.
     ELSE.LOCSTR01
H26: &AC2.EQ.HRAD
H27: &AC3.EQ.&AC2-A1200
L27: &AC3.EQ.HRAD-A1200
H28: &AC3.LT.0
L28: HRAD-A1200.LT.0
NONE
H3: CFD7
L29: HRAD.LT.A1200
L31: CFD7.AND.HRAD.LT.A1200
L30: CFD8.EQV.CFD7.AND.HRAD.LT.A1200
NONE

L32: CFD8
L34: CFD62.OR.CFD8
L35: CFD62.OR.CFD8.OR.CFD9
L36: CFD62.OR.CFD8.OR.CFD9.OR.CFD10

L33: CFD11.EQV.CFD62.OR.CFD8.OR.CFD9.OR.C
     FD10
NONE

H15: START.EQ.START03

H20: .NOT.CFDIN1
L38: START.EQ..IF.CFDIN1.THEN.0.ELSE.STAR
     T03
L37: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
     ART03
NONE
```

```
     CAPT03
*C12: CAPT1.EQ.CAPT04


L17: LOCFD06.EQ..IF.CFDIN1.THEN.0.ELSE..I
     F.CLANDFD.THEN.LOCFD05.ELSE.LOCFD03
L18: CFD7.EQV.CLANDFD.AND.TFD7
L19: CLANDFD.AND.TFD7

L20: CLANDFD
L21: LOCFD.EQ..IF.CLANDFD.THEN.LOCFD05.EL
     SE.LOCFD03

L22: LOCFD.EQ..IF.CFDIN1.THEN.0.ELSE..IF.
     CLANDFD.THEN.LOCFD05.ELSE.LOCFD03

*C5: LOCFD.EQ.LOCFD06


L23: LOCSTR02.EQ..IF.CCRUZFD.THEN.LOCSTR.
     ELSE.LOCSTR01
L24: CFD6.EQV.CLANDFD
L25: CFD6

L26: LOCSTR.EQ..IF.CCRUZFD.THEN.LOCSTR.EL
     SE.LOCSTR01

*C11: LOCSTR.EQ.LOCSTR02


L27: &AC3.EQ.HRAD-A1200

L28: HRAD-A1200.LT.0

L29: HRAD.LT.A1200
L30: CFD8.EQV.CFD7.AND.HRAD.LT.A1200
L31: CFD7.AND.HRAD.LT.A1200

L32: CFD8

L33: CFD11.EQV.CFD62.OR.CFD8.OR.CFD9.OR.C
     FD10
L34: CFD62.OR.CFD8
L35: CFD62.OR.CFD8.OR.CFD9
L36: CFD62.OR.CFD8.OR.CFD9.OR.CFD10
*C3: CFD11


L37: START04.EQ..IF.CFDIN1.THEN.0.ELSE.ST
     ART03
L38: START.EQ..IF.CFDIN1.THEN.0.ELSE.STAR
     T03

*C4: START.EQ.START04


L39: TP104.EQ..IF.CCRUZFD.THEN.TP102.ELSE
```

```
EQ4(TP1,.IF.CCRUZFD.THEN.TP102.ELSE.TP103
     ,TP104)

MACEXP(TP206)

IF4(TP2,TP202,TP205,CCRUZFD)

EQ4(TP2,.IF.CCRUZFD.THEN.TP202.ELSE.TP205
     ,TP206)

MACEXP(TP705)

IF4(TP7,TP702,TP704,CCRUZFD)

EQ4(TP7,.IF.CCRUZFD.THEN.TP702.ELSE.TP704
     ,TP705)

MACEXP(YETA02)

IF4(YETA,YETA,YETA01,CFDIN1)

EQ4(YETA,.IF.CFDIN1.THEN.YETA.ELSE.YETA01
     ,YETA02)

MACEXP(PSIE02)

IF4(PSIE,PSIE,PSIE01,CFDIN1)

EQ4(PSIE,.IF.CFDIN1.THEN.PSIE.ELSE.PSIE01
     ,PSIE02)

MACEXP(RLFD04)

EQ3(RLFD1,&AC11,N(&AC10+RLFD))

SUBST1(RLFD,RLFD02,X,RLFD1=N(&AC10+X))

MULTEQ1(&AC10,&AC9,DELTAT)
SUBST1(&MQ2,DEG4,X,&AC9=SRLMT(&AC8,X))

SUBST1(&AC7,&AC6/2**2,X,&AC8=X/TAU3)

EQ3(&AC4,LOCSTR,LOCSTR01)

SUBST1(&AC4,LOCSTR01,X,&AC5=SRLMT(X,&MQ1)
     )

SUBST1(&MQ1,DEG15,X,&AC5=SRLMT(LOCSTR01,X
     ))

MACEXP(AC02)

MACEXP(CFD62)
```

```
H23: .NOT.CCRUZFD
L40: TP1.EQ..IF.CCRUZFD.THEN.TP102.ELSE.T
     P103
L39: TP104.EQ..IF.CCRUZFD.THEN.TP102.ELSE
     .TP103
NONE

H6: TP2.EQ.TP205

H23: .NOT.CCRUZFD
L42: TP2.EQ..IF.CCRUZFD.THEN.TP202.ELSE.T
     P205
L41: TP206.EQ..IF.CCRUZFD.THEN.TP202.ELSE
     .TP205
NONE

H11: TP7.EQ.TP704

H23: .NOT.CCRUZFD
L44: TP7.EQ..IF.CCRUZFD.THEN.TP702.ELSE.T
     P704
L43: TP705.EQ..IF.CCRUZFD.THEN.TP702.ELSE
     .TP704
NONE

H17: YETA.EQ.YETA01

H20: .NOT.CFDIN1
L46: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
     TA01
L45: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
     YETA01
NONE

H18: PSIE.EQ.PSIE01

H20: .NOT.CFDIN1
L48: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
     IE01
L47: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
     PSIE01
NONE

H40: RLFD1.EQ.&AC11
H39: &AC11.EQ.N(&AC10+RLFD)
H16: RLFD.EQ.RLFD02
L50: RLFD1.EQ.N(&AC10+RLFD)
H38: &AC10.EQ.MULT(&AC9,DELTAT)
H35: &MQ2.EQ.DEG4
H36: &AC9.EQ.SRLMT(&AC8,&MQ2)
H33: &AC7.EQ.&AC6/2**2
H34: &AC8.EQ.&AC7/TAU3
H29: &AC4.EQ.LOCSTR
H22: LOCSTR.EQ.LOCSTR01
L55: &AC4.EQ.LOCSTR01

H31: &AC5.EQ.SRLMT(&AC4,&MQ1)
H30: &MQ1.EQ.DEG15

L56: &AC5.EQ.SRLMT(LOCSTR01,&MQ1)
NONE
```

```
*C6: TP1.EQ.TP104

L41: TP206.EQ..IF.CCRUZFD.THEN.TP202.ELSE
     .TP205
L42: TP2.EQ..IF.CCRUZFD.THEN.TP202.ELSE.T
     P205

*C7: TP2.EQ.TP206

L43: TP705.EQ..IF.CCRUZFD.THEN.TP702.ELSE
     .TP704
L44: TP7.EQ..IF.CCRUZFD.THEN.TP702.ELSE.T
     P704

*C8: TP7.EQ.TP705

L45: YETA02.EQ..IF.CFDIN1.THEN.YETA.ELSE.
     YETA01
L46: YETA.EQ..IF.CFDIN1.THEN.YETA.ELSE.YE
     TA01

*C9: YETA.EQ.YETA02

L47: PSIE02.EQ..IF.CFDIN1.THEN.PSIE.ELSE.
     PSIE01
L48: PSIE.EQ..IF.CFDIN1.THEN.PSIE.ELSE.PS
     IE01

*C10: PSIE.EQ.PSIE02

L49: RLFD04.EQ.N(SRLMT(N(AC02-RLFD02)/2**
     2/TAU3,DEG4)*DELTAT+RLFD02)
L50: RLFD1.EQ.N(&AC10+RLFD)

L51: RLFD1.EQ.N(&AC10+RLFD02)

L52: &AC10.EQ.&AC9*DELTAT
L53: &AC9.EQ.SRLMT(&AC8,DEG4)

L54: &AC8.EQ.&AC6/2**2/TAU3

L55: &AC4.EQ.LOCSTR01

L56: &AC5.EQ.SRLMT(LOCSTR01,&MQ1)

L57: &AC5.EQ.SRLMT(LOCSTR01,DEG15)

L58: AC02.EQ..IF.CFD62.THEN.A0.ELSE..IF.C
     FD8.THEN.SRLMT(LOCSTR01,DEG15).ELSE.S
     RLMT(AC01,DEG25)
```

```
IF3(&AC5,SRLMT(LOCSTR01,DEG15),SRLMT(AC01
    ,DEG25),CFD8)

IF4(&AC5,A0,,IF,CFD8,THEN,SRLMT(LOCSTR01,
    DEG15),ELSE,SRLMT(AC01,DEG25),CFD62)


EQ4(&AC5,,IF,CFD62,THEN,A0,ELSE,,IF,CFD8,
    THEN,SRLMT(LOCSTR01,DEG15),ELSE,SRLMT
    (AC01,DEG25),AC02)



SUBST1(&AC5,AC02,X,&AC6=N(X-RLFD))

SUBST1(RLFD,RLFD02,X,&AC6=N(AC02-X))

SUBST1(&AC6,N(AC02-RLFD02),X,&AC8=X/2**2/
    TAU3)

SUBST2(&AC8,N(AC02-RLFD02)/2**2/TAU3,X,RL
    FD04=N(SRLMT(X,DEG4)*DELTAT+RLFD02))


SUBST2(&AC9,SRLMT(&AC8,DEG4),X,RLFD04=N(X
    *DELTAT+RLFD02))


SUBST2(&AC10,&AC9*DELTAT,X,RLFD04=N(X+RLF
    D02))

EQ4(RLFD1,N(&AC10+RLFD02),RLFD04)

MACEXP(RCMD01)

EQ3(&AC11,RLFD1,RLFD04)

SUBST1(&AC11,RLFD04,X,&AC12=N(X-ROLL))

SUBST1(&AC12,N(RLFD04-ROLL),X,&AC13=SRLMT
    (X,&MQ4))

SUBST1(&MQ4,DEG25,X,&AC13=SRLMT(N(RLFD04-
    ROLL),X))

EQ3(RCMD1,&AC13,SRLMT(N(RLFD04-ROLL),DEG2
    5))


EQ4(RCMD1,SRLMT(N(RLFD04-ROLL),DEG25),RCM
    D01)


HYPEXP(SPEC,HRAD,GE,0,AND,HRAD,LT,1500,B2
    3)
HYPEXP(SPEC,A1200=1200,B23)
SUBST2(A1200,1200,B23,X,X,GE,0)

ANDB(HRAD,GE,0,HRAD,LT,1500,B23)
APT1(HRAD,A1200)

SUBST2(&AC2,HRAD,X,R(X-A1200))
```

```
L60:  ,NOT,(CLANDFD,AND,,NOT,TFD7)
L57:  &AC5,EQ,SRLMT(LOCSTR01,DEG15)

L32:  CFD8
L62:  &AC5,EQ,,IF,CFD8,THEN,SRLMT(LOCSTR01
      ,DEG15),ELSE,SRLMT(AC01,DEG25)

L61:  ,NOT,CFD62
L63:  &AC5,EQ,,IF,CFD62,THEN,A0,ELSE,,IF,C
      FD8,THEN,SRLMT(LOCSTR01,DEG15),ELSE,S
      RLMT(AC01,DEG25)
L58:  AC02,EQ,,IF,CFD62,THEN,A0,ELSE,,IF,C
      FD8,THEN,SRLMT(LOCSTR01,DEG15),ELSE,S
      RLMT(AC01,DEG25)
L64:  &AC5,EQ,AC02
H32:  &AC6,EQ,N(&AC5-RLFD)
H15:  RLFD,EQ,RLFD02
L65:  &AC6,EQ,N(AC02-RLFD)
L66:  &AC5,EQ,N(AC02-RLFD02)

L54:  &AC8,EQ,&AC6/2**2/TAU3
L67:  &AC8,EQ,N(AC02-RLFD02)/2**2/TAU3

L49:  RLFD04,EQ,N(SRLMT(N(AC02-RLFD02)/2**
      2/TAU3,DEG4)*DELTAT+RLFD02)
L53:  &AC9,EQ,SRLMT(&AC8,DEG4)

L58:  RLFD04,EQ,N(SRLMT(&AC8,DEG4)*DELTAT+
      RLFD02)
L52:  &AC10,EQ,&AC9*DELTAT

L69:  RLFD04,EQ,N(&AC9*DELTAT+RLFD02)
L51:  RLFD1,EQ,N(&AC10+RLFD02)
L70:  RLFD04,EQ,N(&AC10+RLFD02)
NONE

H40:  RLFD1,EQ,&AC11
*C13:  RLFD1,EQ,RLFD04
L72:  &AC11,EQ,RLFD04
H41:  &AC12,EQ,N(&AC11-ROLL)
L73:  &AC12,EQ,N(RLFD04-ROLL)

H43:  &AC13,EQ,SRLMT(&AC12,&MQ4)
H42:  &MQ4,EQ,DEG25

L74:  &AC13,EQ,SRLMT(N(RLFD04-ROLL),&MQ4)
H44:  RCMD1,EQ,&AC13

L75:  &AC13,EQ,SRLMT(N(RLFD04-ROLL),DEG25)

L76:  RCMD1,EQ,SRLMT(N(RLFD04-ROLL),DEG25)

L71:  RCMD01,EQ,SRLMT(N(RLFD04-ROLL),DEG25
      )
NONE

NONE
L78:  A1200,EQ,1200,B23
A5:  1200,B23,GE,0
L77:  HRAD,GE,0,AND,HRAD,LT,1500,B23
L80:  HRAD,GE,0
L79:  A1200,GE,0
H26:  &AC2,EQ,HRAD
L81:  R(HRAD-A1200)
```

```
L62:  &AC5,EQ,,IF,CFD8,THEN,SRLMT(LOCSTR01
      ,DEG15),ELSE,SRLMT(AC01,DEG25)

L63:  &AC5,EQ,,IF,CFD62,THEN,A0,ELSE,,IF,C
      FD8,THEN,SRLMT(LOCSTR01,DEG15),ELSE,S
      RLMT(AC01,DEG25)

L64:  &AC5,EQ,AC02



L65:  &AC6,EQ,N(AC02-RLFD)

L66:  &AC6,EQ,N(AC02-RLFD02)

L67:  &AC8,EQ,N(AC02-RLFD02)/2**2/TAU3


L68:  RLFD04,EQ,N(SRLMT(&AC8,DEG4)*DELTAT+
      RLFD02)

L69:  RLFD04,EQ,N(&AC9*DELTAT+RLFD02)



L70:  RLFD04,EQ,N(&AC10+RLFD02)


*C13:  RLFD1,EQ,RLFD04

L71:  RCMD01,EQ,SRLMT(N(RLFD04-ROLL),DEG25
      )
L72:  &AC11,EQ,RLFD04

L73:  &AC12,EQ,N(RLFD04-ROLL)

L74:  &AC13,EQ,SRLMT(N(RLFD04-ROLL),&MQ4)


L75:  &AC13,EQ,SRLMT(N(RLFD04-ROLL),DEG25)


L76:  RCMD1,EQ,SRLMT(N(RLFD04-ROLL),DEG25)


*C14:  RCMD1,EQ,RCMD01



L77:  HRAD,GE,0,AND,HRAD,LT,1500,B23

L78:  A1200,EQ,1200,B23
L79:  A1200,GE,0

L80:  HRAD,GE,0
L81:  R(HRAD-A1200)

*C1:  R(&AC2-A1200)
```

```
COMMENTS
### FLIGHT DIRECTOR ROUTINE: CONTROL PATH 29

PROVING OF VERIFICATION CONDITIONS

HYPOTHESES
H1: CEXITO
H2: SPEC
H3: CCRUZFD
H4: START.EQ.START04
H5: LOCFD.EQ.LOCFD06
H6: GSFD.EQ.GSFD02
H7: MPILS.EQ.MPILS01
H8: IP1.EQ.IP102
H9: IP2.EQ.IP202
H10: IP3.EQ.IP302
H11: IP4.EQ.IP402
H12: IP5.EQ.IP502
H13: IP6.EQ.IP602
H14: IP7.EQ.IP702
H15: LOCDC.EQ.LOCDC04
H16: FLARE.EQ.FLARE02
H17: YETA.EQ.YETA02
H18: PSIE.EQ.PSIE02
H19: INEFLG.NE.0
H20: .NOT.CFD42
H21: BAC1.EQ.GUID2D
H22: .NOT.BAC1.NE.0
H23: PCMVLD1.EQ.0
H24: PCMVLD1.EQ.0

CONCLUSIONS
C1: .FALSE.

THEOREMS USED
SUBST1(P,Q,R,A(P))=P.EQ.Q.A(Q).IMP.A(Q)
EQV1(A,B)=A.(A.EQV.B).IMP.B
AND1(A,B)=A.AND.B.IMP.A
NOT1(P,Q)=P.EQ.Q.EQV..NOT.(P.NE.Q)
EQV4(A,B)=(A.EQV.B).,NOT.A.IMP..NOT.B
NOTORAND1(A,B)=.NOT.(A.OR.B).EQV..NOT.A.AND..NOT.B
NOT1(P,)=.NOT.P.NE.Q.EQV.P.EQ.Q
AND4(A,B)=A.B.IMP.A.AND.B
FE1(A)=A,.NOT.A.IMP..FALSE.
AND5(A,B)=A.AND.B.IMP.B

PROOF

THEOREMS
SUBST1(BAC1.GUID2D,X,.NOT.X.NE.0)

MACEXP(CEXITC)
MACEXP(CVCRUZ)
MACEXP(TEXITO)

MACEXP(CFD112)
EQV1(CEXITO,CVCRUZ.AND.TEXITO)

ANDR(CVCRUZ,TEXITO)
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HYPOTHESES
H21: BAC1.EQ.GUID2D
H22: .NOT.BAC1.NE.0
NONE
NONE
NONE

NONE
H1: CEXITO
L2: CEXITO.EQV.CVCRUZ.AND.TEXITO
L6: CVCRUZ.AND.TEXITO
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CONCLUSIONS
L1: .NOT.GUID2D.NE.0

L2: CEXITO.EQV.CVCRUZ.AND.TEXITO
L3: CVCRUZ.EQV.CFD112.AND.TVCRUZ
L4: TEXITO.EQV.GUID3D.NE.0.AND.MDA.GE.HRA
    D.AND.TIMER.EQ.BINTME
L5: CFD112.EQV..NOT.CEXITI
L6: CVCRUZ.AND.TEXITO

L7: CVCRUZ
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EOV1(CFD112,.NOT.CEXIT1)

NOT5(GUID2D,0)
MACEXP(CEXIT1)

EOV8(CEXIT1,TMEFLG=0,OR.CCRUZFD.AND.GUID2
    D=0)

NOTORAND1(TMEFLG=0,CCRUZFD.AND.GUID2D=0)

NOT1(GUID2D,0)
AND9(.NOT.TMEFLG=0,.NOT.(CCRUZFD.AND.GUID
    2D=0))
AND4(CCRUZFD,GUID2D=0)

FE1(CCRUZFD.AND.GUID2D=0)


***** U. F. D. *****
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L9: CFD112
L5: CFD112.EOV..NOT.CEXIT1
L1: .NOT.GUID2D.NE.0
NONE

L12: CEXIT1.EOV.TMEFLG.EQ.0.OR.CCRUZFD.AN
    D.GUID2D.EQ.0
L10: .NOT.CEXIT1
L13: .NOT.(TMEFLG.EQ.0.OR.CCRUZFD.AND.GUI
    D2D.EQ.0)
L1: .NOT.GUID2D.NE.0
L14: .NOT.TMEFLG.EQ.0.AND..NOT.(CCRUZFD.A
    ND.GUID2D.EQ.0)
R3: CCRUZFD
L11: GUID2D.EQ.0
L16: CCRUZFD.AND.GUID2D.EQ.0
L15: .NOT.(CCRUZFD.AND.GUID2D.EQ.0)
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L10: .NOT.CEXIT1

L11: GUID2D.EQ.0
L12: CEXIT1.EOV.TMEFLG.EQ.0.OR.CCRUZFD.AN
    D.GUID2D.EQ.0
L13: .NOT.(TMEFLG.EQ.0.OR.CCRUZFD.AND.GUI
    D2D.EQ.0)

L14: .NOT.TMEFLG.EQ.0.AND..NOT.(CCRUZFD.A
    ND.GUID2D.EQ.0)
L11: GUID2D.EQ.0
L15: .NOT.(CCRUZFD.AND.GUID2D.EQ.0)

L16: CCRUZFD.AND.GUID2D.EQ.0

*C1: .FALSE.
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