NAL TM-386

UDC 681.306:
533.6.072

航空宇宙技術研究所資料

TECHNICAL MEMORANDUM OF NATIONAL AEROSPACE LABORATORY

TM-386

実時間飛行シミュレーション用汎用プログラム

原田公一・土屋雅子

1979年7月

航空宇宙技術研究所
NATIONAL AEROSPACE LABORATORY

実時間飛行シミュレーション用汎用プログラム*

原田公一** 土屋雅子**

Application Program for Real Time Flight Simulation

By

Koichi HARADA and Masako TSUCHIYA

ABSTRACT

The present paper in concerned with the application program for the real time flight simulation, which is called Flight Simulation Programmed Package (FSPP) and is constructed with flight dynamics, engine dynamics and external device interface subprograms.

The FSPP was developed with the object of simulating aircraft only by setting the data concerning it and the user can replace and link the subprograms with user's ones.

It was implemented on the computer complex (FSK-II) at the National Aerospace Laboratory, which consists of a master-computer and four slave-computers. The master-computer controls the slave-computers, and the slave-computers execute the subprograms repeatedly at a constant interval solving the vehicle dynamics in real time.

1 はじめに

航空機の操縦，自動車の運転のように，人間が制御系の一要素として閉ループ内に含まれる人間－機械系を設計する場合，実物と同じ臨場感を起させる装置を使えば人間の感覚に直接訴えて，操作の難易等について操縦者から現実に即した評価が得られる。また，その意見を設計に還元し取返しのつかない事態（操縦不能による事故等）を避け安全にかつ無駄無く開発工程を大幅に短縮することも可能である。

航空機の開発設計に用いるこの種の装置を汎用飛行シミュレータと言い，それを用いた試験は空力特性を求めるための風胴試験と総合性能を確認するための飛行試験の中間に位置するものである。

航空宇宙技術研究所（以後航技研と言う）では昭和38年にアナログ計算機，可動模擬操縦席装置，模擬視界装置，フライト・テーブル等からなる汎用飛行シミュレータを設置し[1]，YS-11，C－1，PS－1，VTOL 等の研究・開発に使用してきたが，電子工業の技術革新の大波には勝てず真空管等の部品製造中止により維持が困難となり，かつこの計算機では処理できないような非線形演算を含む大規模なシミュレーションを行う必要が生じてきたため，昭和47～49年度に動特性を模擬するためのアナログ計算機をディジタル計算機に更新した。

この更新システム（以後FSK－IIと言う）は下記の事項に注目して複数の小型計算機で航空機の動特性を模擬する構成になっている[2]。

(1) 飛行シミュレーションのプログラムは，機体の運動力学・エンジン力学・航法・空気力学・外部機器とのつなぎを計算するサブプログラムから構成され，その各々を複数の計算機で処理できること。

(2) 応用範囲を限定し，複数のプログラムを複数の計算機で処理した方が，高価な汎用大型計算機で処理するよりも，対費用効果の面で有利なことも考えられること。

(3) 将来の性能向上の要求にも，計算機を増設し，常にシミュレーションの規模に応じて同一の手法でシステムを構成することができること。

この汎用飛行シミュレータを使いこなすにはその対象目的に応じて模擬する動特性や装備が変ることを考慮

*昭和53年11月6日 受付
**計算センター

し，性能面ばかりでなく使い易さの面で充分な配慮が必要である。しかし1個のプログラムを複数の計算機で処理するような複合計算機は一般に使い難いという点があり，これを改善するためにはプログラムの生成・同期等に関するシステム・プログラムの充実の他に，汎用プログラムの充実も必要となる。このために，飛行シミュレーションを行う時に必要となるプログラムの作成の手間を省き，データの設定だけで多種の飛行シミュレーションを行うことのできる汎用飛行シミュレーション・プログラム（Flight Simulation Programmed Package 略してFSPP と言う。）を開発した。本報告はその詳細を述べたものである。

なお，FSK−Ⅱ のシステム全体については文献(2)，計算機間のデータ転送については文献(4)，(5)に記してあるので参照されたい。

2. 実時間飛行シミュレーションについて

本論に入る前に，実時間飛行シミュレーションがシミュレーション技術の中でどのように位置づけられるかを見，その意義について考えておく。

2.1 モデルの種類

一般に，シミュレーションを行うためには，実世界の対象を構成している事象，および事象間の相互関係を，他の世界の事象，および事象間の相互関係に対応づけなければならない。

この対応づけの方法をモデル化と言い，その対応づけられた他の世界の事象およびその相互関係をモデルと言う。

モデルは，次の様に分類される[3]。

(1) 偶像モデル（Iconic Model）

これは，人・物・事実等の事象を偶像で表わし，この偶像の相互関係で対象を模擬するためのモデルである。

この例としては，電気機関車・駅・信号機等の模型を用いた輸送等のシミュレーションがある。

また，チェス・将棋では駒が兵士の偶像であり，戦いを模擬している。

(2) 相似モデル（Analog Model）

これは，実世界の事象をもう一つの実世界に対応づけ，そこで起きる結果を元の世界に置き替えて模擬するモデルである。

この例として，航空機の縮少模型を用いる風胴実験・港等の縮少模型を用いた港湾の潮の流れの実験等がある。

この本質は，実世界の事象を実験室等でも扱えるように拡大・縮少・抽出し，模擬するところにあり，研究機関で行う実験は大部分この範疇に入る。

また，現実の機器を用いて模擬を行うため，その準備に時間・労力を要し，また費用をかなり必要とするのが普通である。

(3) シンボルで構成されたモデル（Symbolic Model）

これは実世界の事象を抽象的な空間に投影して模擬するためのモデルである。

前述の相似モデルで，“他の世界”とは実世界を拡大・縮少しただけの，もしくは注目した特性を抽出し，他を省略した“実世界”であるのに対し，ここでの世界は概念上の世界である。

このため事象をすべてシンボルで表わし，事象の間の関係をシンボルの間の関係で表わす。

この代表的な例として，科学的な現象を数量化するために，事象に変数を対応させ，事象の間の関係を演算子（Operator）で表わす数式モデルがある。

一般に理論解析と言われるものはこの範疇に入る。

このモデルは，最も経済的かつ効率的・安全であり，これから最も進歩が期待される分野である。

以上3種類のモデルについて述べたが，そのうち偶像モデルはゲーム（Game）に多く採用され，相似モデルは実験に多く現われる。

2.2 計算機シミュレーション

第2次大戦後，急速に進歩した手法として，計算機シミュレーションがある。

これには，アナログ計算機を用い，実世界の事象を電圧・電流等に対応させてモデルを解析するアナログ・シミュレーション，事象を1/0のパターンから成る2進数等に対応づけ数値計算によってモデルを解析するディジタル・シミュレーションおよびアナログ・ディジタル計算機を結合し，各々に計算を分担させるハイブリッド・シミュレーションがある。

アナログ計算機は，電圧・電流等に事象を対応させているため実験の範囲に入れることもできるが機械系等を電気系に対応づけることもできることからシミュレーションのための機械と考えることができる。

ディジタル計算機の場合，FORTRAN 等の高級言語が開発され，数式をそのまま計算機で処理できるようになり，また近年のハード・ソフトの進歩によってシミュレーションのための重要な道具となってきた。

普通シミュレーションと言えば，ディジタル計算機を用いた計算機シミュレーションを指すまでに普及してきている。

これは実世界の事象をシンボルで表わし，そのシンボルにFORTRAN 等の言語を通して数値をもたせ，その数値が他のシンボルの数値と共にいかなる関係で変化す

表1　シミュレーション・モデルと使用機器・手法

使用機器・手法 / モデルの表現方法	実物機器	計算機		理論
		アナログ計算機	ディジタル計算機	
偶像モデル	将棋 継々ごと遊び チェス			
相似モデル	風洞・実験 水槽による潮の流れの実験	電気・機械系の模擬		
シンボルで構成されたモデル			数式モデルによる数値計算	数式モデル解析

るかを観察し，その数値を実世界に置き替えるものである。

そういう意味でシンボル化されたモデルを用いている。

以上述べたモデルと手法を整理すると表1のようになる。

2.3　実時間シミュレーション

計算機内のモデルは，そのハードウェアの許す演算速度の範囲内で処理されるので，計算機内のモデルが持つ時間（論理時間）と演算に要する処理時間とは一致しないのが普通である。

そこで，処理時間とシミュレーションの論理時間が一致している場合，実時間シミュレーションと言い，通常の計算機シミュレーションと区別している。

アナログ計算機ではタイム・スケール（Time Scale）を1にした場合のシミュレーションのことであるが，ディジタル計算機を用いて実時間シミュレーションを行うためには計算機に実時間クロックを実装し，そのクロックと同期して動特性を模擬する[4),5)]。

以上から位置づけると本稿で述べる実時間飛行シミュレーションとは航空機の動特性をディジタル計算機を用いて実時間で模擬し（Symbolic Model），その演算結果を用いて滑走路・計器等のパイロット周辺の環境を現実に想定される状態に再現（Analog Model）して行なうパイロットを含む人間－機械系の実験のことを言う。

3.　FSPP

航技研の汎用飛行シミュレータを用いるシミュレーションは大部分中大型航空機のそれで，型態の異なるVTOL，ヘリコプターのシミュレーションはほとんどない。

したがって，機体諸元・空気力学データを自由に設定できる汎用飛行プログラムを用意しておくと大部分のシミュレーションを包含できると考えられ，この方針に従って開発したのがFSPPである。

3.1　特徴

FSPPの特徴を以下に記す。

(1)　航空機に関するシミュレーションを行う場合に必要となる航空機の基本的な数学モデルを各機能ごとに分割作成してある。

(2)　全体で1個のジョブを形成し，標準的な航空機を模擬できる。

(3)　広範囲の要求に応ずることができるように，利用者が作成したサブプログラムと入替え結合することができる。

(4)　空気力学データをテーブル形式で作成してあるので，機種の変更に対して数式モデルを変更することなく空気力学データの変更で，ある程度対処できる。

(5)　FSPP の各サブプログラムは，システム・プログラムが有する種々のサービスを受けることができる。

(6)　Boeing-707 の機体諸元を参考にしてあらかじめ値を設定してあるので変更を要する部分のパラメータだけを設定するだけでシミュレーションができる。

3.2　サブ・プログラムの構成

シミュレーション・プログラムを作成する時，その動特性（力学系）をいくつかの機能別ブロックに分け，それらを結合して全動特性を構成すると理解しやすい。FSPP を開発する時にもこの手法を取った。

各ブロック毎に入力変数・出力変数を明確にしサブプログラムを作成した（図1参照）。

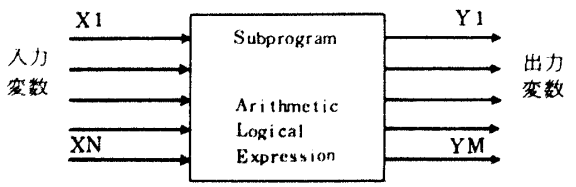


図1　サブプログラムの構成

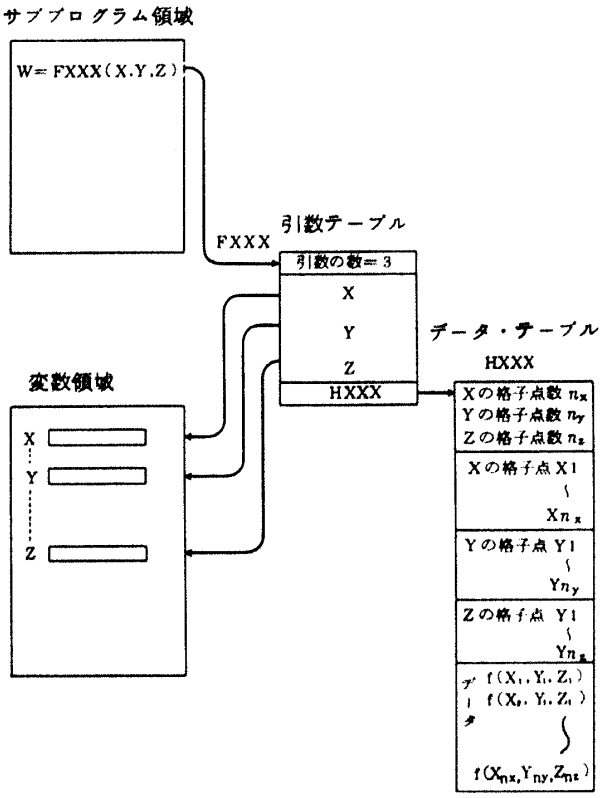


図2　引数3ケの函数の構成例

FSPPは，飛行運動力学，エンジン力学，外部機器インターフェィスのサブプログラムから構成されており，その数式モデルを付録1に示す。

3.3　函数

FSPPは機体諸元，空気力学データを目的に応じて比較的容易に入れ替えることができる。

機体諸元は大部分スカラー変数として与えられ，空力データは配列（Vector，Arrayを含む。）として与えられる。

空気力学係数等を求める時には，迎角，速度等を引数とした函数を参照するが，シミュレーションの範囲が音速を含む範囲内で行うとすると，引数としてマッハ数が必要となったり，亜音速および超音速であればマッハ数が不要となったり，その引数は必ずしも固定ではない。そこで目的によっては引数および引数の数を変更できるように，またデータ，格子点（Break Point）の数およびその値を変更できるようにプログラムと引数テーブル，データ・テーブルの各々を分離している（図2参照）。

引数テーブル，データ・テーブルはライブラリー形式で保存するため（FSPPライブラリー）変更する時には，結合編集時に変更する部分のライブラリーを先に結合する。

4.　飛行シミュレーション

ここではFSPPを用いた飛行シミュレーションについて記す。

以下飛行シミュレータの構成，計算機システム（FSK－Ⅱ）の構成，シミュレーション・プログラムの生成，初期値設定，シミュレーションの実施の順に記す。

4.1　飛行シミュレータの構成

航技研のシミュレータは次のものから構成されている（図3参照）。

(1)　人間に臨場感を与える外部機器装置

可動模擬操縦席装置（Moving Base Cockpit）：人間が搭乗し，操縦席を油圧駆動回路で動揺して加速・回転を行う。

操舵力負荷機構（Control Loading System）：操舵反力を発生する。

模擬視界装置（Visual Display System）：地形・滑走路等の模型上をテレビ・カメラが移動し，その映像をスクリーンに投影して外部視界を発生する。

計器盤：速度・高度等の航空機の状態を表わす。

(2)　変数および手動操作を記録するペンレコーダ等の計測機器

(3)　実験機器を接続したり，シミュレーションのパラメータを設定するための汎用入出力盤

(4)　機器の性能試験に用いるフライト・テーブル

(5)　航空機の動特性を実時間で模擬するための計算機システムおよび特殊目的使用のためのアナログ計算機

(6)　前述の装置を結合するためのインターフェイス

パイロットの前面には，スクリーンがあり，滑走路等の外部視界が投影される。

また，操縦席の手前には計器盤とスロットル・レバー，操縦桿がある。

パイロットは外部視界，計器，操縦桿の反力および操縦席の加速度等から，自分が操縦している航空機の状態を知ることができる。

パイロットの操舵信号はI/Oリンケージを経て航空機の運動を模擬している計算機に入る。

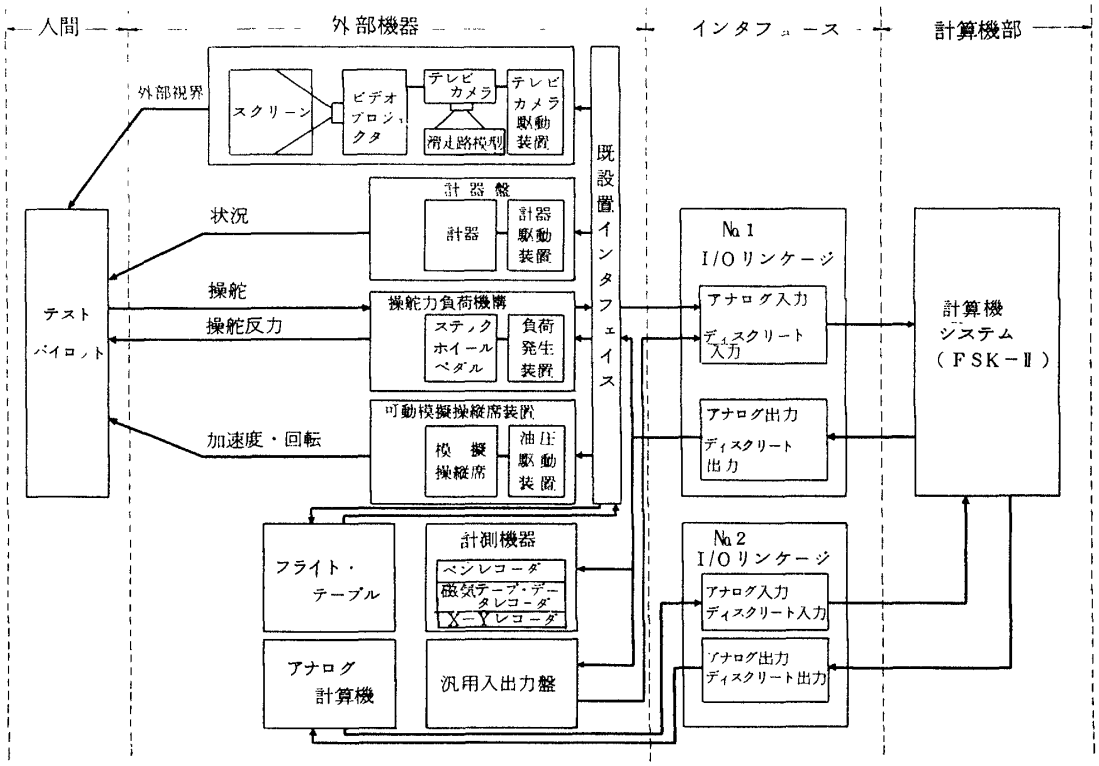


図3　シミュレータの構成

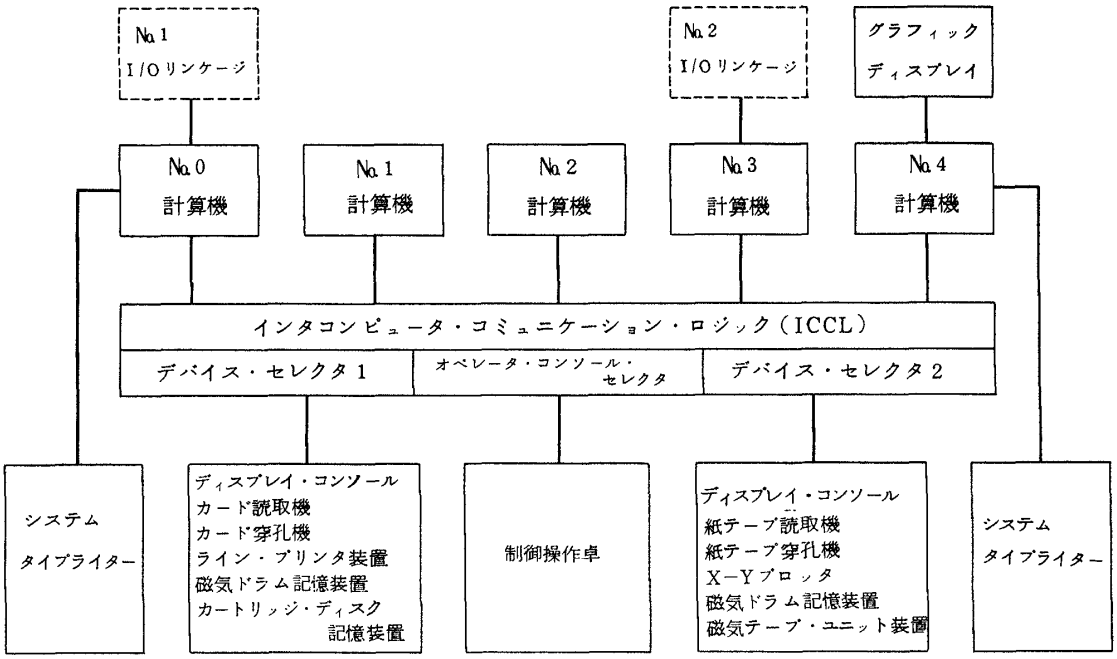


図4　計算機システム（FSK－Ⅱ）の構成

その入力に対する計算機内の動特性の応答はI/Oリンケージを経て可動操縦席装置等に送られ，操縦に必要な情報をパイロットに表示する。

これらの人間周辺の機器については，既に文献1，6，7に報告されている。

4.2 計算機システム（FSK－Ⅱ）の構成

計算機システム（FSK－Ⅱ）のハードウェア構成を図4に示す。

メモリ・サイクル880 ns，1語16ビットのミニコン（MELOM 70）が5台あり，計算機間でデータ転送を行うためのインタコンピュータ・コミュニケーション・ロジック（ICCL），計算機システム全体を制御するための制御操作卓，入出力機器およびそれらを任意の計算機に接続するためのデバイス・セレクタを備えている。

またソフトウェアの構成を図5に示す。

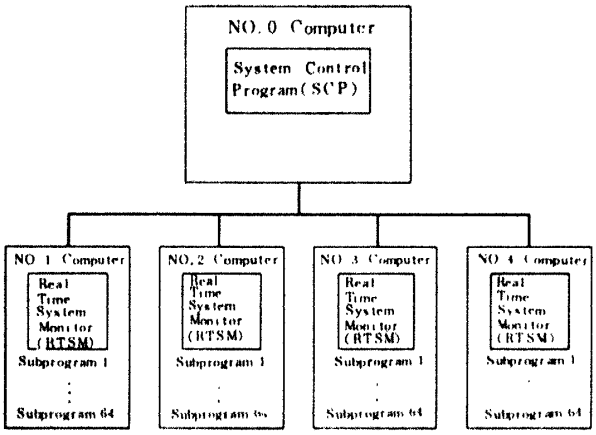


図5 ソフトウェアの構成

NO. 0計算機にはSystem Control Program（SCP）が，NO. 1～NO. 4計算機にはReal Time System Monitor（RTSM）が入る。

SCPはNO. 1～NO. 4計算機のRTSMに対して10 msの間隔で同期信号を送る。また，演算開始・停止等の信号を送り実時間シミュレーションを制御する機能を有すると共に，言語処理，結合編集等のためのサービス処理プログラムを読み出し起動する機能がある。

RTSMは最大64個のサブプログラムを16個ずつの4レベルに分割し，SCPから送られてくる同期信号に連動して，各レベルごとにあらかじめ設定された周期で処理する。

これらについては文献2，4，5に既に報告されている。

FSPPの各サブプログラムはRTSMの制御の下に動作し，RTSMが有する種々のサービスを受けることができる。

4.3 シミュレーション・プログラムの生成

FSPPのサブプログラムをNO. 1，NO. 2計算機に分割し，NO. 0計算機で全体の同期を取り，飛行シミュレーションを行った。

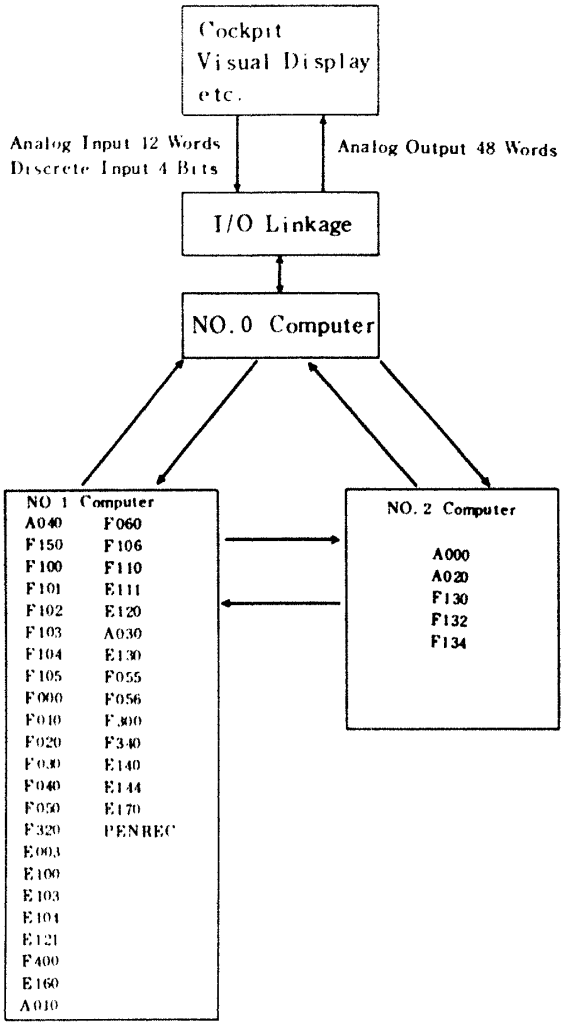


図6 サブプログラムの割付け

その時の，サブプログラムの割付を図6に示す。図中でF000～F400，E003～E170，A000～A040，PENREC はサブプログラム名であり，その内容をProgram NO. として付録1に示してある。

FSPP の各サブプログラムはアセンブラ言語で記述されており，アセンブラで変換されたFSPP の再配置可能なオブジェクト・プログラムをライブラリーと共に結合するのは結合編集プログラム（LEP）である。

また，それは計算機間の転送データおよびI/Oリンケージで入出力するデータを識別し，その制御情報を生成し，指定した計算機にプログラムを組込む機能を有する。

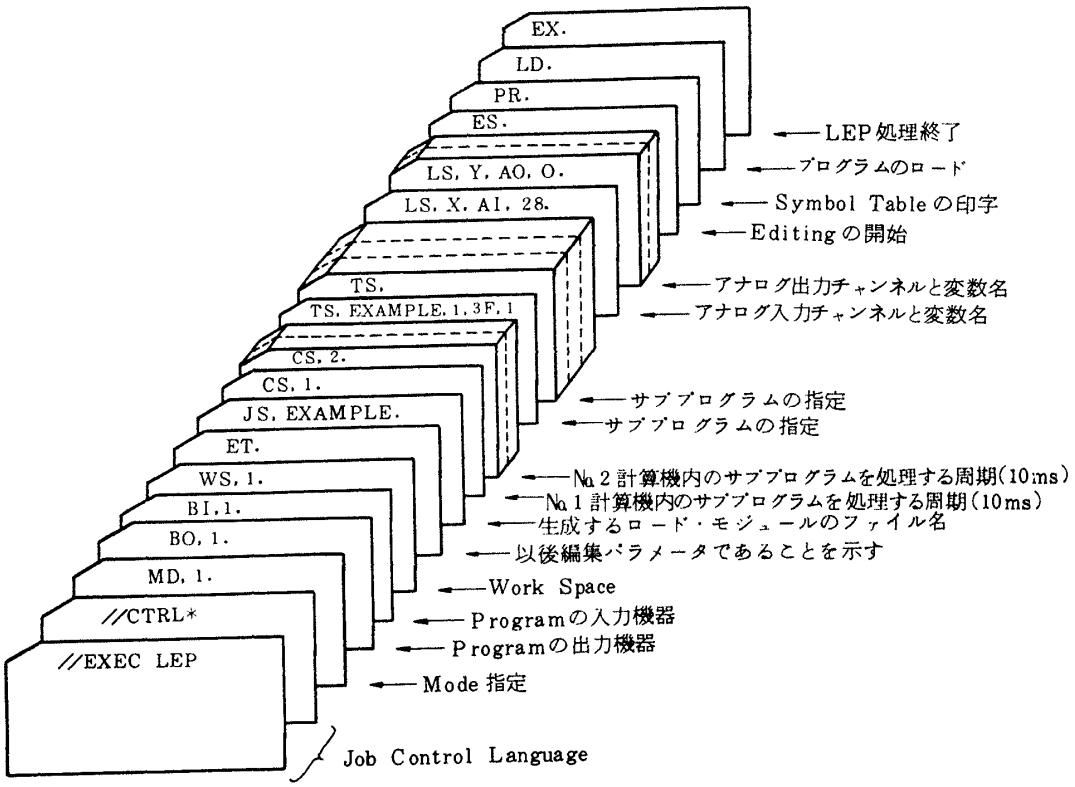


図7　LEPのジョブ制御

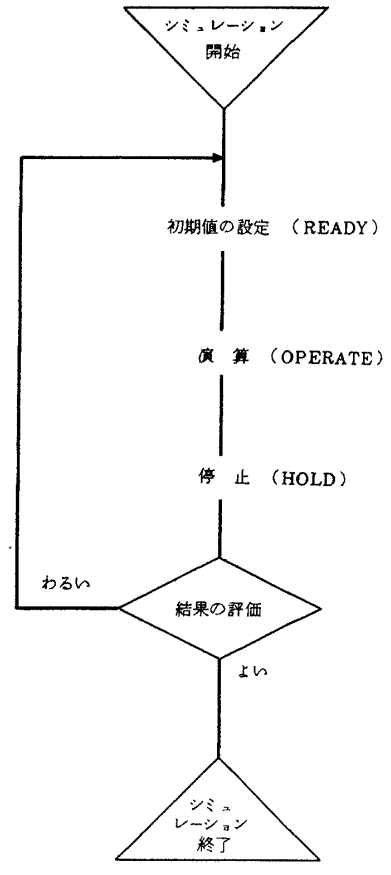


図8　シミュレーションの流れ

FSPPの場合のLEPパラメータを付録2に，その説明を図7に示す。

また，LEP で結合した時のシンボル・テーブルを付録3に示す。

4.4　初期値および印字出力変数の設定

プログラムが完成すると飛行シミュレーションは図8に示すように初期値の設定，演算，停止の順に進行しこれが何度も繰返される。

初期値の設定法としてプログラム内に記述しておくこともできるが，初期値の変更の度にサブプログラムの入れ替えが必要となるため，このシステムではプログラムをLEPで組込んだ後にSCPを通して設定する方法がとられている。組込まれたプログラムには変数の属性に関する情報がもはやないため，初期値設定に先だち変数の属性（単精度/倍精度等）を設定しなければならない。このために属性テーブルを設定する。

変数値を印字する場合，変数の変更を容易にするために出力変数をサブプログラム内に記述せずにプログラム組込み後に指定する。このためにHOLD テーブルを設定する。

図9にこれらのテーブルを設定するためのカードの並びおよびFSPPの属性テーブル，READY テーブル，HOLD テーブルを付録4，5，6に示す。

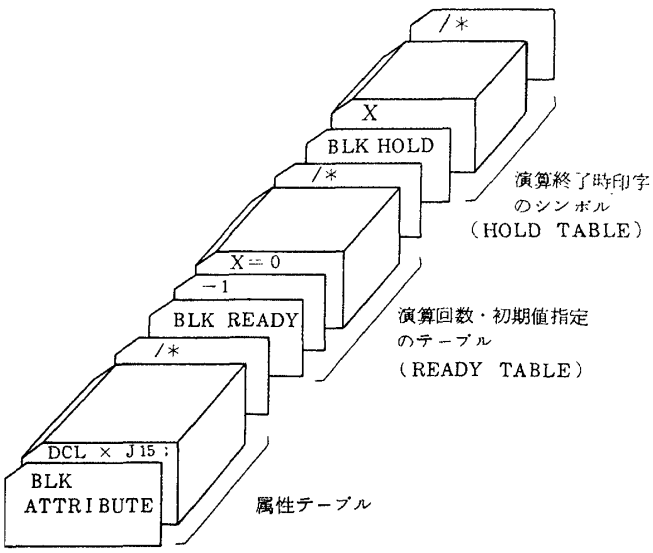


図9 各種テーブル

これらのテーブルはオペレータ・コンソール上のファンクション・スイッチ“CARD READ”で読み込まれ，“READY”で初期値が設定され，“OPERATE”で演算し“HOLD”で演算を停止し，その時の変数値がドラムに出力される。

印字する時には“PRINT(HOLD)” スイッチを押す[2]。

4.5 シミュレーションの実施

機種として，Boeing-707 の機体諸元を参考にした。図 10 ～ 14 に航空機の運動例を示す。

この時の計算機間のデータ転送，同期については文献 4，5 に既に報告しているので参照されたい。

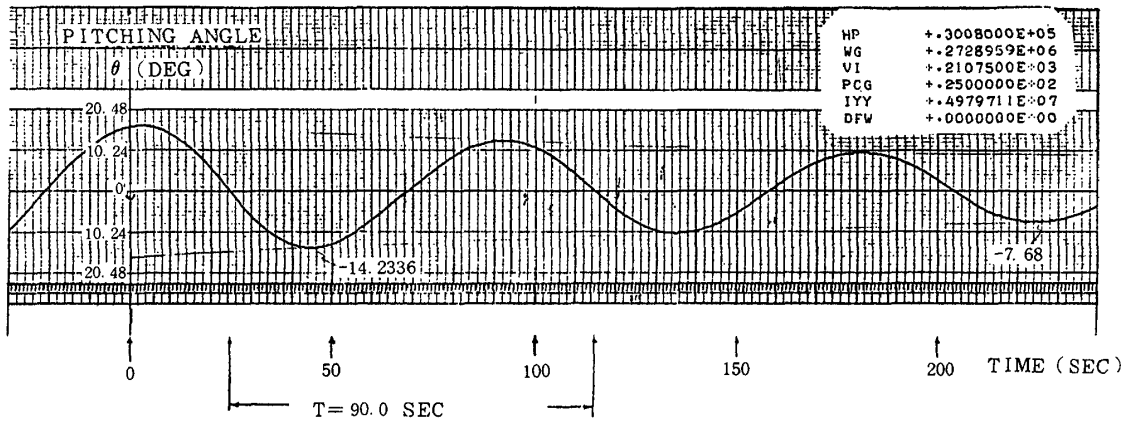


図 10 巡航時の縦運動

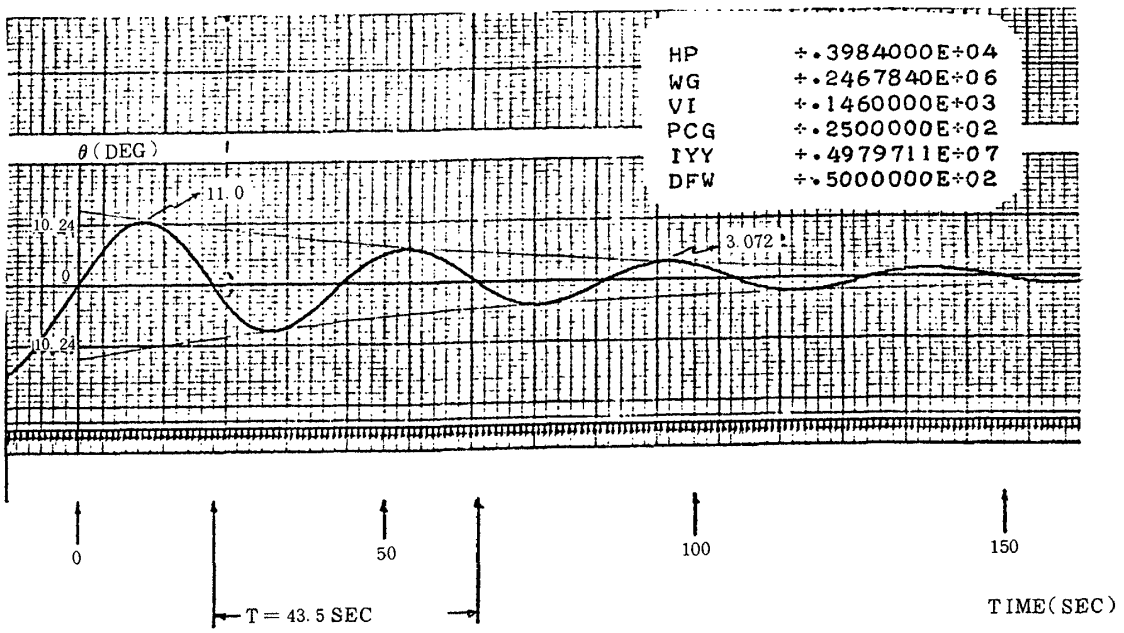


図 11 着陸時の縦運動例

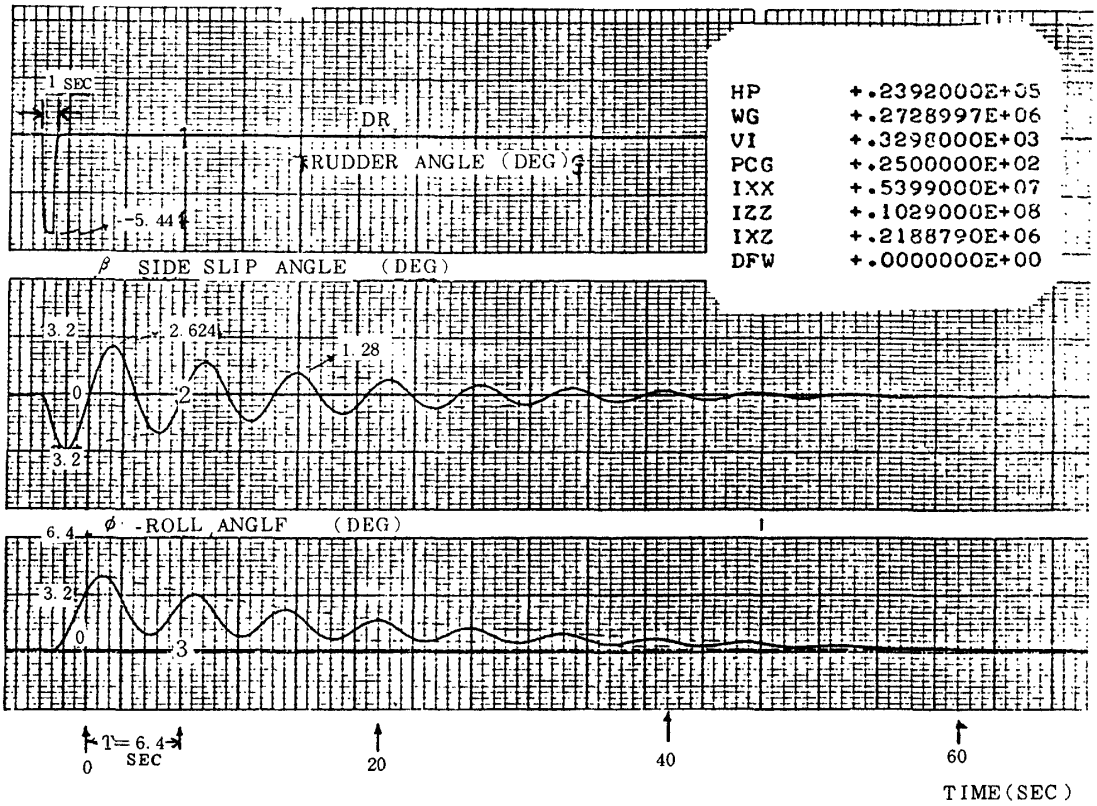


図 12　巡航時の横運動例

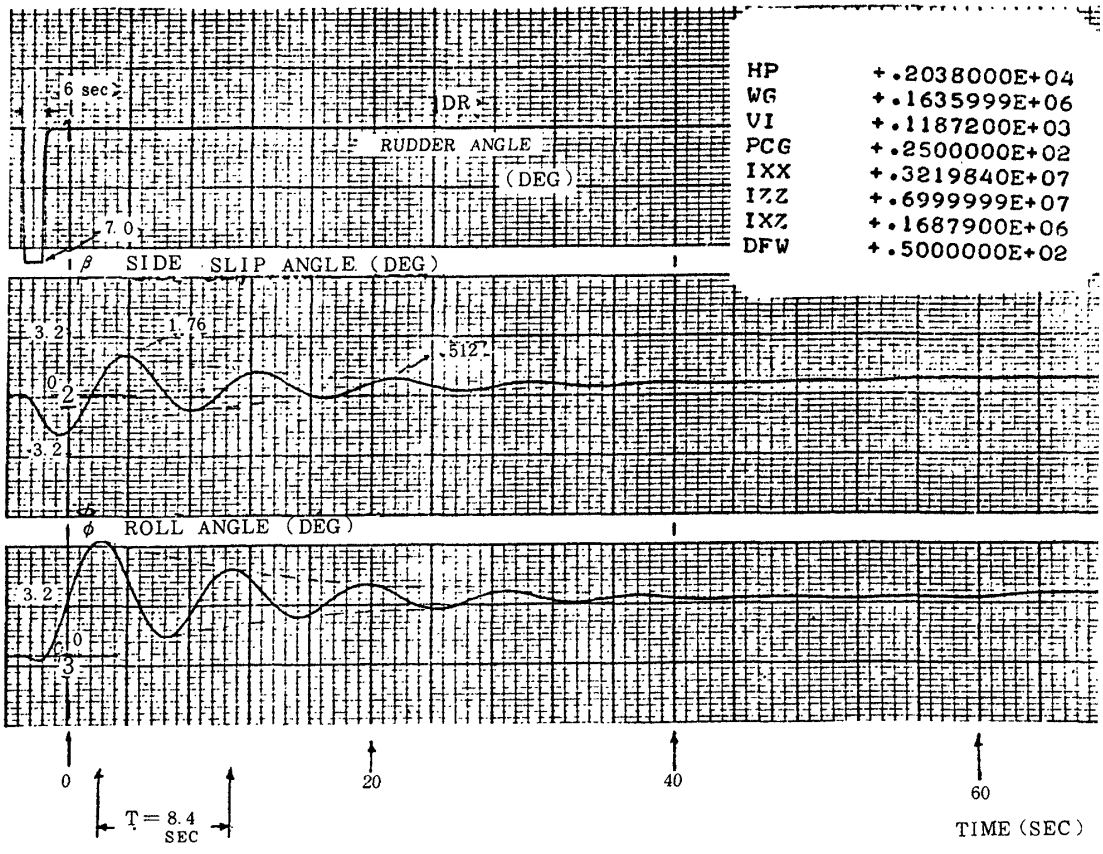


図 13　着陸時の横運動例 (1)

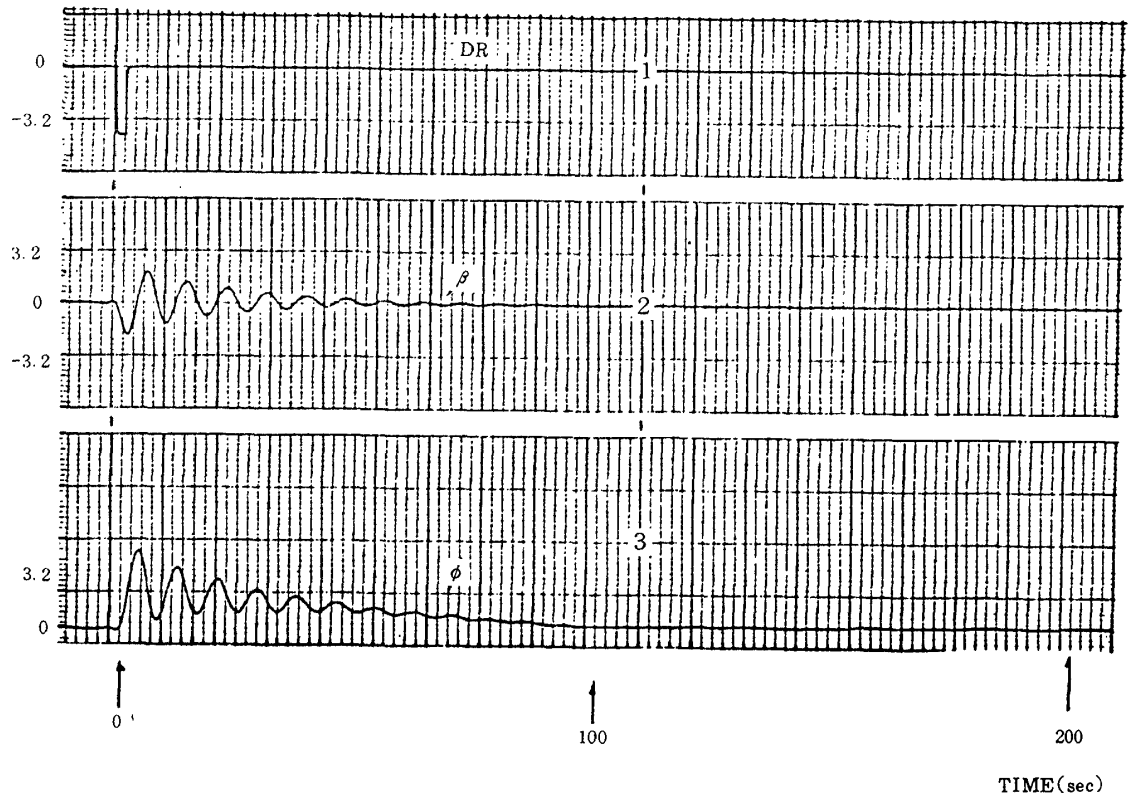


図 14　着陸時の横運動例 (2)

5。おわりに

FSPP は汎用飛行シミュレータを使用するための汎用プログラムであり昭和 50 年 6 月にFSK－Ⅱ システムの機能性能試験に用いて，その有効性を確認した。

今後，STOL等のシミュレーションに広く利用されるものと思う。より使い易くするためにはデータの設定法等に改良の余地があり，今後の課題である。

最後に，FSPPの開発には三菱プレシジョン（株）の協力があったことを記しておく。

参　考　文　献

1) 松浦他：汎用飛行シミュレータ設備の計画・構造および特性，航空宇宙技術研究所報告，TR－70，1965 年 1 月

2) 原田：航空宇宙技術研究所汎用飛行シミュレータ用複合計算機（FSK－Ⅱ），航空宇宙技術研究所報告，TR－553，昭和 53 年 12 月

3) J. A. White 他 ； Analysis of Queueing Systems, ACADEMIC PRESS, NEW YORK (1975), p. 11.

4) 原田：シミュレーション用複合計算機（FSK－Ⅱ）のデータ転送と制御，情報処理第 18 巻第 11 号，昭和 52 年 11 月，pp. 1123 ～ 1129

5) 原田：シミュレーション用複合計算機（FSK－Ⅱ）のデータ転送と制御，航空宇宙技術研究報告，TR－511，1977 年 8 月

6) 百名他：VTOL．機操縦研究設備，航空宇宙技術研究報告，TR－169，1968 年 2 月

7) 池谷：飛行シミュレータ用操舵力負荷機構の試作研究，日本機械学会第 858 回講演会論文集，1975 年 8 月，pp. 129

付　録　1

ＦＳＰＰの数式モデル

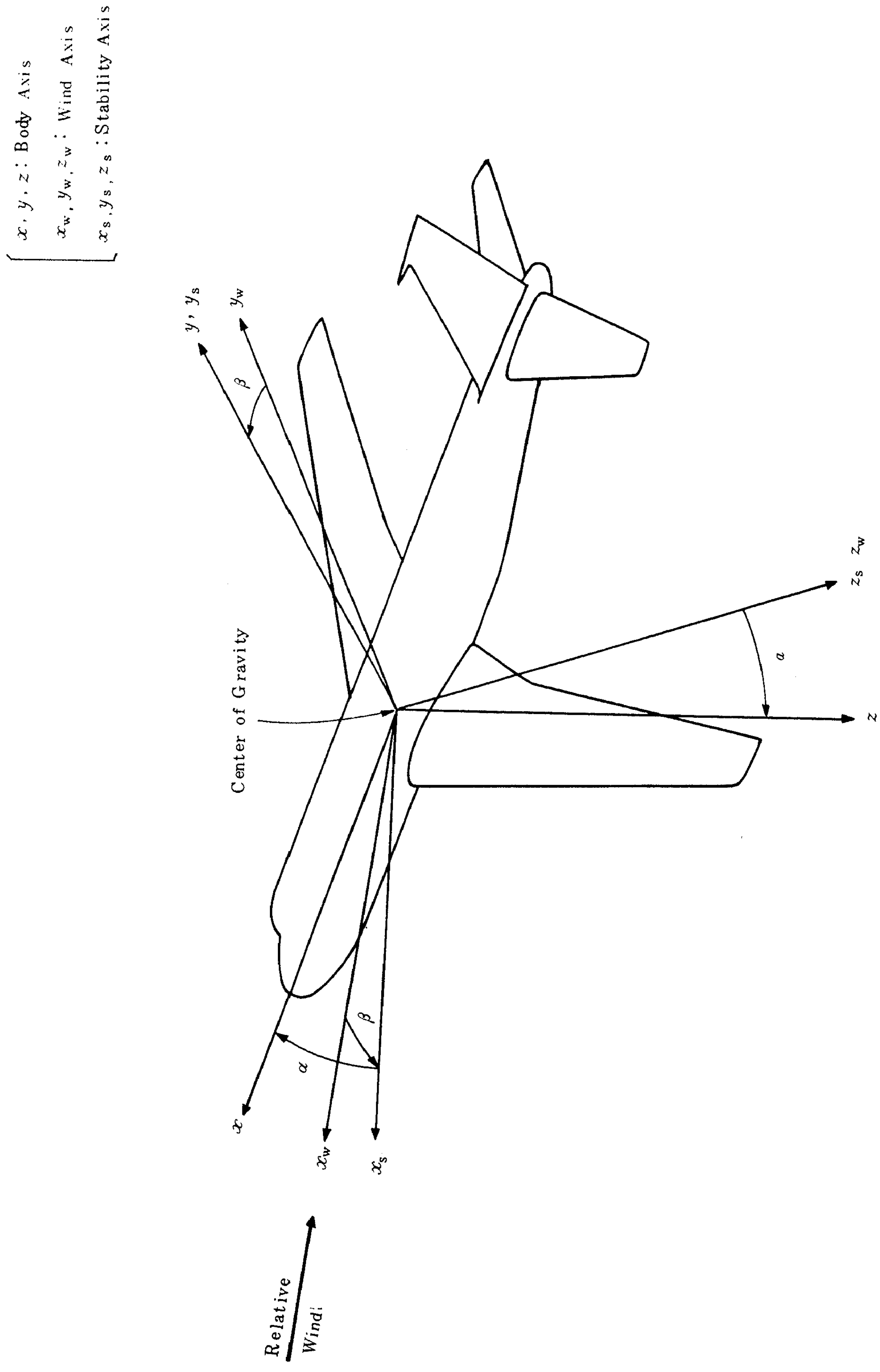
第１部　　説　明　図

第２部　　飛行運動力学

第３部　　エンジン力学

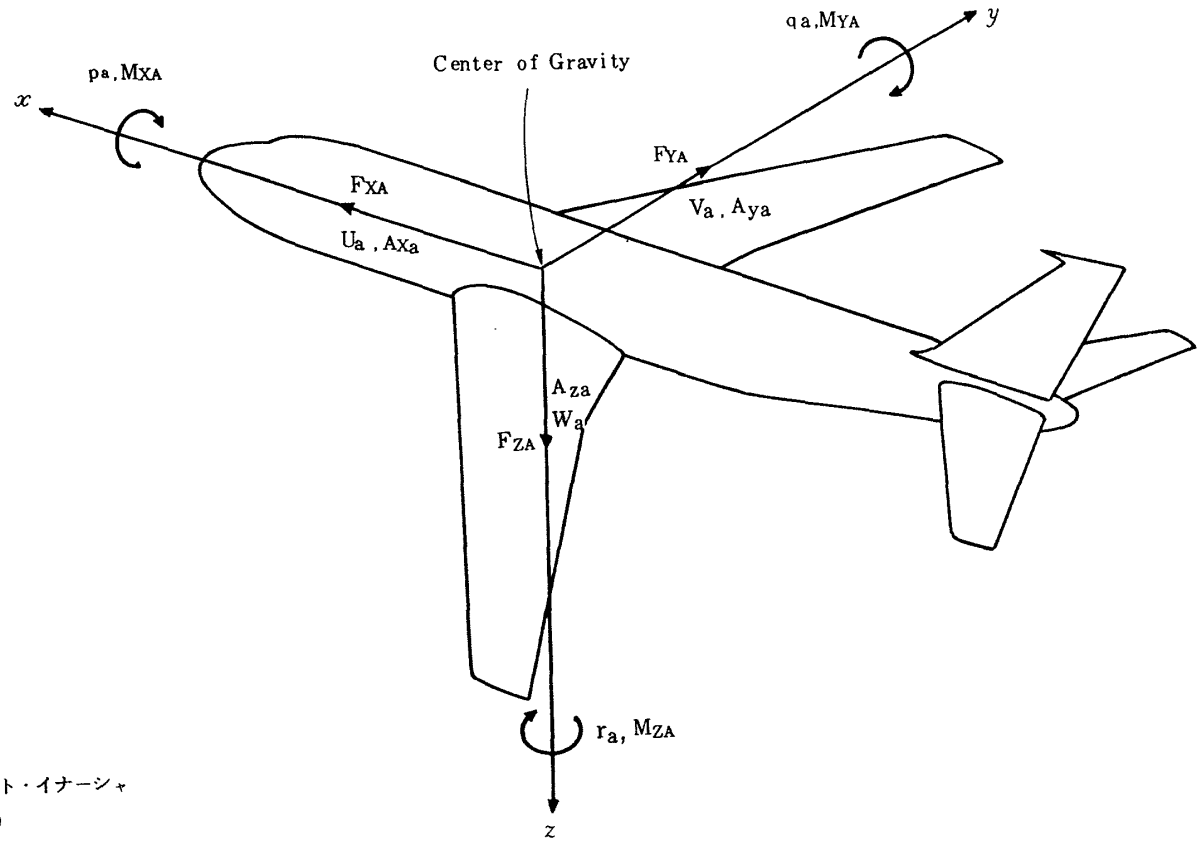
第４部　　外部機器インタフェイス

第1部　説　明　図



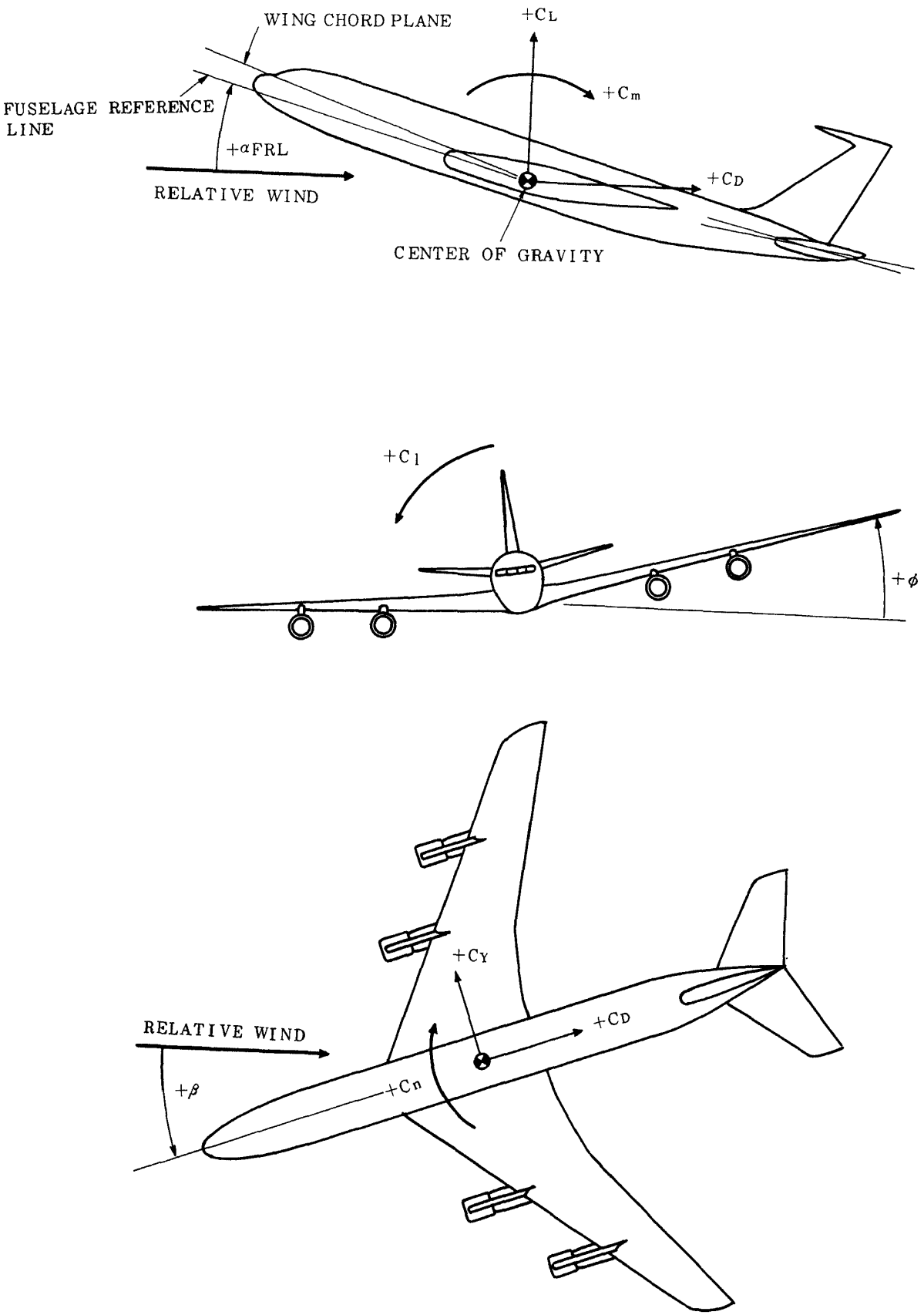
x, y, z : Body Axis
x_w, y_w, z_w : Wind Axis
x_s, y_s, z_s : Stability Axis
y, y_s
y_w
β
Center of Gravity
z_s z_w
α
z
x
x_w
x_s
Relative Wind

説明図 1　座　標　軸

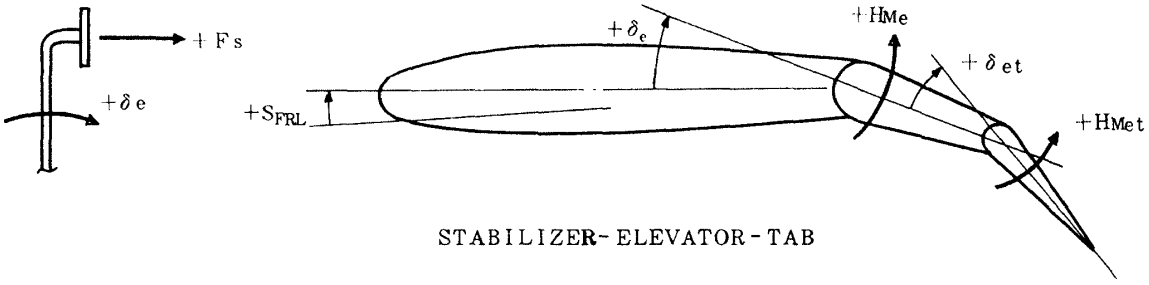


F_{XA}, F_{YA}, F_{ZA}	：	力の成分
M_{XA}, M_{YA}, M_{ZA}	：	モーメントの成分
U_a, V_a, W_a	：	重心の加速度成分
p_a, q_a, r_a	：	重心の角速度成分
A_{XA}, A_{YA}, A_{ZA}	：	重心の加速度成分
I_{XX}, I_{YY}, I_{ZZ}	：	軸まわりのモーメント・イナーシャ
ϕ	：	角変位（バンク角）
θ	：	角変位（ピッチ角）
ψ	：	角変位（ヨー角）

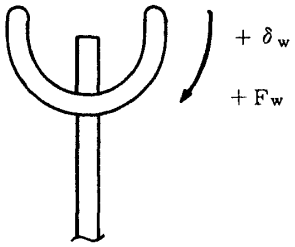
説明図２　重心まわりの各成分



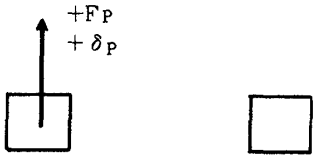
説明図 3　空気力学係数



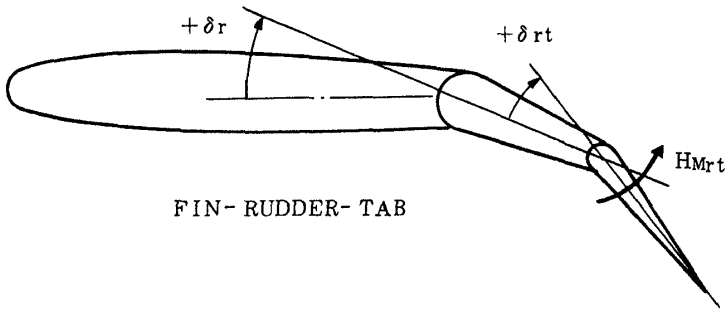
STABILIZER-ELEVATOR-TAB



PILOTS WHEEL

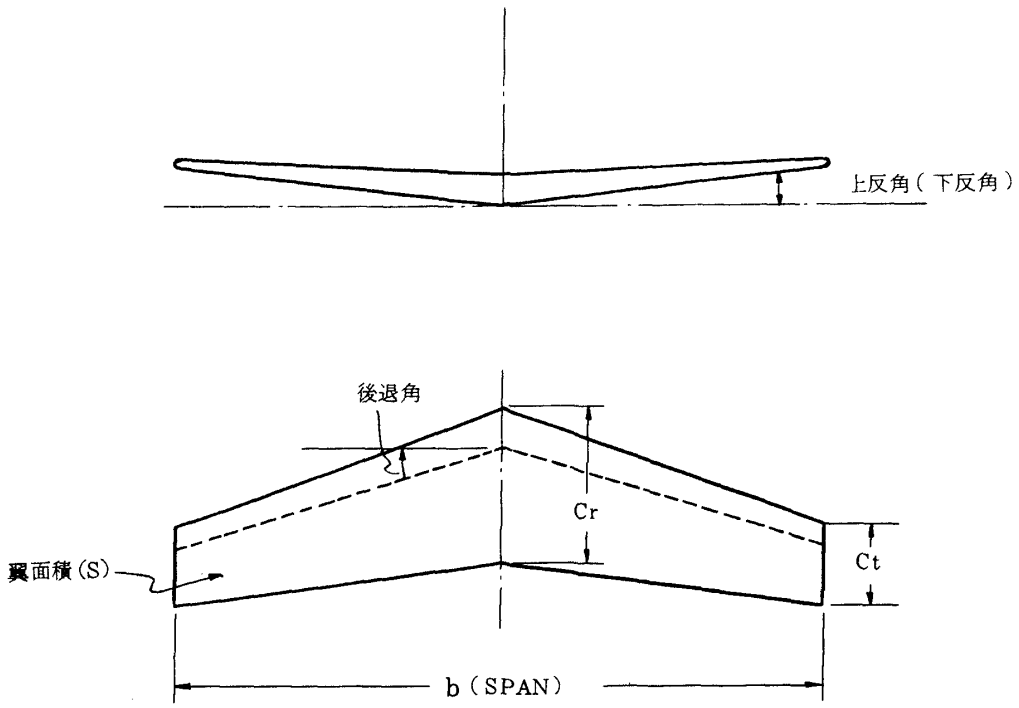


RUDDER PEDALS
(TOP VIEW)

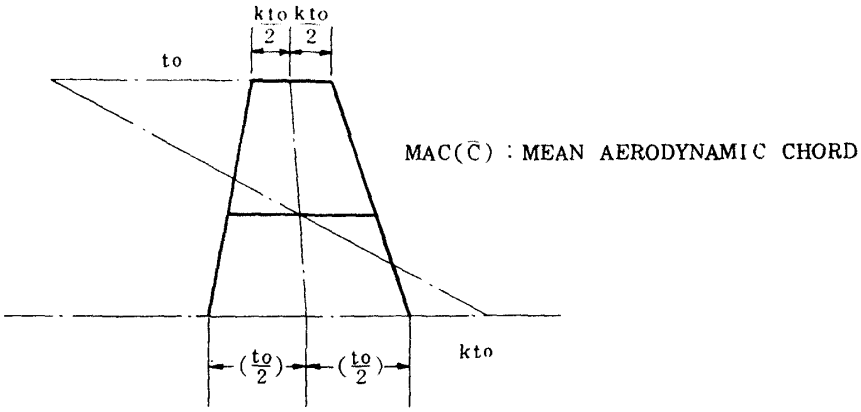


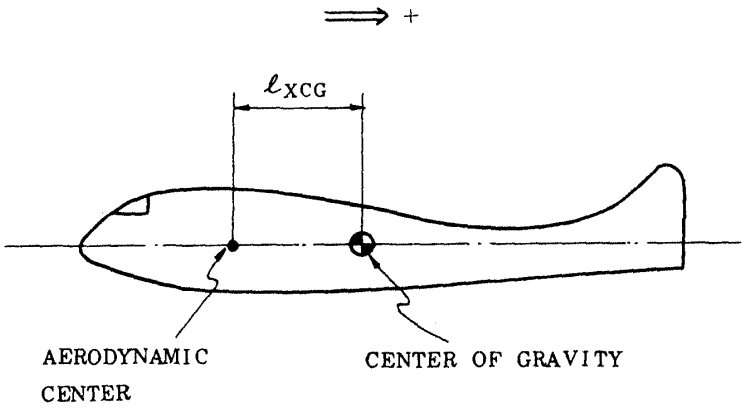
FIN-RUDDER-TAB

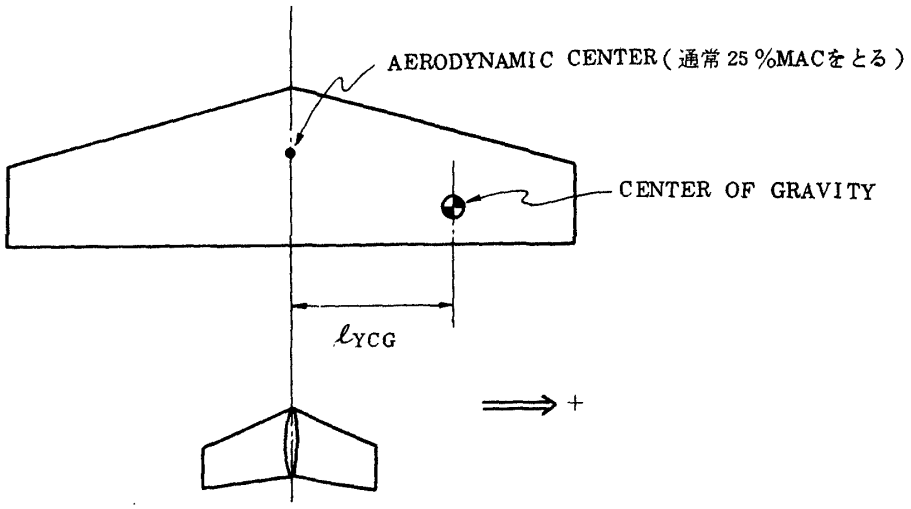
説明図4 制 御 操 作



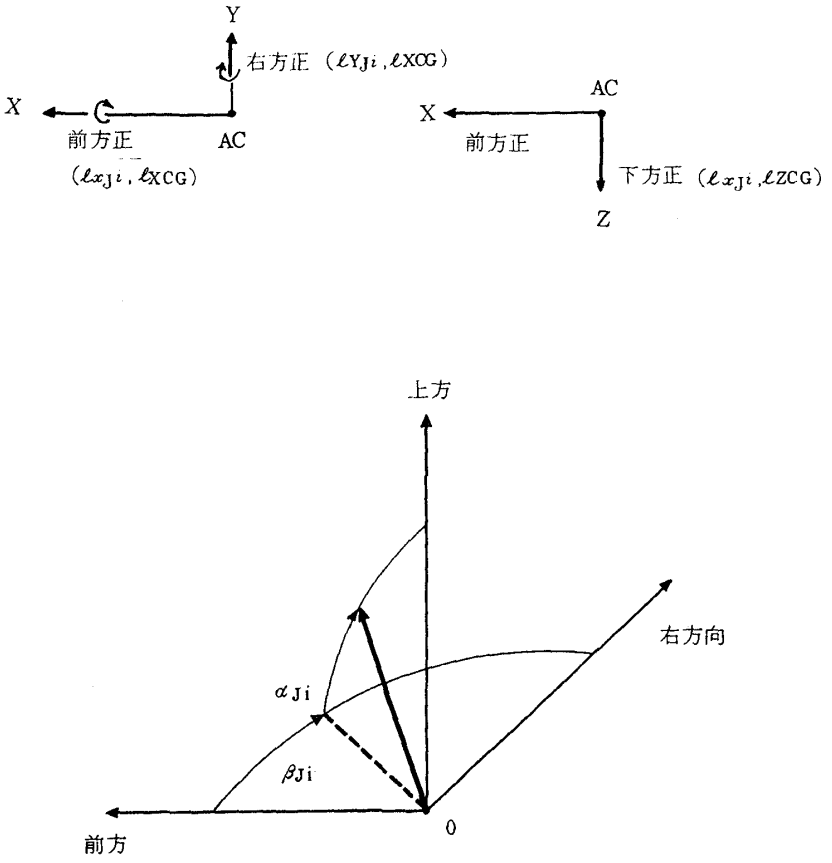
説明図 5　翼



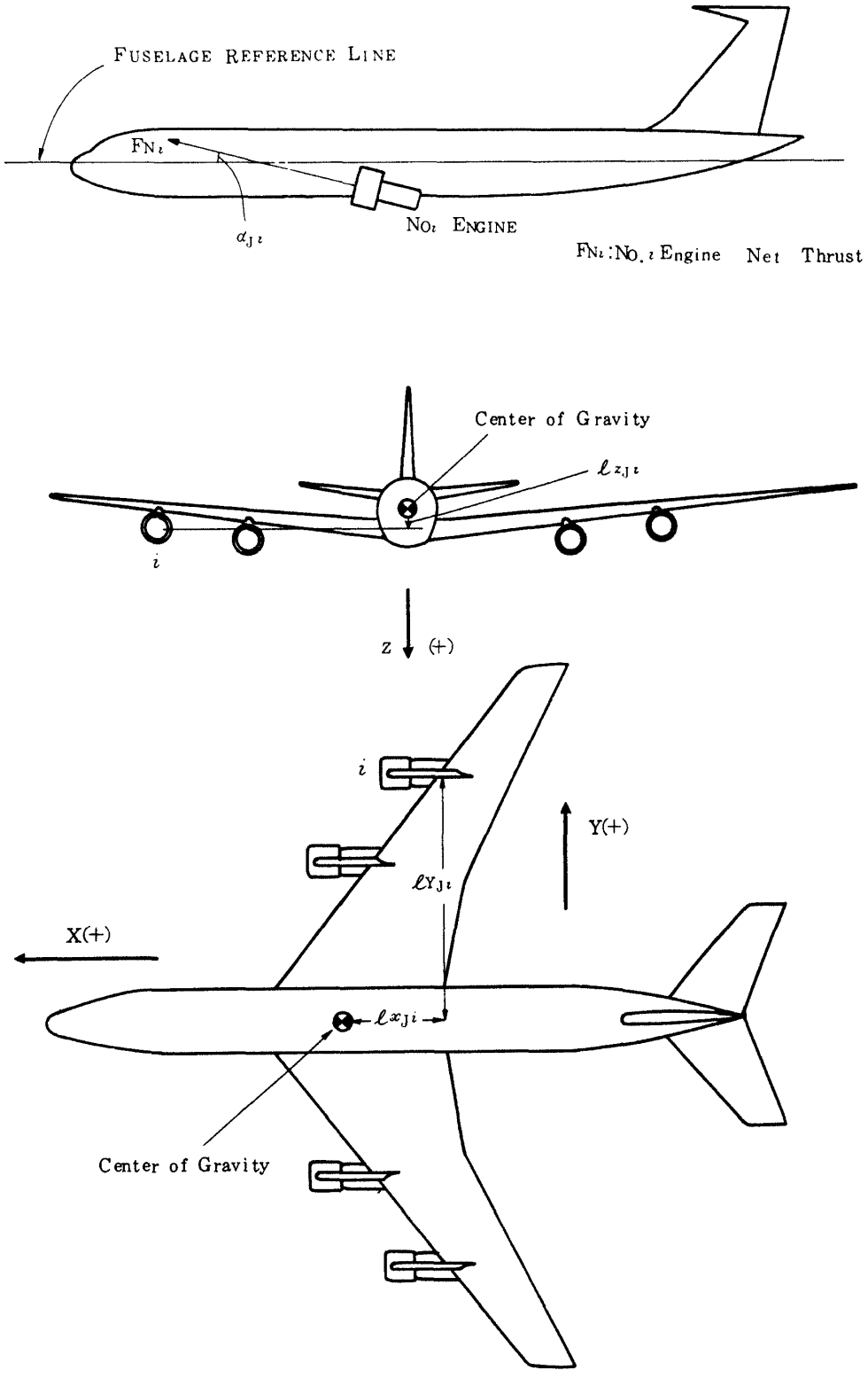




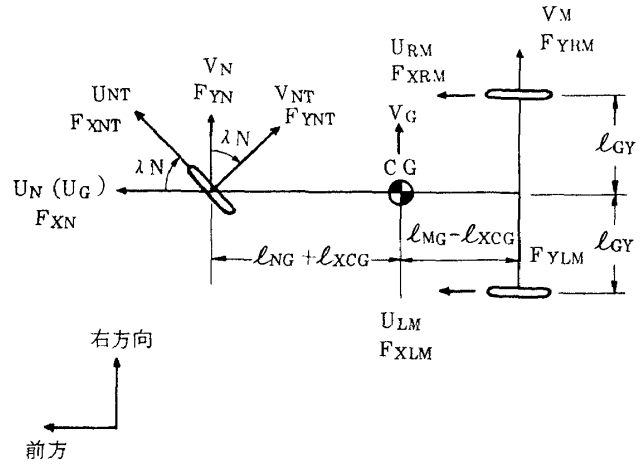
説明図 6　重心と空力中心

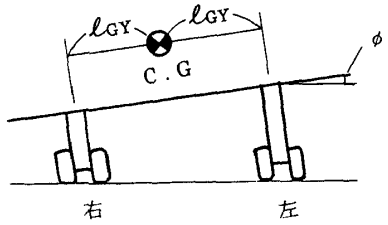


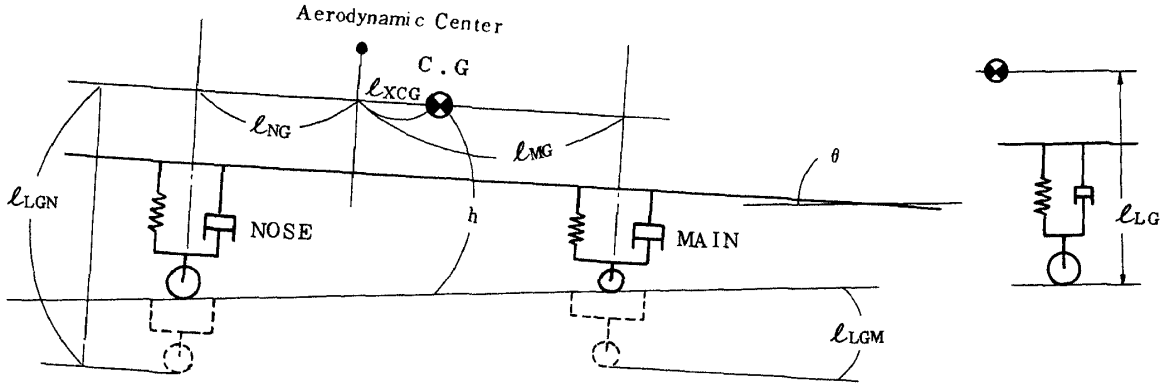
説明図 7　エンジン取付角と位置の符号



説明図 8　エンジンの位置と推力







説明図 9　脚

第2部　飛行運動力学

CORE TYPE

AM	ARITHMETIC
DM	BOOLEAN
CA	CARD INPUT CONSTANT
CD	CARD INPUT FLAG
AI	ANALOGUE INPUT
AO	ANALOGUE OUTPUT
DI	DISCRETE INPUT
DO	DISCRETE OUTPUT

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE

BODY AXIS FORCE & MOMENT

PROGRAM NO. F000

PAGE NO. 1 OF 3

AM	Q	DYNAMIC PRESSURE	q
F320			03
CA	S	WING SURFACE AREA	S
			01
CA	B	WING SPAN	B
			07
CA	C	MEAN AERODYNAMIC	C
		CHOAD	08
AM	CD	DRAG COEF.	CD
F101			13
AM	CY	SIDE FORCE COEF.	CY
F103			15
AM	CL	LIFT COEF.	CL
F100			13
AM	C1	ROLLING MOMENT COEF.	Cℓ
F104			15
AM	CM	PITCHING MOMENT COEF.	Cm
F102			13
AM	CN	YAWING MOMENT COEF.	Cn
F105			15
AM	COSA	COS ALPHA	COSα
F040			15

ITERATION RATE: 12.5/SEC

EQUATION:

$$\begin{cases} FXS = -\bar{q}\cdot S\cdot CD \\ FYS = \bar{q}\cdot S\cdot CY \\ FZS = -\bar{q}\cdot S\cdot CL \end{cases}$$

$$\begin{cases} MXS = \bar{q}\cdot S\cdot B\cdot C\ell \\ MYS = q\cdot S\cdot C\cdot Cm \\ MZS = \bar{q}\cdot S\cdot B\cdot Cn \end{cases}$$

$$\begin{cases} FXA' = (FXS\cdot COS\alpha - FZS\cdot SIN\alpha) \\ FYA' = FYS \\ FZA' = (FXS\cdot SIN\alpha + FZS\cdot COS\alpha) \end{cases}$$

$$\begin{cases} FXA = FXA' + FXJ + FXG \\ FYA = FYA' + FYJ + FYG \\ FZA = FZA' + FZJ + FZG \end{cases}$$

FXA	TOTAL FORCE X-ACFT	FXA	
10	AXIS	(DOUBLE)	
FYA	TOTAL FORCE Y-ACFT	FYA	
10	AXIS	(DOUBLE)	
FZA	TOTAL FORCE Z-ACFT	FZA	
10	AXIS	(DOUBLE)	
MXA	TOTAL MOMENT	MXA	
04	X-ACFT AXIS	(DOUBLE)	
MYA	TOTAL MOMENT	MYA	
04	Y-ACFT AXIS	(DOUBLE)	
MZA	TOTAL MOMENT	MZA	
04	Z-ACFT AXIS	(DOUBLE)	

EQUATION NO: F000

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: BODY AXIS FORCE & MOMENT

PROGRAM NO.: F000

PAGE NO.: 2 OF 3

AM	SINA	SIN ALPHA	SINα
F040			15
CA	LXCG	CG POS X-ACFT	ℓXCG
F340		AXIS	11
AM	LYCG	CG POS Y-ACFT	ℓYCG
F340		AXIS	11
AM	FXJ	ENG FORCE X-ACFT	FXJ
F060		AXIS	-03
AM	FYJ	ENG FORCE Y-ACFT	FYJ
F060		AXIS	-03
AM	FZJ	ENG FORCE Z-ACFT	FZJ
F060		AXIS	-03
AM	FXG	GROUND FORCE X-ACFT	FXG
F050		AXIS	-06
AM	FYG	GROUND FORCE Y-ACFT	FYG
F050		AXIS	-06
AM	FZG	GROUND FORCE Z-ACFT	FZG
F050		AXIS	-06
AM	MXJ	ENG MOMENT X-ACFT	MXJ
F060		AXIS	-11
AM	MYJ	ENG MOMENT Y-ACFT	MYJ
F060		AXIS	-11

ITERATION RATE:

EQUATION:

$$MXA = (MXS \cdot COS\alpha - MZS \cdot SIN\alpha) - \ell YCG \cdot FZA' + MXJ + MXG$$

$$MYA = MYS - \ell XCG \cdot FZA' + MYJ + MYG$$

$$MZA = (MXS \cdot SIN\alpha + MZS \cdot COS\alpha) - \ell XCG \cdot FYA' + MZJ + MZG$$

EQUATION NO.: F000

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	MZJ	ENG MOMENT Z-ACFT	MZJ
F060		AXIS	-11
AM	MXG	GROUND MOMENT	MXG
F050		X-ACFT AXIS	-11
AM	MYG	GROUND MOMENT	MYG
F050		Y-ACFT AXIS	-11
AM	MZG	GROUND MOMENT	MZG
F050		Z-ACFT AXIS	-11

ITERATION RATE:

TITLE

BODY AXIS FORCE & MOMENT

EQUATION:

PROGRAM NO. F000

PAGE NO. 3 OF 3

EQUATION NO:

F000

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
			DOUBLE
AM	FXA	TOTAL FORCE X-	FXA
F000		ACFT AXIS	-10
			DOUBLE
AM	FYA	TOTAL FORCE Y-	FYA
F000		ACFT AXIS	-10
			DOUBLE
AM	FZA	TOTAL FORCE Z-	FZA
F000		ACFT AXIS	-10
AM	WG	GROSS WEIGHT	WG
F340			-08
AM	PAMD	PA DOT MODE TERM	$\dot{p}_{AM}$
F300			13
AM	QAMD	QA DOT MODE TERM	$\dot{q}_{AM}$
F300			13
AM	RAMD	RA DOT MODE TERM	$\dot{r}_{AM}$
F300			13
AM	K	INTEG. CONST.	K
MONITOR			00
AM	IXX	ROLL MOMENT OF	Ixx
F340		INERTIA	-09
AM	IYY	PITCH MOMENT OF	Iyy
F340		INERTIA	-09
AM	IZZ	YAW MOMENT OF	Izz
F340		INERTIA	-09

ITERATION RATE: 12.5/SEC

TITLE: BODY AXIS LINEAR ACCELERATION & ANGULAR VELOCITIES

EQUATION:

LINEAR ACCEL.

$$A_{XA} = \frac{F_{XA}}{W_G} + M_{AXA}$$

$$A_{YA} = \frac{F_{YA}}{W_G} + M_{AYA}$$

$$A_{ZA} = \frac{F_{ZA}}{W_G} + M_{AZA}$$

ANGULAR ACCEL.

$$\dot{p}_{A'} = \frac{1}{I_{XX}} \{ M_{XA} + (I_{YY} - I_{ZZ}) \cdot q_A \cdot r_A + I_{XZ}(p_A \cdot q_A + \dot{r}_A) \}$$

$$\dot{p}_A = \dot{p}_{A'} - \left(\frac{|\sin\phi|}{2^4} - \frac{|\sin\phi|}{2^5} \right)^{\Phi} \cdot \frac{\sin\phi}{|\sin\phi|} + \dot{p}_{AM}$$

$$\dot{q}_A = \frac{1}{I_{YY}} \{ M_{YA} + (I_{ZZ} - I_{XX}) \cdot p_A \cdot r_A + I_{XZ}(r_A + p_A)(r_A - p_A) \} + \dot{q}_{AM}$$

$$r_A = \frac{1}{I_{ZZ}} \{ M_{ZA} + (I_{XX} - I_{YY}) p_A \cdot q_A - I_{XZ}(q_A \cdot r_A - \dot{p}_A) \} + \dot{r}_{AM}$$

PROGRAM NO. F010

PAGE NO. 1 OF 3

A_{XA}	ACCEL X-ACFT AXIS	AXA	AM
13			
A_{YA}	ACCEL Y-ACFT AXIS	AYA	AM
13			
A_{ZA}	ACCEL Z-ACFT AXIS	AZA	AM
12			
$\dot{p}_A$	ROLL ACCEL-ACFT AXIS	PAD	AM
13	(~ RAD/SEC^2)		
$\dot{q}_A$	PITCH ACCEL-ACFT AXIS	QAD	AM
13	(~ RAD/SEC^2)		
$\dot{r}_A$	YAW ACCEL-ACFT AXIS	RAD	AM
13	(~ RAD/SEC^2)		
p_A	ROLL RATE-ACFT AXIS	PA	AM
13	(~ RAD/SEC)		
q_A	PITCH RATE-ACFT AXIS	QA	AM
13	(~ RAD/SEC)		
r_A	YAW RATE-ACFT AXIS	RA	AM
13	(~ RAD/SEC)		

EQUATION NO: F010

CORE TYPE / CORE LOCATION		SYMBOL
INPUT SOURCE		SCALE
		DOUBLE
AM MXA	ROLL MOMENT-X	MXA
F000	ACFT AXIS	04
		DOUBLE
AM MYA	PITCH MOMENT-Y	MYA
F000	ACFT AXIS	04
		DOUBLE
AM MZA	YAW MOMENT-Z	MZA
F000	ACFT AXIS	04
AM MAXA	AXA MODE TERM	MAXA
F300		13
AM MAYA	AYA MODE TERM	MAYA
F300		13
AM MAZA	AZA MODE TERM	MAZA
F300		13
AM SINPI	SIN PAI	$\sin\phi$
F020		15
CA URT	LONG ROUGH AIR &	URT
	TURBULENCE VELOCITY	02
CA VRT	LAT ROUGH AIR &	VRT
	TURBULENCE VELOCITY	02
CA WRT	VERT ROUGH AIR &	WRT
	TURBULENCE VELOCITY	02
AM IXZ	CROSS PRODUCT OF	IXZ
F340	INERTIA	-09

ITERATION RATE:

TITLE

BODY AXIS LINEAR ACCELERATION & ANGULAR VELOCITIES

EQUATION:

IF $\overline{[\text{FREEZE}]}\ \overline{[\text{RESET}]}$

ANG. VEL.

$$p_A = \int \dot{p}_A dt + K_{PR} \cdot U_{RT}$$

$$= \left\{ p_{A(n-1)} + \frac{K}{100} \cdot \dot{p}_A \right\} + K_{PR} \cdot U_{RT}$$

$$q_A = \int \dot{q}_A dt + K_{qR} \cdot V_{RT}$$

$$= \left\{ q_{A(n-1)} + \frac{K}{100} \cdot \dot{q}_A \right\} + K_{qR} \cdot V_{RT}$$

$$r_A = \int \dot{r}_A dt + K_{rR} \cdot W_{RT}$$

$$= \left\{ r_{A(n-1)} + \frac{K}{100} \cdot \dot{r}_A \right\} + K_{rR} \cdot W_{RT}$$

IF [FREEZE] + [RESET]

$$p_A = p_{A(n-1)} \quad q_A = q_{A(n-1)} \quad r_A = r_{A(n-1)}$$

ROUGH AIR CONST.

$$K_{PR} = \frac{1}{2^{11}}$$

$$K_{qR} = K_{rR} = \frac{1}{2^6}$$

PROGRAM NO. F010

PAGE NO. 2 OF 3

Double	: PA	
Double	: QA	
Double	: RA	

EQUATION NO:

F010

CORE TYPE / CORE LOCATION		SYMBOL	TITLE	PROGRAM NO.	F010
INPUT SOURCE		SCALE	BODY AXIS LINEAR ACCELERATION & ANGULAR VELOCITIES	PAGE NO.	3 OF 3

EQUATION:

DM A030 FREEZE	SIMULATION FREEZE	FREEZE FREEZE = 1
DM A030 RESET	SIMULATION RESET	RESET RESET = 1

ITERATION RATE:

EQUATION NO: F010

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	PA	ROLL RATE-ACFT AXIS	p_A
F010			13
AM	QA	PITCH RATE-ACFT AXIS	q_A
F010			13
AM	RA	YAW RATE-ACFT AXIS	r_A
F010			13
DM	RESET	SIM RESET	RESET
A030			RESET = 1
DM	FREEZE	INSTRUCTOR FREEZE	FREEZE
A030			FREEZE = 1
AM	K	INTEG CONST	K
MONITOR			00

ITERATION RATE: 12.5/SEC

TITLE: QUATERNIONS & DIRECTION COSINES & EULER ANGLE

EQUATION:

QUATERNION RATE

$$\begin{cases} \dot{E}_1 = \frac{1}{2}(-E_4 \cdot p_A - E_3 \cdot q_A - E_2 \cdot r_A + E_1 \cdot C_E) \\ \dot{E}_2 = \frac{1}{2}(-E_3 \cdot p_A + E_4 \cdot q_A + E_1 \cdot r_A + E_2 \cdot C_E) \\ \dot{E}_3 = \frac{1}{2}(E_2 \cdot p_A + E_1 \cdot q_A - E_4 \cdot r_A + E_3 \cdot C_E) \\ \dot{E}_4 = \frac{1}{2}(E_1 \cdot p_A - E_2 \cdot q_A + E_3 \cdot r_A + E_4 \cdot C_E) \end{cases}$$

IF $\overline{[\text{FREEZE}]} \cdot \overline{[\text{RESET}]}$

QUATERNION

$$\begin{cases} E_1 = \int \dot{E}_1 dt = E_{1(n-1)} + \left\{ \frac{K}{100} \cdot \dot{E}_1 \overline{[C_E \geqq .75]} + 1 \cdot [C_E \geqq .75] \right\} \\ E_2 = \int \dot{E}_2 dt = E_{2(n-1)} + \left(\frac{K}{100} \cdot \dot{E}_2 \right) \\ E_3 = \int \dot{E}_3 dt = E_{3(n-1)} + \left(\frac{K}{100} \cdot \dot{E}_3 \right) \\ E_4 = \int \dot{E}_4 dt = E_{4(n-1)} + \left(\frac{K}{100} \cdot \dot{E}_4 \right) \end{cases}$$

IF [FREEZE] + [RESET]

$$E_1 = E_{1(n-1)} \quad E_2 = E_{2(n-1)} \quad E_3 = E_{3(n-1)}$$

$$E_4 = E_{4(n-1)}$$

PROGRAM NO. F020

PAGE NO. 1 OF 4

$\dot{E}_1$	No. 1 QUATERNION	E1D	AM
14	RATE		
$\dot{E}_2$	No. 2 QUATERNION	E2D	AM
14	RATE		
$\dot{E}_3$	No. 3 QUATERNION	E3D	AM
14	RATE		
$\dot{E}_4$	No. 4 QUATERNION	E4D	AM
14	RATE		
E_1	No. 1 QUATERNION	E1	AM
14			
E_2	No. 2 QUATERNION	E2	AM
14			
E_3	No. 3 QUATERNION	E3	AM
14			
E_4	No. 4 QUATERNION	E4	AM
14			

EQUATION NO: F020

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE

TITLE: QUATERNIONS & DIRECTION COSINES & EULER ANGLE

PROGRAM NO.: F020

PAGE NO.: 2 OF 4

EQUATION:

DIRECTION COSINE

$$\left.\begin{aligned}
\ell_1 &= E_1^2 - E_2^2 - E_3^2 + E_4^2 \\
\ell_2 &= 2\cdot(E_1\cdot E_2 + E_3\cdot E_4) \\
\ell_3 &= 2\cdot(E_2\cdot E_4 - E_1\cdot E_3) \\
m_1 &= 2\cdot(E_3\cdot E_4 - E_1\cdot E_2) \\
m_2 &= E_1^2 - E_2^2 + E_3^2 - E_4^2 \\
m_3 &= 2\cdot(E_2\cdot E_3 + E_1\cdot E_4) \\
n_1 &= 2\cdot(E_1\cdot E_3 + E_2\cdot E_4) \\
n_2 &= 2\cdot(E_2\cdot E_3 - E_1\cdot E_4) \\
n_3 &= E_1^2 + E_2^2 - E_3^2 - E_4^2
\end{aligned}\right\}\ (\text{OVER FLOW CHECK})$$

$$C_E = 1 - (E_1^2 + E_2^2 + E_3^2 + E_4^2)$$

ℓ_1 / 15	DIRECTION COSINE-ℓ_1	L1	AM
ℓ_2 / 15	DIRECTION COSINE-ℓ_2	L2	AM
ℓ_3 / 15	DIRECTION COSINE-ℓ_3	L3	AM
m_1 / 15	DIRECTION COSINE-m_1	M1	AM
m_2 / 15	DIRECTION COSINE-m_2	M2	AM
m_3 / 15	DIRECTION COSINE-m_3	M3	AM
n_1 / 15	DIRECTION COSINE-n_1	N1	AM
n_2 / 15	DIRECTION COSINE-n_2	N2	AM
n_3 / 15	DIRECTION COSINE-n_3	N3	AM
C_E / 13	QUATERNION CORRECTION	CE	AM

ITERATION RATE:

EQUATION NO.: F020

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE

TITLE: QUATERNIONS & DIRECTION COSINE & EULER ANGLE

PROGRAM NO.: F020

PAGE NO.: 3 OF 4

EQUATION:

SIN & COSINE OF EULER ANGLE

$$\left[\begin{array}{l} \sin\theta = -\ell_3 \\ \cos\theta = \sqrt{1-\ell_3^2} \\ \sin\phi = \dfrac{m_3}{\cos\theta} \\ \cos\phi = \dfrac{n_3}{\cos\theta} \\ \sin\psi = \dfrac{\ell_2}{\cos\theta} \\ \cos\psi = \dfrac{\ell_1}{\cos\theta} \end{array}\right\} \text{[OVERFLOW CHECK]}$$

$$\theta = \tan^{-1}\left(\frac{\sin\theta}{\cos\theta}\right)$$

$$\phi = \tan^{-1}\left(\frac{\sin\phi}{\cos\phi}\right)$$

$$\psi = \tan^{-1}\left(\frac{\sin\psi}{\cos\psi}\right)$$

$\sin\theta$ / 15	SIN THETA	SINTH	AM
$\cos\theta$ / 15	COS THETA	COSTH	AM
$\sin\phi$ / 15	SIN PAT	SINPI	AM
$\cos\phi$ / 15	COS PAI	COSPI	AM
$\sin\psi$ / 15	SIN PSI	SINPS	AM
$\cos\psi$ / 15	COS PSI	COSPS	AM
θ / 06	THETA	THETA	AM
ϕ / 06	PAI	PAI	AM
ψ / 06	PSI	PSI	AM

ITERATION RATE:

EQUATION NO: F020

CORE TYPE	CORE LOCATION	SYMBOL	TITLE	PROGRAM NO.	F020
INPUT SOURCE		SCALE	QUATERNIONS & DIRECTION COSINES & EULER ANGLE	PAGE NO.	4 OF 4

EQUATION:

Double	:E1	
Double	:E2	
Double	:E3	
Double	:E4	

ITERATION RATE:

EQUATION NO: F020

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	AXA	ACCEL-X ACFT	A_{XA}
F010		AXIS	13
AM	AYA	ACCEL-Y ACFT	A_{YA}
F010		AXIS	13
AM	AZA	ACCEL-Z ACFT	A_{ZA}
F010			12
AM	L1	DIRECTION COSINE-ℓ_1	ℓ_1
F020			15
AM	L2	DIRECTION COSINE-ℓ_2	ℓ_2
F020			15
AM	L3	DIRECTION COSINE-ℓ_3	ℓ_3
F020			15
AM	M1	DIRECTION COSINE-m_1	m_1
F020			15
AM	M2	DIRECTION COSINE-m_2	m_2
F020			15
AM	M3	DIRECTION COSINE-m_3	m_3
F020			15
AM	N1	DIRECTION COSINE-n_1	n_1
F020			15
AM	N2	DIRECTION COSINE-n_2	n_2
F020			15

ITERATION RATE: 12.5/SEC

TITLE

EARTH & BODY AXIS VELOCITIES

EQUATION:

$$\begin{cases} \dot{U}e = 32\cdot(\ell_1\cdot A_{XA} + m_1\cdot A_{YA} + n_1\cdot A_{ZA}) \\ \dot{V}e = 32\cdot(\ell_2\cdot A_{XA} + m_2\cdot A_{YA} + n_2\cdot A_{ZA}) \\ \dot{W}e = 32\cdot(\ell_3\cdot A_{XA} + m_3\cdot A_{YA} + n_3\cdot A_{ZA} + 1.0) \end{cases}$$

IF $\overline{[\text{FREEZE}]}\cdot\overline{[\text{RESET}]}$

$$\begin{cases} Uet = \int \dot{U}edt = Uet(n-1) + \dfrac{K}{100}\cdot\dot{U}e \\ Vet = \int \dot{V}edt = Vet(n-1) + \dfrac{K}{100}\cdot\dot{V}e \\ Wet = \int \dot{W}edt = Wet(n-1) + \dfrac{K}{100}\cdot\dot{W}e \end{cases}$$

IF [FREEZE] + [RESET]

$$Uet = Uet(n-1)$$

$$Vet = Vet(n-1)$$

$$Wet = Wet(n-1)$$

PROGRAM NO. F030

PAGE NO. 1 OF 3

$\dot{U}e$	LONG. ACCEL. EARTH	UED	AM
06	AXIS		
$\dot{V}e$	LAT. ACCEL. EARTH	VED	AM
16	AXIS		
$\dot{W}e$	VERT. ACCEL. EARTH	WED	AM
06	AXIS		
Uet	LONG. VEL. EARTH AXIS	UET	AM
02			
Vet	LAT. VEL. EARTH AXIS	VET	AM
02			
Wet	VERT. ACCEL. EARTH	WET	AM
02	AXIS		
Ue'	LONG. VEL. PRIME EARTH	UEP	AM
02	AXIS		
Ve'	LAT. VEL. PRIME EARTH	VEP	AM
02	AXIS		
We'	VERT. VEL. PRIME EARTH	WEP	AM
02	AXIS		

EQUATION NO: F030

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: EARTH & BODY AXIS VELOCITIES

PROGRAM NO.: F030

PAGE NO.: 2 OF 3

AM	N3	DIRECTION COSINE-n3	n3
F020			15
CA	UW	EART AXIS LONG WIND VEL.	Uw
			02
CA	VW	EART AXIS LAT WIND VEL.	Vw
			02
CA	WW	EART AXIS VERT WIND VEL.	Ww
			02
CA	URT	LONG ROUGH AIR & TURBLENCE VELOCITY	URT
			02
CA	VRT	LAT ROUGH AIR & TURBLENCE VELOCITY	VRT
			02
CA	WRT	VERT ROUGH AIR & TURBLENCE VELOCITY	WRT
			02
DM	RESET	INSTRUCTOR RESET	RESET
A030			RESET = 1
DM	FREEZE	INSTRUCTOR FREEZE	FREEZE
A030			FREEZE = 1
AM	K	INTEG CONST.	K
MONITOR			00
AM	SINPS	SIN PSI	sin ψ
F020			00

ITERATION RATE:

EQUATION:

$$\begin{cases} U'e = Uet + Uw \cdot \cos\psi + U_{RT} \\ V'e = Vet + Vw \cdot \sin\psi + V_{RT} \\ W'e = Wet + Ww + W_{RT} \end{cases}$$

$$\begin{cases} U_A = \ell_1 \cdot U'e + \ell_2 \cdot V'e + \ell_3 \cdot W'e \\ V_A = m_1 \cdot U'e + m_2 \cdot V'e + m_3 \cdot W'e \\ W_A = n_1 \cdot U'e + n_2 \cdot V'e + n_3 \cdot W'e \end{cases}$$

$$V_{PL} = \sqrt{U_A^2 + W_A^2}$$

$$V_{PI} = \sqrt{U_A^2 + V_A^2 + W_A^2}$$

$$X = .3048\left\{\int Uetdt\right\} = X(n-1) + \frac{K}{100} \cdot (.3048\ Uet)$$

$$Y = .3048\left\{\int Vetdt\right\} = Y(n-1) + \frac{K}{100} \cdot (.3048\ Vet)$$

$$Z = -.3048\left\{\int Wetdt\right\} = Z(n-1) - \frac{K}{100} \cdot (.3048\ Wet)$$

$$|X, Y, Z| < 4096@02$$

U_A	LONG VEL ACFT AXIS	UA	AM
02			
V_A	LAT VEL ACFT AXIS	VA	AM
18	DOUBLE		
W_A	VERT VEL ACFT AXIS	WA	AM
02			
V_{PL}	$\sqrt{U_A^2 + W_A^2}$	VPL	AM
02			
V_{PI}	TRUE AIR SPEED 1	VP1	AM
02			
X	ACFT POSITION	X	AM
02	−X (M)		
Y	ACFT POSITION	Y	AM
02	−Y (M)		
Z	ACFT POSITION	Z	AM
02	−Z (M)		

EQUATION NO.: F030

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	COSPS	COS PSI	cosψ
F020			00

ITERATION RATE:

TITLE

EARTH & BODY AXIS VELOCITIES

EQUATION:

PROGRAM NO. F030

PAGE NO. 3 OF 3

Double	:UET	
Double	:VET	
Double	:WET	
Double	:X	
Double	:Y	
Double	:Z	

EQUATION NO:

F030

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	HFG	GEOMETRIC FIELD ELEVATION	hfg 02
AM F320	HG	BAROMETRIC PRESSURE	Hg 08
AM F320	TSL	SEA LEVEL TEMP.	TSL 07
AM F320	LR	LAPS RATE	LR 22
AM F320	TK	OUTSIDE AIR TEMP.	TK 05
AM F030	WEP	VERT. VEL. PRIME EARTH AXIS	W_e' 02
DM A030	RESET	INSTRUCTOR RESET	RESET RESET = 1
DM A030	FREEZE	INSTRUCTOR FREEZE	FREEZE FREEZE = 1
AM F030	UA	LONG. VEL. ACFT AXIS	U_A 02
AM F030	VA	LAT. VEL. ACFT AXIS DOUBLE	V_A 18
AM F030	WA	VERT. VEL. ACFT AXIS	W_A 02

ITERATION RATE: 12.5/SEC

TITLE

RATE & POSITION & STAB AXIS ANGULAR VELOCITIES

EQUATION:

$$hfp = hfg + 930\,(29.92 - Hg)$$

$$\dot{hp} = \left[-W'e \left(\frac{T_{SL} + 273.16 + (LR)\cdot hp}{Tk} \right) \{ \overline{[WOW]} + [hfp \geqq hfp(n-1)] \} + (hpf - hfp(n-1)) \right.$$
$$\left. [WOW][\overline{hfp \geqq hfp(n-1)}] \right]$$

$$ho = \int \dot{hp}\,dt = ho(n-1) + \left\{ \left(\frac{K}{100} \cdot \dot{hp} \right) \overline{[FREEZE]\cdot[RESET]} + 0([FREEZE] + [RESET]) \right\} \text{(DOUBLE ADD)}$$

$h_{PDB} = ho + hfp$ (DOUBLE ADD)

$hps = h_{PDB}$ (SHIFT LEFT 4 Remain left half)

$h' = ho$ (SHIFT LEFT 9 Remain left half) ($\geqq 8.0$)

$hp = h_{PDB}$ (Remain left half)

PROGRAM NO. F040

PAGE NO. 1 OF 3

hfp 02	FIELD PRESS ALT.	HFP AM
$\dot{hp}$ 02	RATE OF CHANGE OF ALT.	HPD AM
ho 14	ALT FROM FIELD DOUBLE	HO AM DOUBLE
h_{PDB} 14	PRESS ALT.	HPDB AM DOUBLE
hps 02	PRESS ALT. SINGLE	HPDB AM
h' 07	GROUND REACTION ALT.	HSL AM
hp -02	PRESSURE ALT.	HP AM
$\dot{U}_A$ 02	LONG. ACCEL. ACFT AXIS	UAD AM
$\dot{V}_A$ 02	LAT. ACCEL. ACFT AXIS	VAD AM
$\dot{W}_A$ 02	VERT. ACCEL. ACFT AXIS	WAD AM

EQUATION NO: F040

CORE TYPE / CORE LOCATION		SYMBOL
INPUT SOURCE		SCALE
AM AXA	ACCEL -X ACFT AXIS	A_{XA}
F010		13
AM AYA	ACCEL -Y ACFT AXIS	A_{YA}
F010		13
AM AZA	ACCEL -Z ACFT AXIS	A_{ZA}
F010		12
AM PA	ROLL RATE -ACFT AXIS	p_A
F010		13
AM QA	PITCH RATE -ACFT AXIS	q_A
F010		13
AM RA	YAW RATE -ACFT AXIS	r_A
F010		13
AM L3	DIRECTION COSINE -ℓ_3	ℓ_3
F020		15
AM M3	DIRECTION COSINE -m_3	m_3
F020		15
AM N3	DIRECTION COSINE -n_3	n_3
F020		15
AM VP	TRUE AIR SPEED	V_P
F030		02
AM K	INTEG CONST.	K
MONITOR		00

ITERATION RATE:

TITLE

RATE & POSITION & STAB AXIS ANGULAR VELOCITIES

EQUATION:

$$\sin\alpha = \frac{W_A}{(\sqrt{U_A^2 + W_A^2} - 4.0)^{\oplus} + 4.0}$$

$$\cos\alpha = \sqrt{1 - \sin^2\alpha}$$

$$\dot{U}_A = 32.17(A_{XA} + \ell_3) - q_A \cdot W_A + r_A \cdot V_A$$

$$\dot{V}_A = 32.17\,(A_{YA} + m_3) - r_A \cdot U_A + p_A \cdot W_A$$

$$\dot{W}_A = 32.17(A_{ZA} + n_3) - p_A \cdot V_A + q_A \cdot U_A$$

$$\dot{\alpha} = \frac{\dot{W}_A \cdot \cos\alpha - \dot{U}_A \cdot \sin\alpha}{(\sqrt{U_A^2 + W_A^2} - 4.0)^{\oplus} + 4.0}$$

$$\sin\beta = V_A \cdot \frac{1}{V_P}$$

$$\dot{\beta} = \dot{V}_A \cdot \frac{1}{V_P}$$

$(V_P \geqq 50$ (LIMIT))

$$\alpha = 57.13 \sin\alpha$$

$$\beta = 57.13 \sin\beta$$

PROGRAM NO. F040

PAGE NO. 2 OF 3

$\dot{\alpha}$ 15	ALPHA -DOT	ALPHD AM
$\dot{\beta}$ 15	BETA -DOT	BETAD AM
α 07	ALPHA	ALPHA AM
β 09	BETA	BETA AM
p_S 13	ROLL RATE -STAB AXIS	PS AM
q_S 13	PITCH RATE -STAB AXIS	QS AM
r_S 13	YAW RATE -STAB AXIS	RS AM
$\sin\alpha$ 15	SIN ALPHA	SINA AM
$\cos\alpha$ 15	COS ALPHA	COSA AM
$\sin\beta$ 15	SIN BETA SIDE SLIP	SINB AM

EQUATION NO:

F040

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE

TITLE

RATE & POSITION & STAB AXIS
ANGULAR VELOCITIES

PROGRAM NO.	F040
PAGE NO.	3 OF 3

EQUATION:

$$\begin{cases} p_S = p_A \cdot \cos\alpha + r_A \cdot \sin\alpha \\ q_S = q_A \\ r_S = p_A \cdot \sin\alpha + r_A \cdot \cos\alpha \end{cases}$$

ITERATION RATE:

EQUATION NO:

F040

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: GROUND FORCES & MOMENTS & VELOCITIES

PROGRAM NO.: F050

PAGE NO.: 1 OF 4

AM UEP	LONG VEL PRIME EARTH	Ue′	
F030	AXIS	02	
AM VEP	LAT VEL PRIME EARTH	Ve′	
F030	AXIS	02	
AM L1	DIRECTION COSINE-ℓ_1	ℓ_1	
F020		15	
AM L2	DIRECTION COSINE-ℓ_2	ℓ_2	
F020		15	
AM M1	DIRECTION COSINE-m_1	m_1	
F020		15	
AM M2	DIRECTION COSINE-m_2	m_2	
F020		15	
CA LMG	A·C-MAIN GEAR	ℓ_{MG}	
	INTERVAL-X ACFT AXIS	09	
CA LNG	A·C-NOSE GEAR	ℓ_{NG}	
	INTERVAL-X ACFT AXIS	09	
AM LXCG	LONG CG LOC	ℓ_{XCG}	
F340		11	
AM SINTH	SIN THETA	$\sin\theta$	
F020		15	
CA LLG	LENGTH OF LANDING	ℓ_{LG}	
	GEAR	09	

ITERATION RATE: 12.5/SEC

EQUATION:

$$\begin{cases} U_G = \ell_1 \cdot U'e + \ell_2 \cdot V'e & U'_G = U_G + 2(A_{XA} + \sin\theta) \\ V_G = m_1 \cdot U'e + m_2 \cdot V'e & V'_G = V_G + 2A_{YA} \\ V_M = V'_G - (\ell_{MG} - \ell_{XCG} - \ell_{LG} \cdot \sin\theta) \cdot (r_A + K_D \cdot \dot{r}_A) \\ V_N = V'_G + (\ell_{NG} + \ell_{XCG})(r_A + K_D \cdot \dot{r}_A) \\ V_{NT} = V_N \sin\lambda_N + U_G \cdot \cos\lambda_N \\ V_{NT} = V_N \cdot \cos\lambda_N - U_G \cdot \sin\lambda_N \end{cases}$$

U_G	ACFT FWD PAVEMENT	UG	AM
02	VEL		
V_G	ACFT SIDEWAYS	VG	AM
02	PAVEMENT VEL		
V_M	MAIN GEAR SIDEWAYS	VM	AM
02	PAVEMENT VEL		
V_N	NOSE GEAR SIDEWAYS	VN	AM
02	PAVEMENT VEL		
U_{NT}	NOSE GEAR VEL	UNT	AM
02			
V_{NT}	NOSE GEAR VEL	VNT	AM
02			
δ^*_{SN}	NOSE GEAR STRUT	DSN	AM
15	COMPRESSION		
δ^*_{SR}	RIGHT GEAR STRUT	DSR	AM
15	COMPRESSION		
δ^*_{SL}	LEFT GEAR STRUT	DSL	AM
15	COMPRESSION		

EQUATION NO: F050

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	RA	YAW RATE -ACFT	r_A
F010		AXIS	13
AM	RAD	YAW ACCEL -ACFT	$\dot{r}_A$
F010		AXIS	13
CA	KD	DAMPING CONST KD	K_D
			15
AM	SINRN	SIN RAMDA N	$\sin\lambda_N$
F055			15
AM	COSRN	COS RAMDA N	$\cos\lambda_N$
F055			15
CA	SNMAX	NOSE GEAR MAXIMUM	δ_{SNMAX}
		COMPRESSION	12
CA	LLGM	MAIN GEAR LENGTH	ℓ_{LGM}
			07
CA	LLGN	NOSE GEAR LENGTH	ℓ_{LGN}
			07
AM	HSL	GROUND REACTION	h'
F040		ALT	07
AM	QA	PITCH RATE -ACFT AXIS	q_A
F010			13
CA	KN1	DAMP CONST KN1	K_{N1}
			15

ITERATION RATE:

TITLE

GROUND FORCES & MOMENTS & VELOCITIES

EQUATION:

STRUT COMPRESSION

$$\delta^*_{SN} = \frac{1}{\delta_{SNMAX}} \{ \ell_{LGN} - h' - K_{N1}\cdot\dot{hp} - (\ell_{NG} + \ell_{XCG})(\sin\theta + K_{NZ}\cdot q_A) \}^{\oplus}$$

$$\delta^*_{SR} = \frac{1}{\delta_{SMMAX}} \{ \ell_{LGH} - h' - K_{M1}\cdot\dot{hp} + (\ell_{MG} - \ell_{XCG} - \ell_{LG}\cdot\sin\theta)(\sin\theta + K_{M2}\cdot q_A) + \ell_{GY}\cdot(\sin\phi + K_{M3}\cdot p_A) \}^{\oplus}$$

$$\delta^*_{SL} = \frac{1}{\delta_{SMMAX}} \{ \ell_{LGM} - h' - K_{M1}\cdot\dot{hp} + (\ell_{MG} - \ell_{XCG} - \ell_{LG}\cdot\sin\theta)(\sin\theta + K_{M2}\cdot Q_A) - \ell_{GY}\cdot(\sin\phi + K_{M3}\cdot p_A) \}^{\oplus}$$

WHERE

$p_A \cdot q_A$ · LIMITED TO ± 1.0

$\delta^*_{SN} \cdot \delta^*_{SR} \cdot \delta^*_{SL}$ · LIMITED TO 1.0

PROGRAM NO. F050

PAGE NO. 2 OF 4

T_{NT}	NOSE GEAR FWD VEL	TNT	AM
15	SIGN		
T_L	LEFT GEAR FWD VEL	TL	AM
15	SIGN		
T_R	RIGHT GEAR FWD VEL	TR	AM
15	SIGN		
S_M	MAIN GEAR SIDE VEL	SM	AM
15	SIGN		
F_{ZLM}	VERTICAL FORCE LEFT	FZLM	AM
-10	GEAR		
F_{ZRM}	VERTICAL FORCE RT	FZRM	AM
-10	GEAR		
F_{ZN}	VERTICAL FORCE NOSE	FZN	AM
-10	GEAR		
F_{YLM}	LAT FORCE LEFT	FYLM	AM
-10	GEAR		
F_{YRM}	LAT FORCE RT	FYRM	AM
-10	GEAR		
F_{YNT}	LAT FORCE NOSE	FYNT	AM
-10	GEAR SIGN		

EQUATION NO:

F050

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE

TITLE: GROUND FORCES & MOMENTS & VELOCITIES

PROGRAM NO.: F050

PAGE NO.: 3 OF 4

CA	KN2	DAMP. CONST KN2	K_{N2}
			15
CA	KM1	DAMP. CONST KM1	K_{M1}
			15
CA	KM2	DAMP. CONST KM2	K_{M2}
			15
CA	KM3	DAMP. CONST KM3	K_{M3}
			15
AM	HPD	RATE OF CHANGE	$\dot{h}_P$
F040		OF ALT	02
AM	SINPI	SIN PAI	$\sin\phi$
F020			15
AM	PA	ROLL RATE -ACFT AXIS	p_A
F010			13
CA	LGY	FRL -MAIN GEAR	L_{GY}
		INTERVAL Y -ACFT AXIS	04
CA	SMMAX	MAIN GEAR MAXIMUM	δ_{SMAX}
		COMPRESSION	12
CA	K1	GEAR CONST K1	K_1
			13
CA	K2	GEAR CONST K2	K_2
			-11

ITERATION RATE:

EQUATION:

$$\left.\begin{aligned} T_{NT} &= T_{NT}(n-1) + \frac{1}{2} U_{NT} \\ T_L &= T_L(n-1) + \frac{1}{2}\left\{U'_G + \ell_{GY}(r_A + K_D \cdot \dot{r}_A)\right\} \\ T_R &= T_R(n-1) + \frac{1}{2}\left\{U'_G - \ell_{GY}(r_A + K_D \cdot \dot{r}_A)\right\} \\ S_M &= S_M(n-1) + \frac{1}{2} V_M \end{aligned}\right\} \text{LIMITED TO } \pm 1.0$$

$$F_{ZLM} = \frac{-\delta^*_{SLM}}{K1 - \delta^*_{SLM}} \cdot K2$$

$$F_{ZRM} = \frac{-\delta^*_{SRM}}{K1 - \delta^*_{SRM}} \cdot K2$$

$$F_{ZN} = \frac{-\delta^*_{SN}}{K3 - \delta^*_{SN}} \cdot K4$$

$$F_{YLM} = K5 \cdot S_M \cdot F_{ZLM}$$

$$F_{YRM} = K5 \cdot S_M \cdot F_{ZRM}$$

$$F_{YNT} = K5 \cdot (V_{NT}/U_{NT}) \cdot F_{ZN} \qquad \left[\begin{array}{l} |V_{NT}| \leqq 1.0 \\ U_{NT} \geqq 4.0 \end{array}\right]$$

$$F_{YN} = F_{XNT} \cdot \sin\lambda_N + F_{YNT} \cdot \cos\lambda_N$$

F_{YN}	LAT FORCE NOSE	FYN	AM
-10	GEAR		
F_{XLM}	LONG FORCE LEFT	FXLM	AM
-10	GEAR		
F_{XRM}	LONG FORCE RIGHT	FXRM	AM
-10	GEAR		
F_{XNT}	LONG FORCE NOSE	FXNT	AM
-10	GEAR SIGN		
F_{XN}	LONG FORCE NOSE	FXN	AM
-10	GEAR		
F_{XG}	TOTAL GEAR FORCE	FXG	AM
-06	X -AXIS		
F_{YG}	TOTAL GEAR FORCE	FYG	AM
-06	Y -AXIS		
F_{ZG}	TOTAL GEAR FORCE	FZG	AM
-06	Z -AXIS		
M_{XG}	TOTAL GEAR MOMENT	MXG	AM
-11	X -AXIS		
M_{YG}	TOTAL GEAR MOMENT	MYG	AM
-11	Y -AXIS		

EQUATION NO: F050

CORE TYPE	CORE LOCATION	INPUT SOURCE	SYMBOL	SCALE
CA	K3	GEAR CONST K3	K_3	13
CA	K4	GEAR CONST K4	K_4	-04
CA	K5	PAVEMENT CONST K5	K_5	15
AM	F1G	$f(U_G)$	f_{1G}	15
AM	FBL	LEFT BRAKE FORCE	F_{BL}	-10
F056				
AM	FBR	RIGHT BRAKE FORCE	F_{BR}	-10
F056				
AM	AXA	ACCEL-X ACFT AXIS	AXA	13
F010				
AM	AYA	ACCEL-Y ACFT AXIS	AYA	13
F010				

ITERATION RATE:

TITLE: GROUND FORCES & MOMENTS & VELOCITIES

EQUATION:

GROUND FORCE

$$F_{XLM} = T_L \cdot (f_{1G} \cdot F_{ZLM} + F_{BL})$$

$$F_{XRM} = T_R \cdot (f_{1G} \cdot F_{ZRM} + F_{BR})$$

$$F_{XNT} = f_{1G} \cdot T_{NT} \cdot F_{ZN}$$

$$F_{XN} = F_{XNT} \cdot \cos\lambda_N - F_{YNT} \cdot \sin\lambda_N$$

$$F_{XG} = F_{XN} + F_{XRM} + F_{XLM} - F_{ZG} \cdot \sin\theta$$

$$F_{YG} = F_{YN} + F_{YRM} + F_{YLM}$$

$$F_{ZG} = F_{ZN} + F_{ZRM} + F_{ZLM}$$

GROUND MOMENT

$$M_{XG} = \ell_{GY}(F_{ZRM} - F_{ZLM}) - \ell_{LG} \cdot F_{YG}$$

$$M_{YG} = \ell_{LG} \cdot F_{XG} - (\ell_{NG} + \ell_{XCG}) \cdot F_{ZN} + (F_{ZLM} + F_{ZRM})(\ell_{MG} - \ell_{XCG} - \ell_{LG} \cdot \sin\theta)$$

$$M_{ZG} = (\ell_{NG} + \ell_{XCG}) \cdot F_{YN} - (\ell_{MG} - \ell_{XCG} - \ell_{LG} \cdot \sin\theta) \cdot (F_{YLM} + F_{YRM}) + \ell_{GY} \cdot (F_{XLM} - F_{XRM})$$

WEIGHT ON WHEEL LOGIC

$$[WOWL] = [\delta^{*}_{SL} \geqq .1]$$

$$[WOWR] = [\delta^{*}_{SR} \geqq .1]$$

$$[WOW] = [WOWL] \cdot [WOWR]$$

PROGRAM NO. F050

PAGE NO. 4 OF 4

M_{ZG}	TOTAL GEAR MOMENT	MZG	AM
-11	Z-AXIS		
WOWL	WEIGHT ON LEFT GEAR	WOWL	DM
ON G = 1			
WOWR	WEIGHT ON RIGHT GEAR	WOWR	DM
ON G = 1			
WOW	WEIGHT ON WHEEL	WOW	DM
ON G = 1			
U'_G	FWD GROUND SPEED	UGDS	AM
02	PLUS DAMPING		
V'_G	$V_G + 2A_{YA}$	VGDS	AM
02			

EQUATION NO: F050

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: NOSE WHEEL ANGLE

PROGRAM NO.: F055

PAGE NO.: 1 OF 2

CA	PHYD	UTILITY HYD SYS PRESSURE	P_{HYD} 03
CD	HD	L/G HANDLE DOWN	H_D
CD	DL	NOSE GEAR DOWN AND LOCK	D_L
CA	PRAMD	NOSE WHEEL STEERING HANDLE VELOCITY	P_λ 03
AM	FZN	VERTICAL FORCE NOSE GEAR	F_{ZN} -10
F050			
CA	KZN	WEIGHT ON WHEEL CONST	K_{ZN} -10
AM	UGDS	FORWARD GROUND SPEED PLUS DAMPING	U_G' 02
F050			
AM	VN	NOSE GEAR SIDEWAYS PAVEMENT VELOCITY	V_N 02
F050			

ITERATION RATE: 1.19/SEC

EQUATION:

$$\begin{cases} [P_{HYD} > 640][H_D][D_L] & \dot{\lambda}_{NH} = (|80.5P_\lambda| - 5)^{\oplus} \dfrac{P_\lambda}{|P_\lambda|} \\ \overline{[P_{HYD} > 640][H_D][D_L]} & \dot{\lambda}_{NH} = 0 \end{cases}$$

$$\begin{cases} [F_{ZN} < K_{ZN}][(U_G < 0.5) + (|33.4P_\lambda| > 3.0)] & \dot{\lambda}_{NC} = 0 \\ [F_{ZN} < K_{ZN}]\overline{[(U_G < 0.5) + (|33.4P_\lambda| > 3.0)]} & \dot{\lambda}_{NC} = 57.3 \cdot \dfrac{V_N \cdot \overbrace{\left(\dfrac{U_G'}{16}\right)}^{\text{LIMIT TO 1.0}}}{\underbrace{\sqrt{V_N^2 + U_G'^2}}} - \lambda_{N\,pos} \\ [F_{ZN} \geqq K_{ZN}] & \dot{\lambda}_{NC} = -\lambda_{Npos} \quad \text{NEVER LESS THAN 4.0} \end{cases}$$

$$\begin{cases} \dot{\lambda}_N = 20\dot{\lambda}_{NC} + \dot{\lambda}_{NH} \\ \lambda_{Npos} = \lambda_{Npos}(n-1) + \dfrac{K}{100} \cdot \dot{\lambda}_N \quad \left(\lambda_{Npos\,LIMITED} \pm 60^\circ\right) \end{cases}$$

$$\lambda_N = \frac{\lambda_{Npos}}{57.3}$$

$\dot{\lambda}_{NH}$	NOSE WHEEL COMMAND ~DEG/SEC	RNHD	AM
09			
$\dot{\lambda}_{NC}$	NOSE WHEEL CASTERING	RNCD	AM
09			
λ_{NPOS}	NOSE WHEEL POSITION ~ DEG	RNPOS	AM
09			
λ_N	NOSE WHEEL POSITION ~ RAD	RMDN	AM
09			
$\cos\lambda_N$	COS RANDA N	COSRN	AM
15			
$\sin\lambda_N$	SIN RAMDA N	SINRN	AM
15			

EQUATION NO: F055

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE

TITLE

NOSE WHEEL ANGLE

PROGRAM NO. F055

PAGE NO. 2 OF 2

EQUATION:

$$\cos \lambda_N = 1 - \frac{\lambda_N^2}{2}$$

$$\sin \lambda_N = \left(\frac{\lambda_N}{|\lambda_N|} \right) \cdot \sqrt{1 - (\cos \lambda_N)^2}$$

ITERATION RATE:

EQUATION NO:

F055

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	PHYD	UTILITY HYD SYS PRESSURE	P_{HYD} 03
CA	DBL	NORMALIZED BRAKE CONTROL LEFT	δ^*_{BL} 15
CA	DBR	NORMALIZED BRAKE CONTROL RIGHT	δ^*_{BR} 15
AM	UG	ACFT FORWARD PAVE-	U_G
F050		MENT VELOCITY	02
AM	FZLM	VERTICAL FORCE LEFT	F_{ZLM}
F050		GEAR	-10
AM	FZRM	VERTICAL FORCE RIGHT	F_{ZRM}
F050		GEAR	-10
CA	KB	BRAKE CONST K_B	K_B -10
CA	KL1	SKI CONST K_{L1}	K_{L1} 15
CA	KL2	PAVEMENT CONST K_{L2}	K_{L2} 15
DM	WOW	WEIGHT ON WHEEL	WOW
F050			ON GROUND=1

ITERATION RATE: 1.19/SEC

TITLE: BRAKE FORCES

EQUATION:

$$[A1] = [P_{HYD} > 768]$$

$$\begin{cases} X_L = -K_B \cdot \delta^*_{BL} \cdot [A1] + 0[\overline{A1}] \\ X_R = -K_B \cdot \delta^*_{BR} \cdot [A1] + 0[\overline{A1}] \end{cases}$$

$$[S_L] = [U_G > 0.5]\{[X_L < K_{L1} \cdot F_{ZLM}] + [S_L](n-1) \cdot [X_L < K_{L2} \cdot F_{ZLM}]\}$$

$$[S_R] = [U_G > 0.5]\{[X_R < K_{L1} \cdot F_{ZRM}] + [S_R](n-1) \cdot [X_R < K_{L2} \cdot F_{ZRM}]\}$$

$$\begin{cases} L_{LO} = K_{L1} \cdot F_{ZLM}[S_L] + K_{L2} \cdot F_{ZLM}[\overline{S_L}] \\ L_{RO} = K_{L1} \cdot F_{ZRM}[S_R] + K_{L2} \cdot F_{ZRM}[\overline{S_R}] \end{cases}$$

$$\begin{cases} F_{BL} = X_L \cdot [WOW] + 0 \cdot [\overline{WOW}] & (\leq L_L) \\ F_{BR} = X_R \cdot [WOW] + 0 \cdot [\overline{WOW}] & (\leq L_R) \end{cases}$$

PROGRAM NO. F056

PAGE NO. 1 OF 1

X_L -10	BRAKE PRESSURE LEFT	XL	AM
X_R -10	BRAKE PRESSURE RIGHT	XR	AM
S_L SKID = 1	LEFT GEAR SKID	SL	DM
S_R SKID = 1	RIGHT GEAR SKID	SR	DM
L_{LO} -10	PAVEMENT FRICTION LEFT	LLO	AM
L_{RO} -10	PAVEMENT FRICTION RIGHT	LRO	AM
F_{BL} -10	BRAKE FORCE LEFT	FBL	AM
F_{BR} -10	BRAKE FORCE RIGHT	FBR	AM

EQUATION NO: F056

CORE TYPE	CORE LOCATION	INPUT SOURCE	SYMBOL	SCALE
AM	FN1	ENG 1 NET THRUST	F_{N1}	00
	E160			
AM	FN2	ENG 2 〃	F_{N2}	00
	E160			
AM	FN3	ENG 3 〃	F_{N3}	00
	E160			
AM	FN4	ENG 4 〃	F_{N4}	00
	E160			
AM	FN5	ENG 5 〃	F_{N5}	00
	E160			
AM	FN6	ENG 6 〃	F_{N6}	00
	E160			
CA	COSAJ1	COS ALPHA J1	$\cos\alpha_{J1}$	15
CA	COSAJ2	〃 J2	$\cos\alpha_{J2}$	15
CA	COSAJ3	〃 J3	$\cos\alpha_{J3}$	15
CA	COSAJ4	〃 J4	$\cos\alpha_{J4}$	15
CA	COSAJ5	〃 J5	$\cos\alpha_{J5}$	15

ITERATION RATE: 2.38/SEC

TITLE

ENGINE FORCE AND MOMENT

EQUATION:

$$\begin{cases} F_{NX1} = F_{N1}\cdot\cos\alpha_{J1}\cdot\cos\beta_{J1}\ [ENGN \geqq 1] + 0\ \overline{[ENGN \geqq 1]} \\ F_{NX2} = F_{N2}\cdot\cos\alpha_{J2}\cdot\cos\beta_{J2}\ [ENGN \geqq 2] + 0\ \overline{[ENGN \geqq 2]} \\ F_{NX3} = F_{N3}\cdot\cos\alpha_{J3}\cdot\cos\beta_{J3}\ [ENGN \geqq 3] + 0\ \overline{[ENGN \geqq 3]} \\ F_{NX4} = F_{N4}\cdot\cos\alpha_{J4}\cdot\cos\beta_{J4}\ [ENGN \geqq 4] + 0\ \overline{[ENGN \geqq 4]} \\ F_{NX5} = F_{N5}\cdot\cos\alpha_{J5}\cdot\cos\beta_{J5}\ [ENGN \geqq 5] + 0\ \overline{[ENGN \geqq 5]} \\ F_{NX6} = F_{N6}\cdot\cos\alpha_{J6}\cdot\cos\beta_{J6}\ [ENGN \geqq 6] + 0\ \overline{[ENGN \geqq 6]} \end{cases}$$

$$\begin{cases} F_{NY1} = F_{N1}\cdot\cos\alpha_{J1}\cdot\sin\beta_{J1}\ [ENGN \geqq 1] + 0\ \overline{[ENGN \geqq 1]} \\ F_{NY2} = F_{N2}\cdot\cos\alpha_{J2}\cdot\sin\beta_{J2}\ [ENGN \geqq 2] + 0\ \overline{[ENGN \geqq 2]} \\ F_{NY3} = F_{N3}\cdot\cos\alpha_{J3}\cdot\sin\beta_{J3}\ [ENGN \geqq 3] + 0\ \overline{[ENGN \geqq 3]} \\ F_{NY4} = F_{N4}\cdot\cos\alpha_{J4}\cdot\sin\beta_{J4}\ [ENGN \geqq 4] + 0\ \overline{[ENGN \geqq 4]} \\ F_{NY5} = F_{N5}\cdot\cos\alpha_{J5}\cdot\sin\beta_{J5}\ [ENGN \geqq 5] + 0\ \overline{[ENGN \geqq 5]} \\ F_{NY6} = F_{N6}\cdot\cos\alpha_{J6}\cdot\sin\beta_{J6}\ [ENGN \geqq 6] + 0\ \overline{[ENGN \geqq 6]} \end{cases}$$

PROGRAM NO. F060

PAGE NO. 1 OF 8

F_{NX1}	ENG 1 FORCE	FNX1	AM
00	X-ACFT AXIS		
F_{NX2}	ENG 2 〃	FNX2	AM
00			
F_{NX3}	ENG 3 〃	FNX3	AM
00			
F_{NX4}	ENG 4 〃	FNX4	AM
00			
F_{NX5}	ENG 5 〃	FNX5	AM
00			
F_{NX6}	ENG 6 〃	FNX6	AM
00			
F_{NY1}	ENG 1 FORCE	FNY1	AM
00	Y-ACFT AXIS		
F_{NY2}	ENG 2 〃	FNY2	AM
00			
F_{NY3}	ENG 3 〃	FNY3	AM
00			
F_{NY4}	ENG 4 〃	FNY4	AM
00			

EQUATION NO: F060

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	COSAJ6	COS ALPHA J6	$\cos\alpha_{J6}$
			15
CA	COSBJ1	COS BETA J1	$\cos\beta_{J1}$
			15
CA	COSBJ2	COS BETA J2	$\cos\beta_{J2}$
			15
CA	COSBJ3	COS BETA J3	$\cos\beta_{J3}$
			15
CA	COSBJ4	COS BETA J4	$\cos\beta_{J4}$
			15
CA	COSBJ5	COS BETA J5	$\cos\beta_{J5}$
			15
CA	COSBJ6	COS BETA J6	$\cos\beta_{J6}$
			15
CA	SINAJ1	SIN ALPHA J1	$\sin\alpha_{J1}$
			15
CA	SINAJ2	SIN ALPHA J2	$\sin\alpha_{J2}$
			15
CA	SINAJ3	SIN ALPHA J3	$\sin\alpha_{J3}$
			15
CA	SINAJ4	SIN ALPHA J4	$\sin\alpha_{J4}$
			15

ITERATION RATE:

TITLE

ENGINE FORCE AND MOMENT

EQUATION:

$$\begin{cases} F_{NZ1} = -F_{N1}\cdot\sin\alpha_{J1}\ [ENGN \geqq 1] + 0\ \overline{[ENGN \geqq 1]} \\ F_{NZ2} = -F_{N2}\cdot\sin\alpha_{J2}\ [ENGN \geqq 2] + 0\ \overline{[ENGN \geqq 2]} \\ F_{NZ3} = -F_{N3}\cdot\sin\alpha_{J3}\ [ENGN \geqq 3] + 0\ \overline{[ENGN \geqq 3]} \\ F_{NZ4} = -F_{N4}\cdot\sin\alpha_{J4}\ [ENGN \geqq 4] + 0\ \overline{[ENGN \geqq 4]} \\ F_{NZ5} = -F_{N5}\cdot\sin\alpha_{J5}\ [ENGN \geqq 5] + 0\ \overline{[ENGN \geqq 5]} \\ F_{NZ6} = -F_{N6}\cdot\sin\alpha_{J6}\ [ENGN \geqq 6] + 0\ \overline{[ENGN \geqq 6]} \end{cases}$$

（説明図 7 参照）

$$\begin{cases} F_{XJ} = F_{NX1} + F_{NX2} + F_{NX3} + F_{NX4} + F_{NX5} + F_{NX6} \\ F_{YJ} = F_{NY1} + F_{NY2} + F_{NY3} + F_{NY4} + F_{NY5} + F_{NY6} \\ F_{ZJ} = F_{NZ1} + F_{NZ2} + F_{NZ3} + F_{NZ4} + F_{NZ5} + F_{NZ6} \end{cases}$$

PROGRAM NO. F060

PAGE NO. 2 OF 8

F_{NY5}	ENG5 FORCE	FNY5	AM
00	Y-ACFT AXIS		
F_{NY6}	ENG6 〃	FNY6	AM
00			
F_{NZ1}	ENG1 FORCE	FNZ1	AM
00	Z-ACFT AXIS		
F_{NZ2}	ENG2 〃	FNZ2	AM
00			
F_{NZ3}	ENG 3 〃	FNZ3	AM
00			
F_{NZ4}	ENG4 〃	FNZ4	AM
00			
F_{NZ5}	ENG5 〃	FNZ5	AM
00			
F_{NZ6}	ENG6 〃	FNZ6	AM
00			
F_{XJ}	ENG FORCE-X	FXJ	AM
-03	ACFT AXIS		
F_{YJ}	〃 -Y	FYJ	AM
-03			

EQUATION NO:

F060

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	SINAJ5	SIN ALPHA J5	$\sin\alpha_{J5}$
			15
CA	SINAJ6	SIN ALPHA J6	$\sin\alpha_{J6}$
			15
CA	SINBJ1	SIN BETA J1	$\sin\beta_{J1}$
			15
CA	SINBJ2	SIN BETA J2	$\sin\beta_{J2}$
			15
CA	SINBJ3	SIN BETA J3	$\sin\beta_{J3}$
			15
CA	SINBJ4	SIN BETA J4	$\sin\beta_{J4}$
			15
CA	SINBJ5	SIN BETA J5	$\sin\beta_{J5}$
			15
CA	SINBJ6	SIN BETA J6	$\sin\beta_{J6}$
			15
AM	PN11	ENG1 PERCENT N1	$\%N_{11}$
E111			08
AM	PN12	ENG2 PERCENT N1	$\%N_{12}$
E111			08
AM	PN13	ENG3 PERCENT N1	$\%N_{13}$
E111			08

ITERATION RATE:

TITLE

ENGINE FORCE AND MOMENT

EQUATION:

$$\begin{cases} AL_i = 6.2832\left\{\frac{1}{60}\left(\frac{N_{11P}}{100}\right)(\%N_{1i})I_{1i} + \frac{1}{60}N_{zi}\cdot I_{zi}\right\}[ENGN \geqq i] \\ \qquad + 0\ [ENGN < i] \\ L_{xi} = AL_i\cdot\cos\alpha_{Ji}\cdot\cos\beta_{Ji} \\ L_{yi} = AL_i\cdot\cos\alpha_{Ji}\cdot\sin\beta_{Ji} \\ L_{zi} = -AL_i\cdot\sin\alpha_{Ji} \end{cases}$$

$(i = 1 \sim 6)$

PROGRAM NO. F060

PAGE NO. 3 OF 8

F_{ZJ}	ENG FORCE - Z	FZJ	AM
-03	ACFT AXIS		
A_{L1}	ENG1 ANGULAR	AL1	AM
-09	MOMENTUM		
A_{L2}	ENG2 ANGULAR	AL2	AM
-09	〃		
A_{L3}	ENG3 ANGULAR	AL3	AM
-09	〃		
A_{L4}	ENG4 ANGULAR	AL4	AM
-09	〃		
A_{L5}	ENG5 ANGULAR	AL5	AM
-09	〃		
A_{L6}	ENG6 ANGULAR	AL6	AM
-09	〃		
L_{X1}	ENG1 GYRO MOMENT	LX1	AM
-09	X-ACFT AXIS		
L_{X2}	ENG2 GYRO MOMENT	LX2	AM
-09	〃		
L_{X3}	ENG3 GYRO MOMENT	LX3	AM
-09	〃		

EQUATION NO:

F060

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	PN14	ENG4 PERCENT N1	$\%_{N14}$
E111			08
AM	PN15	ENG5 PERCENT N1	$\%_{N15}$
E111			08
AM	PN16	ENG6 PERCENT N1	$\%_{N16}$
E111			08
AM	N21	ENG1 N2	N_{21}
E104			01
AM	N22	ENG2 N2	N_{22}
E104			01
AM	N23	ENG3 N2	N_{23}
E104			01
AM	N24	ENG4 N2	N_{24}
E104			01
AM	N25	ENG5 N2	N_{25}
E104			01
AM	N26	ENG6 N2	N_{26}
E104			01
CA	ENGN	NUMBERS OF ENGINE	ENGN
			00
AM	PA	ROLL RATE-ACFT	p_A
F010		AXIS	13

ITERATION RATE:

TITLE

ENGINE FORCE AND MOEMNT

EQUATION:

$$M_{XJ} = \sum_{i=1}^{6} \{ F_{NZi}(\ell_{YJi} - \ell_{YCG}) - F_{NYi}\cdot\ell_{ZJi} \}$$

$$+ \sum_{i=1}^{6} (L_{Yi}\cdot r_A - L_{Zi}\cdot q_A) + K_X$$

$$= F_{NZ1}(\ell_{YJ1} - \ell_{YCG}) + F_{NZ2}(\ell_{YJ2} - \ell_{YCG})$$

$$+ F_{NZ3}(\ell_{YJ3} - \ell_{YCG}) + F_{NZ4}(\ell_{YJ4} - \ell_{YCG})$$

$$+ F_{NZ5}(\ell_{YJ5} - \ell_{YCG}) + F_{NZ6}(\ell_{YJ6} - \ell_{YCG})$$

$$- F_{NY1}\cdot\ell_{ZJ1} - F_{NY2}\cdot\ell_{ZJ2} - F_{NY3}\cdot\ell_{ZJ3} - F_{NY4}\cdot\ell_{ZJ4}$$

$$- F_{NY5}\cdot\ell_{ZJ5} - F_{NY6}\cdot\ell_{ZJ6} + (L_{Y1} + L_{Y2} + L_{Y3} + L_{Y4}$$

$$+ L_{Y5} + L_{Y6})\cdot r_A - (L_{Z1} + L_{Z2} + L_{Z3} + L_{Z4}$$

$$+ L_{Z5} + L_{Z6})\cdot q_A + K_X$$

$$M_{YJ} = \sum_{i=1}^{6} \{ F_{NXi}\cdot\ell_{ZJi} - F_{NZi}(\ell_{XJi} - \ell_{XCG}) \}$$

$$+ \sum_{i=1}^{6} (L_{Zi}\cdot p_A - L_{Xi}\cdot r_A) + K_Y$$

$$= F_{NX1}\cdot\ell_{ZJ1} + F_{NX2}\cdot\ell_{ZJ2} + F_{NX3}\cdot\ell_{ZJ3} + F_{NX4}\cdot\ell_{ZJ4}$$

$$+ F_{NX5}\cdot\ell_{ZJ5} + F_{NX6}\cdot\ell_{Z6} - F_{NZ1}(\ell_{XJ1} - \ell_{XCG})$$

$$- F_{NZ2}(\ell_{XJ2} - \ell_{XCG}) - F_{NZ3}(\ell_{XJ3} - \ell_{XCG})$$

$$- F_{NZ4}(\ell_{XJ4} - \ell_{XCG}) - F_{NZ5}(\ell_{XJ5} - \ell_{XCG})$$

$$- F_{NZ6}(\ell_{XJ6} - \ell_{XCG})$$

$$+ (L_{Z1} + L_{Z2} + L_{Z3} + L_{Z4} + L_{Z5} + L_{Z6})\cdot p_A$$

$$- (L_{X1} + L_{X2} + L_{X3} + L_{X4} + L_{X5} + L_{X6})\cdot r_A + K_Y$$

PROGRAM NO. F060

PAGE NO. 4 OF 8

L_{X4}	ENG4 GYRO MOMENT	LX4	AM
-09	X-ACFT AXIS		
L_{X5}	ENG5 GYRO MOMENT	LX5	AM
-09	"		
L_{X6}	ENG6 GYRO MOMENT	LX6	AM
-09	"		
L_{Y1}	ENG1 GYRO MOMENT	LY1	AM
-09	Y-ACFT AXIS		
L_{Y2}	ENG2 GYRO MOMENT	LY2	AM
-09	"		
L_{Y3}	ENG3 GYRO MOMENT	LY3	AM
-09	"		
L_{Y4}	ENG4 GYRO MOMENT	LY4	AM
-09	"		
L_{Y5}	ENG5 GYRO MOMENT	LY5	AM
-09	"		
L_{Y6}	ENG6 GYRO MOMENT	LY6	AM
-09	"		
L_{Z1}	EMG1 GYRO MOMENT	LZ1	AM
-09	Z-ACFT AXIS		

EQUATION NO:

F060

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: ENGINE FORCE AND MOMENT

PROGRAM NO.: F060

PAGE NO.: 5 OF 8

AM	QA	PITCH RATE-ACFT	q_A
F010		AXIS	13
AM	RA	YAW RATE-ACFT	r_A
F010		AXIS	13
CA	LXJ1	ENG1 POS. X-ACFT	ℓ_{XJ1}
			08
CA	LXJ2	ENG2 POS. X-ACFT	ℓ_{XJ2}
			08
CA	LXJ3	ENG3 POS. X-ACFT	ℓ_{XJ3}
			08
CA	LXJ4	ENG4 POS. X-ACFT	ℓ_{XJ4}
			08
CA	LXJ5	ENG5 POS. X-ACFT	ℓ_{XJ5}
			08
CA	LXJ6	ENG6 POS. X-ACFT	ℓ_{XJ6}
			08
CA	LYJ1	ENG1 POS. Y-ACFT	ℓ_{YJ1}
			08
CA	LYJ2	ENG2 POS. Y-ACFT	ℓ_{YJ2}
			08
CA	LYJ3	ENG3 POS. Y-ACFT	ℓ_{YJ3}
			08

ITERATION RATE:

EQUATION:

$$M_{ZJ} = \sum_{i=1}^{6} \{ F_{NYi} \cdot (\ell_{XJi} - \ell_{XCG}) - F_{NXi} \cdot (\ell_{YJi} - \ell_{YCG}) \}$$

$$+ \sum_{i=1}^{6} (L_{xi} \cdot q_A - L_{yi} \cdot p_A) + K_z$$

$$= F_{NY1}(\ell_{XJ1} - \ell_{XCG}) + F_{NY2} \cdot (\ell_{XJ2} - \ell_{XCG})$$

$$+ F_{NY3} \cdot (\ell_{XJ3} - \ell_{XCG}) + F_{NY4}(\ell_{XJ4} - \ell_{XCG})$$

$$+ F_{NY5} \cdot (\ell_{XJ5} - \ell_{XCG}) + F_{NY6} \cdot (\ell_{XJ6} - \ell_{XCG})$$

$$- F_{NX1}(\ell_{YJ1} - \ell_{YCG}) - F_{NX2}(\ell_{YJ2} - \ell_{YCG})$$

$$- F_{NX3}(\ell_{YJ3} - \ell_{YCG}) - F_{NX4}(\ell_{YJ4} - \ell_{YCG})$$

$$- F_{NX5}(\ell_{YJ5} - \ell_{YCG}) - F_{NX6}(\ell_{YJ6} - \ell_{YCG})$$

$$+ (L_{x1} + L_{x2} + L_{x3} + L_{x4} + L_{x5} + L_{x6}) \cdot q_A$$

$$- (L_{y1} + L_{y2} + L_{y3} + L_{y4} + L_{y5} + L_{y6}) \cdot p_A + K_z$$

（説明図　7　参照）

L_{z2}	ENG2 GYRO MOMENT	LZ2	AM
-09	Z-ACFT AXIS		
L_{z3}	ENG3 GYRO MOMENT	LZ3	AM
-09	〃		
L_{z4}	ENG4 GYRO MOMENT	LZ4	AM
-09	〃		
L_{z5}	ENG5 GYRO MOMENT	LZ5	AM
-09	〃		
L_{z6}	ENG6 GYRO MOMENT	LZ6	AM
-09	〃		
M_{XJ}	ENGINE MOMENT	MXJ	AM
-11	X-ACFT AXIS		
M_{YJ}	ENGINE MOMENT	MYJ	AM
-11	Y-ACFT AXIS		
M_{ZJ}	ENGINE MOMENT	MZJ	AM
-11	Z-ACFT AXIS		

EQUATION NO.: F060

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	LYJ4	ENG4 POS. Y-ACFT	ℓ_{YJ4}
			08
CA	LYJ5	ENG5 POS. Y-ACFT	ℓ_{YJ5}
			08
CA	LYJ6	ENG6 POS. Y-ACFT	ℓ_{YJ6}
			08
CA	LZJ1	ENG1 POS. Z-ACFT	ℓ_{ZJ1}
			08
CA	LZJ2	ENG2 POS. Z-ACFT	ℓ_{ZJ2}
			08
CA	LZJ3	ENG3 POS. Z-ACFT	ℓ_{ZJ3}
			08
CA	LZJ4	ENG4 POS. Z-ACFT	ℓ_{ZJ4}
			08
CA	LZJ5	ENG5 POS. Z-ACFT	ℓ_{ZJ5}
			08
CA	LZJ6	ENG6 POS. Z-ACFT	ℓ_{ZJ6}
			08
AM	LXCG	LONG. CENTER OF	ℓ_{XCG}
F340		GRAVITY POSITION	11
AM	LYCG	LAT.	ℓ_{YCG}
F340			11

ITERATION RATE:

TITLE

ENGINE FORCE AND MOMENT

EQUATION:

PROGRAM NO. F060

PAGE NO. 6 OF 8

EQUATION NO:

F060

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	KX	MXJ CONST KX	K_X
			-11
CA	KY	MYJ CONST KY	K_Y
			-11
CA	KZ	MZT CONST KZ	K_Z
			-11
CA	I11	ENG1 ROTOR 1 INERTIA	I_{11}
			00
CA	I12	ENG2 ROTOR 1 INERTIA	I_{12}
			00
CA	I13	ENG3 ROTOR 1 INERTIA	I_{13}
			00
CA	I14	ENG4 ROTOR 1 INERTIA	I_{14}
			00
CA	I15	ENG5 ROTOR 1 INERTIA	I_{15}
			00
CA	I16	ENG6 ROTOR 1 INERTIA	I_{16}
			00
CA	I21	ENG1 ROTOR 2 INERTIA	I_{21}
			00
CA	I22	ENG2 ROTOR 2 INERTIA	I_{22}
			00

ITERATION RATE:

TITLE

ENGINE FORCE AND MOMENT

EQUATION:

PROGRAM NO. F060

PAGE NO. 7 OF 8

EQUATION NO.

F060

CORE TYPE	CORE LOCATION	INPUT SOURCE	SYMBOL	SCALE
CA	I23	ENG3 ROTOR2 INERTIA	I_{23}	00
CA	I24	ENG4 ROTOR2 INERTIA	I_{24}	00
CA	I25	ENG5 ROTOR2 INERTIA	I_{25}	00
CA	I26	ENG6 ROTOR2 INERTIA	I_{26}	00
CA	N11P		N_{11p}	01

ITERATION RATE:

TITLE: ENGINE FORCE AND MOMENT

EQUATION:

PROGRAM NO. F060

PAGE NO. 8 OF 8

EQUATION NO: F060

CORE TYPE / CORE LOCATION	INPUT SOURCE	SYMBOL / SCALE
AM CLBSC	F106	CLBSC 18
AM CLA	F106	CLA 20
AM DCLBAF	F106	DCLBAF 13
AM CLDE	F106	CLDE 23
AM DCLSKA	F106	DCLSKA 13
AM D2CL	F106	D2CL 13
AM D1CL	F106	D1CL 13
AM CLBDF	F106	CLBDF 13
AM DCLLE	F110	ΔC_{LLE} 13
AM DCLSF	F110	$\Delta CL_{\delta FWSP}$ 13
AM ALPHA	F040 ALPHA	α 07

ITERATION RATE: 12.5/SEC

TITLE: FAST INTEGRATION LIFT COEFFICIENT

PROGRAM NO. F100

PAGE NO. 1 OF 4

EQUATION:

$CL_{BASIC\alpha} = CLBSC \cdot \alpha$

$\Delta CL\alpha = CLA \cdot \alpha$

$(\Delta CL\delta e)_{K\alpha} = f_{5240} \cdot f_{5230} \cdot (f_{5210} - 0.002) \cdot \delta e$

$(\Delta CL\delta et)_{K\alpha} = CLDE \cdot \delta et$

$K\alpha = f_{5250}$

$CL_{K\alpha TERM} = K\alpha \cdot \{(\Delta CL\delta e)_{K\alpha} + (\Delta CL\delta et)_{K\alpha} + DCLSKA\}$

$CL_{BASIC} = CL_{BASIC\alpha} + DCLBAF + CLBDF$

$CL1 = D2CL + D1CL + CL_{BASIC} + \Delta CL\alpha + CL_{K\alpha TERM} + \Delta C_{LLE} + \Delta CL\delta_{FWSP}$

$CL_{BASIC\alpha}$ 13	CLBA	AM
$\Delta CL\alpha$ 13	DCLA	AM
$(\Delta CL\delta e)_{K\alpha}$ 13	DCLDE	AM
$(\Delta CL\delta et)_{K\alpha}$ 13	DCLDET	AM
$K\alpha$ 14	KALPH	AM
$CLK\alpha_{TERM}$ 13	CLKAT	AM
CL_{BASIC} 13	CLB	AM
CL1 13	CL1	AM

EQUATION NO:

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE

TITLE: FAST INTEGRATION LIFT COEFFICIENT

PROGRAM NO.: F100

PAGE NO.: 2 OF 4

	F5240	f (M, δe)	f5240 14
	F5230	f (δe, M)	f5230 14
	F5210	f (M, hp)	f5210 21
AM	DE F130	ELEVATOR ANGLE	δe 09
AM	DET F130	ELEVATOR TAB ANGLE	δet 09
	F5250	f (α, δFW)	f5250 14
AM	CLQS F106		CLQS 08
AM	CLAD F106		CLAD 08
AM	QS	STAB AXIS PITCH RATE	qs 13
AM	ALPHD F040	ALPHA DOT	$\dot{\alpha}$ 15
AM	VP F320	TRUE AIRSPEED	VP 02

ITERATION RATE:

EQUATION:

$$\left.\begin{aligned}\Delta C_{LQS} &= C_{LQS} \cdot \frac{qs}{V_P} \\ \Delta C_{L\alpha} &= C_{LAD} \cdot \frac{\dot{\alpha}}{V_P}\end{aligned}\right\} \quad V_P \geqq 50$$

$$\Delta C_{LAZA} = C_{LAZA} \cdot (-A_{ZA} - 1)$$

$$\Delta C_{LSP} = -f_{6441} \cdot f_{6471} \cdot (f_{6451} - 0.4) - f_{6421} \cdot f_{6531} \cdot (f_{6452} - 0.4)$$
$$- f_{6422} \cdot f_{6532} \cdot (f_{6453} - 0.4) - f_{6442} \cdot f_{6472} \cdot (f_{6454} - 0.4)$$

$$CL = CL1 + \Delta CL\dot{\alpha} + \Delta C_{Lqs} + \Delta C_{LAZA}$$
$$+ \Delta C_{LGE} + \Delta C_{LLG} + \Delta C_{LSP}$$

CL 13	LIFT COEFFICIENT	CL	AM
ΔCLqS 13		DCLQS	AM
ΔCLα̇ 13		DCLAD	AM
ΔCLAZA 13		DCLAZA	AM
ΔCLSP 13		DCLSP	AM

EQUATION NO:

CORE TYPE / CORE LOCATION	INPUT SOURCE	SYMBOL / SCALE
AM CLAZA / F106		CLAZA / 19
AM AZA	ACCEL-Z ACFT AXIS	AZA / 12
F6441	f (δSPIL, δFWIL)	f6441 / 17
F6442	f (δSPIR, δFWIR)	f6442 / 17
F6471	f (M, hp, δSPIL)	f6471 / 14
F6472	f (M, hp, δSPIR)	f6472 / 14
F6421	f (δSPOL, δFWOL)	f6421 / 17
F6422	f (δSPOR, δFWOR)	f6422 / 17
AM DCLGE / F110		ΔCLGE / 13
AM DCLLG / F110		ΔCLLG / 13
F6451	f (α, δFWIL)	f6451 / 14

ITERATION RATE:

TITLE: FAST INTEGRATION LIFT COEFFICIENT

EQUATION:

PROGRAM NO. F100

PAGE NO. 3 OF 4

EQUATION NO:

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
	F6452	f (α, δFWOL)	f6452
			14
	F6453	f (α, δFWOR)	f6453
			14
	F6454	f (α, δFWIR)	f6454
			14
	F6531	f (M, hp, δSPOL)	f6531
			14
	F6532	f (M, hp, δSPOR)	f6532
			14

ITERATION RATE:

TITLE
FAST INTEGRATION LIFT COEFFICIENT

EQUATION:

PROGRAM NO. F100

PAGE NO. 4 OF 4

EQUATION NO:

CORE TYPE / CORE LOCATION	SYMBOL
INPUT SOURCE	SCALE

TITLE: FAST INTEGRATION DRAG COEFFICIENT

PROGRAM NO.: F101

PAGE NO.: 1 OF 2

INPUT SOURCE		SYMBOL / SCALE
AM DCDM / F106		DCDM / 13
AM CDBSC / F106		CDBSC / 16
AM DCDGE / F110		ΔCDGE / 13
AM DCDLG / F110		ΔCDLG / 13
AM DCDWM / F110		ΔCDWM / 13
F3660	f (β, δr)	f3660 / 18
F7160	f (M, CL)	f7160 / 14
F6751	f (δSPIL)	f6751 / 22
F6752	f (δSPIR)	f6752 / 22
F6753	f (δSPOL)	f6753 / 22
F6754	f (δSPOR)	f6754 / 22

ITERATION RATE: 12.5/SEC

EQUATION:

$$\Delta C_{D\beta} = f_{3660}$$

$$\Delta C_{DSP} = f_{7160} \cdot \{ f_{6751} \cdot f_{7001} + f_{6752} \cdot f_{7002} + f_{6753} \cdot f_{7003} + f_{6754} \cdot f_{7004} \}$$

$$\Delta C_{D\alpha} = f_{6250}$$

$$CD = CDBSC + \Delta C_{D\beta} + DCDM + \Delta C_{D\alpha} + \Delta C_{DSP} + \Delta CDGE + \Delta CDLG + \Delta CDWM$$

ΔCDβ / 13		DCDB
ΔCDSP / 13		DCDSP
ΔCDα / 13		DCDA
CD / 13	DRAG COEFFICIENT	CD

EQUATION NO:

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: FAST INTEGRATION DRAG COEFFICIENT

PROGRAM NO.: F101

PAGE NO.: 2 OF 2

EQUATION:

		SYMBOL
F7001	f (CL, δFWIL)	f7001
		11
F7002	f (CL, δFWIR)	f7002
		11
F7003	f (CL, δFWOL)	f7003
		11
F7004	f (CL, δFWOR)	f7004
		11
F6250	f (α, δFW)	f6250
		17

ITERATION RATE:

EQUATION NO:

CORE TYPE / CORE LOCATION	SYMBOL
INPUT SOURCE	SCALE

TITLE: FAST INTEGRATION PITCHING MOMENT COEFFICIENT

PROGRAM NO. F102

PAGE NO. 1 OF 5

INPUT SOURCE		SYMBOL / SCALE
AM D2CM / F106		D2CM / 13
AM CMBSA / F106		CMBSA / 20
AM CMA / F106		CMA / 20
AM D1CM / F106		D1CM / 13
AM CMQA / F106		CMQA / 04
AM CMQAD / F106	DOUBLE	CMQAD / 15
AM CMAD / F106		CMAD / 08
AM ALPHA / F040	ALPHA	α / 07
F4120	f (α, δFW)	f4120 / 17
F3620	f (α, δFW)	f3620 / 20
F5230	f (δe, M)	f5230 / 14

ITERATION RATE: 12.5/SEC

EQUATION:

$$CMBA = CMBSA \cdot \alpha$$

$$DCMA = CMA \cdot \alpha$$

$$Cm_{BASIC\alpha\,\delta FW} = f_{4120} - 1.0 + f_{3620} - 0.0085$$

$$K\delta e = f_{5230} \cdot f_{5240}$$

$$(\Delta Cm\delta e)_{K\alpha} = -K\delta e \cdot f_{6240} \cdot \delta e$$

$$(\Delta Cm\delta et)_{K\alpha} = -(f_{6230} - 0.001) \cdot \delta et$$

$$(\Delta Cm_{SFRL})_{K\alpha} = -f_{6220} \cdot (SFRL + 4.0)$$

$$\Delta Cm_{K\alpha} = K\alpha \cdot \{(\Delta Cm\delta e)_{K\alpha} + (\Delta Cm\delta et)_{K\alpha} + (\Delta Cm_{SFRL})_{K\alpha}\}$$

$$\Delta Cm_{AZA} = -f_{4010} \cdot (-AZA - 1.0) + f_{3760} - 0.05$$

$$\Delta Cm_{qA} = CMQA \cdot \frac{q_A}{VP}$$

$$\Delta Cm_{\dot{q}A} = CMQAD \cdot \frac{\dot{q}_A}{VP^2}$$

$$\Delta Cm\dot{\alpha} = CMAD \cdot \frac{\dot{\alpha}}{VP}$$

$VP \geqq 50.0$

		OUTPUT
CMBA / 13		CMBA AM
DCMA / 13		DCMA AM
CmBASICαδFW / 13		CMBAF AM
Kδe / 13		KDE AM
(ΔCmδe)Kα / 13		DCMDE AM
(ΔCmδet)Kα / 13		DCMDET AM
(ΔCmSFRL)Kα / 13		DCMSFL AM
ΔCmKα / 13		DCMKA AM
ΔCmAZA / 13		DCMAZA AM
ΔCmqA / 13		DCMQA AM

EQUATION NO:

CORE TYPE / CORE LOCATION		SYMBOL
INPUT SOURCE		SCALE

TITLE: FAST INTEGRATION PITCHING MOMENT COEFFICIENT

PROGRAM NO. F102

PAGE NO. 2 OF 5

F5240	f (δe, M)	f5240 / 14
F6240	f (M, hp)	f6240 / 20
AM DE F130	DELTA-ELEVATOR	δe / 09
AM F6230	f (M, hp)	f6230 / 22
AM DET F130	DELTA-ELEVATOR TAB	δet / 09
F6220	f (M, hp)	f6220 / 19
AM SFRL A030	STABILIZER POS	SFRL / 11
AM KALPH F100		Kα / 14
F4010	f (M, hp)	f4010 / 20
AM AZA F010	ACCEL-Z ACFT AXIS	AZA / 12
F3760	f (AZA, VE, %CG)	f3760 / 18

ITERATION RATE:

EQUATION:

$$\Delta Cm\delta_{SP} = -f_{4021} \cdot f_{4061} \cdot f_{7741} - f_{4022} \cdot f_{4062} \cdot f_{7742}$$

$$+ \left\{ \left(\frac{f_{4101}}{2} + 0.25 \right) \cdot f_{4041} \cdot f_{7743} \right.$$

$$\left. + \left(\frac{f_{4102}}{2} + 0.25 \right) \cdot f_{4042} \cdot f_{7744} \right\}$$

$$\times \left\{ 1 - KCm_4 \cdot |\delta_{FWON} - \delta_{FWIN}| + KCm_5 (|\delta_{FWON} - \delta_{FWIN}| - 0.22)^{\oplus} \right\} - Kcm_6 \cdot \left(1.0 - \frac{hp - hfp}{2^{11}}\right)^{\oplus}$$

$$\cdot \underbrace{\left(1.0 - \frac{|\delta_{FWON} - \delta_{FWIN}|}{2}\right)}_{1/2 \geqq}$$

$$Cm = Cm_{BASIC\alpha,\delta FW} + D1CM + D2CM + CMBA + DCMA + \Delta Cm_{qA} + \Delta Cm_{\dot{q}A} + \Delta Cm_{\dot{\alpha}} + \Delta Cm_{AZA} + \Delta Cm_{K\alpha} + \Delta Cm\delta_{SP} + \Delta Cm_{FSP} + \Delta Cm_{LG} + \Delta Cm_{GE}$$

Cm 13	PITCHING MOMENT COEF.	CM AM
ΔCmq̇A 13		DCMQAD AM
ΔCmα̇ 13		DCMAD
ΔCmδSP 13		DCMSP AM

EQUATION NO:

CORE TYPE	CORE LOCATION	INPUT SOURCE		SYMBOL / SCALE
AM	QA	F010	PITCH RATE / ACFT AXIS	qA / 13
AM	QAD	F010	QA DOT	$\dot{q}$A / 13
AM	VP	F320	TRUE AIR SPEED	VP / 02
AM	ALPHD	F040	ALPHA DOT	$\dot{\alpha}$ / 15
	F4021		f (δSPIL, δFWIL)	f4021 / 22
	F4022		f (δSPIR, δFWIR)	f4022 / 22
	F4061		f (M, hp, δSPIL)	f4061 / 14
	F4062		f (M, hp, δSPIR)	f4062 / 14
	F4101		f (M, hp, δSPOL)	f4101 / 13
	F4102		f (M, hp, δSPOR)	f4102 / 13
	F4041		f (δSPOL, δFWOL)	f4041 / 18

ITERATION RATE:

TITLE: FAST INTEGRATION PITCHING MOMENT COEFFICIENT

EQUATION:

PROGRAM NO. F102

PAGE NO. 3 OF 5

EQUATION NO:

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
	F4042	f (δSPOR, δFWOR)	f4042
			18
	F7741	f (α, δFWIL)	f7741
			14
	F7742	f (α, δFWIR)	f7742
	F7743	f (α, δFWOL)	f7743
	F7744	f (α, δFWOR)	f7744
CA	KCM4	CONST	KCm4
			14
CA	KCM5	CONST	KCm5
			14
CA	KCM6	CONST	KCm6
			13
AM	DFWON		δFWON
F150			15
AM	DFWIN		δFWIN
F150			15
AM	HP		hp
F040			-02

ITERATION RATE:

TITLE

FAST INTEGRATION PITCHING MOMENT COEFFICIENT

EQUATION:

PROGRAM NO. F102

PAGE NO. 4 OF 5

EQUATION NO:

CORE TYPE / CORE LOCATION	SYMBOL
INPUT SOURCE	SCALE
AM HFP F040	hfP 02
AM DCMSF F110	ΔCmFSP 13
AM DCMLG F110	ΔCmLG 13
AM DCMGE F110	ΔCmGE 13

ITERATION RATE:

TITLE: FAST INTEGRATION PITCHING MOMENT COEFFICIENT

EQUATION:

PROGRAM NO. F102

PAGE NO. 5 OF 5

EQUATION NO:

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
	CYB		CYB
F106			18
	CYR		CYR
F106			07
	CYP		CYP
F106			10
	DSPR	RT SPOILER DEF	δSPR
F150			09
	DSPL	LT SPOILER DEF	δSPL
F150			09
	F4340	f (CL, δFW)	f4340
			24
	F4470	f (M)	f4470
			15
	RS	YAW RATE -STABILITY	rs
F040		AXIS	13
	PS	ROLL RATE -STABILITY	ps
F040		AXIS	13
	VP	TRUE AIR SPEED	VP
F030			02
	F4660	f (M)	f4660
			14

ITERATION RATE: 12.5/SEC

TITLE

FAST INTEGRATION SIDE FORCE COEFFICIENT

EQUATION:

$$\Delta C_{Y\beta} = CYB \cdot \beta$$

$$\Delta C_{Y\delta SP} = -(\delta SPR - \delta SPL) \cdot (f_{4340} - 0.0008) \cdot f_{4470}$$

$$\left.\begin{aligned} \Delta C_{YrS} &= CYR \cdot \frac{rs}{V_P} \\ \Delta C_{YPS} &= CYP \cdot \frac{p_S}{V_P} \end{aligned}\right\} \quad V_P \geqq 50$$

$$\Delta C_{Y\delta r} = f_{4660} \cdot \left\{ K_{CY1} \cdot \delta r - K_{CY2} \cdot (|\delta r| - 17.0)^{\oplus} \cdot \frac{\delta r}{|\delta r|} + K_{CY3} \cdot \delta ttr \right\}$$

$$C_Y = \Delta C_{Y\beta} + \Delta C_{Y\delta SP} + \Delta C_{YrS} + \Delta C_{YPS} + \Delta C_{Y\delta r}$$

PROGRAM NO. F103

PAGE NO. 1 OF 2

ΔCYB		DCYB
15		
ΔCYδSP		DCYSP
15		
ΔCYrs		DCYRS
15		
ΔCYPS		DCYPS
15		
ΔCYδr		DCYDR
15		
CY	SIDE FORCE	CY
15	COEF	

EQUATION NO: F103

CORE TYPE / CORE LOCATION	INPUT SOURCE	SYMBOL / SCALE
CA KCY1	CONST	KCY1 / 20
AM DR	RUDDER ANGLE	δr / 09
F134		
AM KCY2		KCY2 / 20
CA KCY3		KCY3 / 20
AM DTTR	RUDDER TAB DEF.	δttr / 09
A030		

ITERATION RATE:

TITLE: FAST INTEGRATION SIDE FORCE COEFFICIENT

EQUATION:

PROGRAM NO. F103

PAGE NO. 2 OF 2

EQUATION NO: F103

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
	FLBGE		FLBGE
			07
	C1B		C1B
			20
	C1P		C1P
			07
	C1DR		C1DR
			22
	C1R		C1R
			09
AM	BETA	BETA	β
F040			09
AM	PS	ROLL RATE-STAB.	ps
F040		AXIS	13
AM	VP	TRUE AIR SPEED	VP
F030			02
AM	DR	RUDDER DEF.	δr
F134			09
	F6310	f (α, δFW)	f6310
			15
	F5000	f (h')	f5000
			15

ITERATION RATE: 12.5/SEC

TITLE: FAST INTEGRATION ROLLING MOMENT COEFFICIENT

EQUATION:

$$\Delta C_{\ell\beta} = C1B \cdot \beta$$

$$\Delta C_{\ell PS} = C1P \cdot \frac{ps}{V_P} \qquad (V_P \geqq 50)$$

$$\Delta C_{\ell\delta r} = C1DR \cdot \delta_r$$

$$F_{\ell GE} = 1.0 + (f_{6310} - 0.8) \cdot f_{5000}$$

$$(\Delta C_{\ell\delta SP})\delta_{SP} = K_{C\ell 2} \cdot (1.0 - K_{C\ell 4} \cdot \delta_{FWN}) \cdot (C_L - 1.4)^{\oplus} + f_{4250}$$

$$\Delta C_{\ell\delta SP} = (\Delta C_{\ell\delta SP})\delta_{SP} \cdot \left\{ 0.4 f_{4551} \cdot f_{5131} + 0.6 f_{4552} \cdot f_{5132} - 0.4 f_{4553} \cdot f_{5133} - 0.6 f_{4554} \cdot f_{5134} \right\}$$

$$\Delta C_{\ell\delta a} = -\left\{ f_{4200} \cdot f_{4210} \cdot (K_{C\ell 3} \cdot \delta_{a1}) + f_{4220} \cdot f_{4230} \cdot f_{4240} \cdot \frac{\delta_{aO}}{|\delta_{aO}|} \right\} \cdot F_{\ell GE}$$

$$\Delta C_{\ell rS} = C_{1R} \cdot \frac{rS}{V_P} \qquad (V_P \geqq 50)$$

$$C_\ell = \Delta C_{\ell\beta} + \Delta C_{\ell PS} + \Delta C_{\ell rs} + \Delta C_{\ell\delta a} + \Delta C_{\ell\delta r} + \Delta C_{\ell\delta SP} + \Delta C_{\ell LE} + \Delta C_{\ell FSP} + \Delta C_{\ell LG}$$

PROGRAM NO. F104

PAGE NO. 1 OF 4

ΔCℓβ		DC1B	AM
15			
ΔCℓps		DC1PS	AM
15			
ΔCℓδr		DC1DR	AM
15			
FℓGE		FLGE	AM
13			
Cℓ	ROLLING MOMENT	C1	AM
15	COEF.		
ΔCℓδSP		DC1DSP	AM
15			
ΔCℓδa		DC1DA	AM
15			
ΔCℓrs		DC1RS	AM
15			

EQUATION NO: F104

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	KC12	CONST	KCℓ2
			20
CA	KC14	CONST	KCℓ4
			15
AM	DFWN	NORM FLAP	δFWN
F150			15
AM	CL	LIFT COEF.	CL
			13
	F4250	f (CL, δFW)	f4250
			18
	F4551	f (δSPIR, δFWIR)	f4551
			15
	F4552	f (δSPOR, δFWOR)	f4552
			15
	F4553	f (δSPIL, δFWIL)	f4553
			15
	F4554	f (δSPOL, δFWOL)	F4554
			15
	F5131	f (M, hp, δSPIR)	f5131
			14
	F5132	f (M, hp, δSPOR)	f5132
			14

ITERATION RATE:

TITLE

FAST INTEGRATION ROLLING MOMENT COEFFICIENT

EQUATION:

PROGRAM NO. F104

PAGE NO. 2 OF 4

EQUATION NO:

F104

CORE TYPE / CORE LOCATION	INPUT SOURCE		SYMBOL / SCALE
	F5133	f (M, hp, δSPIL)	f5133 / 14
	F5134	f (M, hp, δSPOL)	f5134 / 14
	F4200	f (CL, δFW)	f4200 / 21
	F4210	f (M, hp)	f4210 / 15
AM	DC1LE / F110		ΔCℓLE / 15
AM	DC1SF / F110		ΔCℓFSP / 15
AM	DC1LG / F110		ΔCℓLG / 15
CA	KC11	CONST.	KCℓ3 / 12
AM	DAI / F132	AILERON INBOARD DEF.	δai / 09
	F4220	f (|δao|)	f4220 / 15
	F4230	f (CL, δFW)	f4230 / 20

ITERATION RATE:

TITLE

FAST INTEGRATION ROLLING MOMENT COEFFICIENT

EQUATION:

PROGRAM NO. F104

PAGE NO. 3 OF 4

EQUATION NO:

F104

CORE TYPE / CORE LOCATION		SYMBOL
INPUT SOURCE		SCALE
F4240	f (M, hp)	f4240
		15
AM DAO	AILERON OUTBOARD	δao
F132	DEF.	09
AM RS	YAW RATE STAB.	rs
F040	AXIS	13

ITERATION RATE:

TITLE
FAST INTEGRATION ROLLING MOMENT COEFFICIENT

EQUATION:

PROGRAM NO. F104

PAGE NO. 4 OF 4

EQUATION NO:
F104

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	BETA	BETA	β
F040			09
AM	CNB		CNB
F106			19
AM	KRS		KRS
F106			14
AM	CNR		CNR
F106			07
AM	CNP		CNP
F106			09
AM	DCNLG		DCNLG
F106			15
AM	RS	YAW RATE STAB.	rs
F040		AXIS	13
AM	PS	ROLL RATE STAB.	ps
F040		AXIS	13
AM	VP	TRUE AIR SPEED	VP
F030			02
	F4640	f (M)	f4640
			14
	F4700	f (|δr|)	f4700
			19

ITERATION RATE: 12.5/SEC

TITLE

FAST INTEGRATION YAWING MOMENT COEFFICIENT

EQUATION:

$$\Delta Cn\beta = CNB \cdot \beta$$

$$\left.\begin{aligned} \Delta Cnrs &= CNR \cdot \frac{rs}{Vp} \\ \Delta Cnps &= CNP \cdot \frac{ps}{Vp} \end{aligned}\right\} \quad Vp \geqq 50$$

$$\Delta Cn\delta r = -f_{4640} \cdot (f_{4700} \cdot \frac{\delta r}{|\delta r|} + Kcn_1 \cdot \delta ttr)$$

$$\Delta Cn\delta sp = Kcn_3 \cdot (\delta SPR - \delta SPL) \cdot (f_{4430} - 0.045) \cdot f_{4440}$$

$$Cn = \Delta Cn\beta + \Delta Cnps + \Delta Cnrs + \Delta Cn\delta r + \Delta Cn\delta sp + \Delta Cn_{LG}$$

PROGRAM NO. F105

PAGE NO. 1 OF 2

ΔCnβ		DCNB
15		
ΔCnrs		DCNRS
15		
ΔCnps		DCNPS
15		
ΔCnδr		DCNDR
15		
ΔCnδsp		DCNSP
15		
Cn	YAWING MOMENT	CN
15	COEF.	

EQUATION NO: F105

CORE TYPE / CORE LOCATION		SYMBOL
INPUT SOURCE		SCALE

TITLE: FAST INTEGRATION YAWING MOMENT COEFFICIENT

PROGRAM NO.: F105

PAGE NO.: 2 OF 2

EQUATION:

AM DR	RUDDER DEF.	δr	
F134		09	
CA KCN1	CONST	KCn1	
		26	
AM DTTR	RUDDER TAB DEF.	δttr	
A030		09	
KCN3	CONST	KCn3	
		19	
DSPR	RT SPOILER DEF.	δSPR	
F150		15	
DSPL	LT SPOILER DEF.	δSPL	
F150		15	
F4430	f (CL, δFW)	f4430	
		18	
F4440	f (M)	f4440	
		15	

ITERATION RATE:

EQUATION NO.: F105

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
	F6370	f (δFWI, δFWO)	F6370
			18
	F3420	f (hp, M)	f3420
			20
	F3400	f (α, δFW)	f3400
			14
CA	KCL1	CONST	KCL1
			09
AM	DFWIN	NORM. INBOARD FLAP	δFWIN
F150			15
AM	DFWON	NORM.OUTBOARD FLAP	δFWON
F150			15
	F5220	f (M, hp)	f5220
			23
	F5200	f (M, hp)	f5200
			20
	F6270	f (VE, δFW)	f6270
			18
	F3410	f (M, hp)	f3410
			17
	F6410	f (δFWI, δFWO)	f6410
			15

ITERATION RATE: 2.38/SEC

TITLE

MIDDLE INTEGRATION COEFFICIENT

EQUATION:

$CLBSC = f_{6370}$

$CLA = f_{3420} - 0.0232$

$DCLBAF = -(f_{3400} - 0.01)\cdot(1.0 - KCL1\cdot|\delta FWIN - \delta FWON|)$

$CLDE = f_{5220} - 0.0004$

$DCLSKA = f_{5200}\cdot(SFRL + 4.0)$

$D2CL = f_{6270}$

$D1CL = f_{3410} - 0.14$

$CLBDF = f_{6410}$

$CLQS = f_{3450} - KCL3\cdot\ell_{XCG}$

$CLAD = -f_{3440}$

$CLAZA = f_{3460}$

PROGRAM NO. F106

PAGE NO. 1 OF 7

CLBSC		CLBSC	AM
18			
CLA		CLA	AM
20			
DCLBAF		DCLBAF	AM
13			
CLDE		CLDE	AM
23			
DCLSKA		DCLSKA	AM
13			
D2CL		D2CL	AM
13			
D1CL		D1CL	AM
13			
CLBDF		CLBDF	AM
13			
CLQS		CLQS	AM
08			
CLAD		CLAD	AM
08			

EQUATION NO: F106

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
	F3450	f (M, hp)	f3450
			08
CA	KCL3	CONST	KCL3
			12
AM	LXCG	CENTER OF GRAVITY	ℓXCG
F340		POS. X-AXIS	11
	F3440	f (M)	f3440
			08
	F3460	f (M, hp)	f3460
			19
	F3610	f (M, CL)	f3610
			19
AM	M	MACH NUMBER	M
F320			13
	F3600	f (CL, δFW)	f3600
			16
	F3630	f (CL, δFW)	f3630
			16
	F4650	f (VE, δFW)	f4650
			18
CA	KCM1	CONST	KCM1
			14

ITERATION RATE:

TITLE: MIDDLE INTEGRATION COEFFICIENT

EQUATION:

$$DCDM = (f_{3610} - 0.01)^{\oplus} + 0.5(M - 0.9)^{\oplus}$$

$$CDBSC = f_{3600} + f_{3630}$$

$$D2CM = (f_{4650} - 0.012) \cdot \left\{ 1.0 + KCM1 \cdot \underbrace{\left(1.0 - \frac{|\delta_{FWN} - 0.8|}{KCM1}\right)^{\oplus}}_{1.0 \geqq} \right\}$$

$$CMBSA = -f_{3740}$$

$$CMA = f_{4130}$$

$$D1CM = -(f_{3730} - 0.001) - (f_{3720} - 0.01)$$

$$CMQA = -(f_{4150} + 4.0 \cdot \ell_{XCG}) \cdot \{1.0 + (0.563 - M)^{\oplus}\}$$

$$CMQAD = 2^{14} \cdot \underbrace{(KCM3 \cdot f_{6230})}_{1 \geqq}$$

$$CMAD = f_{4140}$$

PROGRAM NO. F106

PAGE NO. 2 OF 7

CLAZA		CLAZA	AM
19			
DCDM		DCDM	AM
13			
CDBSC		CDBSC	AM
16			
D2CM		D2CM	AM
13			
CMBSA		CMBSA	AM
20			
CMA		CMA	AM
20			
D1CM		D1CM	AM
13			
CMQA		CMQA	AM
04			
CMQAD	Double	CMQAD	AM
15			
CMAD		CMAD	AM
08			

EQUATION NO: F106

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	DFWN	NORM. FLAP POS.	δFWN
F150			15
	F3740	f (δFW)	f3740
			20
	F4130	f (M, hp)	f4130
			20
	F3730	f (M, hp)	f3730
			17
	F3720	f (M, hp)	f3720
			19
	F4150	f (M, hp)	f4150
			07
CA	KCM3	CONST	KCM3
			07
	F6230	f (M, hp)	f6230
			22
	F4140	f (M, hp)	f4140
			08

ITERATION RATE:

TITLE

MIDDLE INTEGRATION COEFFICIENT

EQUATION:

$$CYB = -f_{431} \cdot f_{432}$$

$$CYR = f_{436} \cdot f_{435}$$

$$CYP = f_{437} + f_{440}$$

$$FLBGE = \{1.0 - f_{5000} \cdot (f_{6300} - 0.111)\}$$

$$C1B = -\{(1.0 - KC11 \cdot \delta_{FWN})^{\oplus} \cdot f_{4260} + f_{4270}\} \cdot FLBGE$$

$$C1P = -\{f_{4500} \cdot (1.0 - KC11 \cdot \delta_{FWN})^{\oplus} + f_{7640}\}$$

$$C1DR = (f_{4510} - 0.00032) \cdot f_{4520}$$

$$C1R = f_{4530} + f_{4540}$$

PROGRAM NO. F106

PAGE NO. 3 OF 7

EQUATION NO:

F106

CORE TYPE / CORE LOCATION		SYMBOL
INPUT SOURCE		SCALE

TITLE: MIDDLE INTEGRATION COEFFICIENT

PROGRAM NO.: F106

PAGE NO.: 4 OF 7

F431	f (CL, δFW)	f431 / 20
F432	f (M)	f432 / 14
F436	f (M)	f436 / 14
F435	f (CL)	f435 / 09
F437	f (δFW)	f437 / 12
F440	f (CL, M)	f440 / 11
F5000	f (h')	f5000 / 15
F6300	f (α, δFW)	f6300 / 15
CA KC11	CONST	KC11 / 12
AM DFWN F150	NORM. FLAP POS.	δFWN / 15
F4260	f (CL, hp, M)	f4260 / 23

ITERATION RATE:

EQUATION:

$$FNGE = 1.0 - f_{6340} \cdot f_{5000}$$

$$CNB = (f_{6320} \cdot f_{6330} - KCN1 \cdot \delta_{LG}) \cdot FNGE$$

$$KRS = 1.0 - KCN2 \cdot \ell XCG$$

$$CNR = -\left\{f_{4450} \cdot (1.0 - KC11 \cdot \delta_{FWN})^{\oplus} + f_{4670}\right\} \cdot KRS$$

$$CNP = -\left\{f_{4460} - 10.712 + (f_{5030} - 4.642) \cdot (1.0 - KC11 \cdot \delta_{FWN})^{\oplus}\right\}$$

$$DCNLG = KCN4 \cdot (\overset{*}{\delta}_{LGR} - \overset{*}{\delta}_{LGL})$$

CYB	18	CYB AM
CYR	07	CYR AM
CYP	10	CYP AM
FLBGE	07	FLBGE AM
C1B	20	C1B AM
C1P	07	C1P AM
C1DR	22	C1DR AM
C1R	09	C1R AM
FNGE	12	FNGE AM
CNB	19	CNB AM

EQUATION NO: F106

CORE TYPE / CORE LOCATION / INPUT SOURCE		SYMBOL / SCALE
F4270	f (CL, δFW)	f4270 / 23
F4500	f (VE, hp)	f4500 / 09
F7640	f (VE, δFW)	f7640 / 09
F4510	f (CL, δFW)	f4510 / 24
F4520	f (M)	f4520 / 14
F4530	f (CL, δFW)	f4530 / 09
F4540	f (M)	f4540 / 15
F6340	f (α, δFW)	f6340 / 16
F6320	f (CL, δFW)	f6320 / 23
F6330	f (M)	f6330 / 14

ITERATION RATE:

TITLE

MIDDLE INTEGRATION COEFFICIENT

EQUATION:

PROGRAM NO. F106

PAGE NO. 5 OF 7

KRS / 14	KRS AM
CNR / 07	CNR AM
CNP / 09	CNP AM
DCNLG / 15	DCNLG AM

EQUATION NO:

F106

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE

MIDDLE INTEGRATION COEFFICIENT

PROGRAM NO.	F106
PAGE NO.	6 OF 7

EQUATION:

CA	KCN1	CONST	KCN1
			26
AM	DLG	DELT LG	δLG
F150			11
CA	KCN2	CONST	KCN2
			20
AM	LXCG	C. G. POS. X-AXIS	ℓXCG
F340			11
	F4450	f (M, CL, hp)	f4450
			11
CA	KC11	CONST	KC11
			12
AM	DFWN	NORM. FLAP POS.	δFWN
F150			15
	F4670	f (CL, δFW)	f4670
			10
	F4460	f (CL, δFW)	f4460
			10
	F5030	f (CL, M)	f5030
			11
CA	KCN4	CONST	KCN4
			17

ITERATION RATE:

EQUATION NO:

F106

CORE TYPE / CORE LOCATION		SYMBOL
INPUT SOURCE		SCALE

TITLE: MIDDLE INTEGRATION COEFFICIENT

PROGRAM NO.: F106

PAGE NO.: 7 OF 7

EQUATION:

AM NDLGR F150	NORM. RT GEAR	δ*LGR 11
AM NDLGL F150	NORM. LT GEAR	δ*LGL 11

ITERATION RATE:

EQUATION NO: F106

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	F6260	$f(\alpha, \delta_{FW})$	f_{6260}
			15
AM	F5000	$f(h')$	f_{5000}
			15
AM	F6400	$f(\alpha, \delta_{FW})$	f_{6400}
			14
AM	F6350	$f(\alpha, \delta_{FW})$	f_{6350}
			17
AM	F6360	$f(\alpha, \delta_{FW})$	f_{6360}
			18
AM	DLE	DELTA LE FLAP	δ_{LE}
F150			15
AM	EAS	EQUIVALENT AIR SPEED	VE
F320			02
AM	DFW	DELTA FLAP	δ_{FWN}
F150			15
CA	DFWM	DELTA FLAP MAX	δ_{FWMAX}
			09
AM	ALPHA	ALPHA	α
F040			07
AM	NDLGL	NORM. LEFT GEAR	δ^*_{LGL}
F150			11

ITERATION RATE: 2.38/SEC

TITLE: MEDIUM BAND PARTIAL FORCE & MOMENT COEFFICIENT

EQUATION:

$$\Delta C_{LLE} = -(1 - \delta_{LE}) \cdot \{f_{6260} - 0.2\} + K_{CL2} \cdot VE \cdot \underbrace{(2^5 \cdot \delta_{FWN})}_{\text{LIMIT TO } 1.0}$$

$$\Delta C_{LGE} = \frac{1}{2} \cdot (K_{CL6} \cdot \delta_{FWMAX} \cdot \delta_{FWN} + K_{CL4} \cdot \alpha + K_{CL5}) \cdot f_{5000}$$

$$\Delta C_{L\delta FWSP} = -(f_{6400} - 0.4)$$

$$\Delta C_{LLG} = -(f_{6350} - 0.1 + f_{6360} - 0.1) \cdot \frac{\delta^*_{LGL} + \delta^*_{LGR}}{2}$$

PROGRAM NO. F110

PAGE NO. 1 OF 5

ΔC_{LLE}	LIFT COEF.LE FLAP	DCLLE	AM
13			
ΔC_{LGF}	LIFT COEF.GROUND	DCLGE	AM
13	EFFECT		
$\Delta C_{L\delta FWSP}$	LIFT COEF.SPLIT	DCLSF	AM
13	FLAP		
ΔC_{LLG}	LIFT COEF. LANDING	DCLLG	AM
13	GEAR		

EQUATION NO: F110

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	NDLGR	NORM. RT GEAR	δ^*_{LGR}
F150			11
CA	KCL2	LIFT CONST. KCL2	K_{CL2}
			26
CA	KCL6	LIFT CONST. KCL6	K_{CL6}
			19
CA	KCL4	LIFT CONST. KCL4	K_{CL4}
			21
CA	KCL5	LIFT CONST. KCL5	K_{CL5}
			13

ITERATION RATE:

TITLE
MEDIUM BAND PARTIAL FORCE & MOMENT COEFFICIENT

EQUATION:

PROGRAM NO. F110

PAGE NO. 2 OF 5

EQUATION NO:
F110

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: MEDIUM BAND PARTIAL FORCE & MOMENT COEFFICIENT

PROGRAM NO.: F110

PAGE NO.: 3 OF 5

AM	F3640	f(CL, δ_{FW})	f_{3640}
			18
AM	F3650	f(M)	f_{3650}
			20
AM	DLG	DELTA LG	δ_{LG}
	F150		11
CA	KWM	WINDMIL CONST.	KWM
			13
AM	F4630	f(WG, δ_{FW})	f_{4630}
			13
AM	F3540	f(δ_{FW})	f_{3540}
			16
AM	F3560	f(M)	f_{3560}
			14
AM	F3000	f(δ_{FW})	f_{3000}
			13
AM	M	MACH NO.	M
	F320		13

ITERATION RATE:

EQUATION:

$$\Delta C_{DGE} = -f_{5000}(f_{3640} - 0.022)$$

$$\Delta C_{DLG} = f_{3650} \cdot \delta_{LG}$$

$$\Delta C_{DWM} = K_{WM}$$

$$C_{LBUFF} = (f_{4630} - f_{3540})\ \overline{[M \geqq 0.4][\delta_{FW} = 0]}$$

$$+ f_{3560}\,[M \geqq 0.4][\delta_{FW} = 0]$$

$$C_{LSTALL} = f_{3000}$$

ΔC_{DGE}	DRAG COEF. GROUND	DCDGE	AM	
13	EFFECT			
ΔC_{DLG}	DRAG COEF. LANDING	DCDLG	AM	
13	GEAR			
ΔC_{DWM}	DRAG COEF. WINDMIL	DCDWM	AM	
13				
C_{LBUFF}	BUFFET CL	CLBUFF	AM	
13				
C_{LSTAL}	STALL CL	CLSTAL	AM	
13				

EQUATION NO.: F110

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	F3770	f(M)	f_{3770}
			20
AM	F4000	$f(\delta_{FW})$	f_{4000}
			22
AM	F4720	$f(\delta_{FWI}, \delta_{FW})$	f_{4720}
			18
AM	F3750	$f(\delta_{FWI}, \delta_{FW})$	f_{3750}
			22
CA	KCM7	PITCH MOMENT CONST.	K_{cm7}
		KCM7	15
CA	KCM8	PITCH MOMENT CONST.	K_{cm8}
		KCM8	12
CA	KCM9	PITCH MOMENT CONST.	K_{cm9}
		KCM9	15
CA	DFWIM	INBD FLAP MAX	δ_{FWIMAX}
			09
CA	DLEM	LE FLAP MAX	δ_{LEMAX}
			09

ITERATION RATE:

TITLE

MEDIUM BAND PARTIAL FORCE & MOMENT COEFFICIENT

EQUATION:

$$\Delta Cm_{LG} = (f_{3770} - f_{4000}) \cdot \delta_{LG}$$

$$\Delta Cm_{GE} = Kcm_7 \cdot (1.0 - Kcm_8 \cdot |\delta_{FWN} - Kcm_9|) \cdot f_{5000}$$

$$\Delta Cm_{FSP} = f_{4720} - 0.01932 + (f_{3750} - 0.00306) \cdot \alpha$$

PROGRAM NO. F110

PAGE NO. 4 OF 5

ΔC_{mLG}	PITCH MOMENT COEF.	DCMLG	AM
13	LANDING GEAR		
ΔC_{mGE}	PITCH MOMENT COEF.	DCMGE	AM
13	GROUND EFFECT		
ΔC_{mFSP}	PITCH MOMENT COEF.	DCMSF	AM
13	SPLIT FLAP		

EQUATION NO:

F110

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: MEDIUM BAND PARTIAL FORCE & MOMENT COEFFICIENT

PROGRAM NO.: F110

PAGE NO.: 5 OF 5

AM	DFWOL	LT OTBD TE FLAP	δ_{FWOL}
A030			09
AM	DFWOR	RT OTBD TE FLAP	δ_{FWOR}
A030			09
AM	DFWIL	LT INBD TE FLAP	δ_{FWIL}
A030			09
AM	DFWIR	RT INBD TE FLAP	δ_{FWIR}
A030			09
AM	DLEL	LT LE FLAP POS.	δ_{LEL}
A030			09
AM	DLER	RT LE FLAP POS.	δ_{LER}
A030			09
CA	KC18	ROLL MOMENT CONST.	$K_{C\ell 8}$
		$KC\ell 8$	13
CA	KC15	ROLL MOMENT CONST.	$K_{C\ell 5}$
		$KC\ell 5$	13
CA	KC16	ROLL MOMENT CONST.	$K_{C\ell 6}$
		$KC\ell 6$	20
CA	KC17	ROLL MOMENT CONST.	$K_{C\ell 7}$
		$KC\ell 7$	17
CA	DFWOM	OTBD FLAP MAX	δ_{FWOMAX}
			09

ITERATION RATE:

EQUATION:

$$\Delta C_{\ell FSP} = K_{C\ell 8} \cdot \frac{\delta_{FWOL} - \delta_{FWOR}}{\delta_{FWOMAX}} + K_{C\ell 5} \cdot \frac{\delta_{FWIL} - \delta_{FWIR}}{\delta_{FWIMAX}}$$

$$\Delta C_{\ell LE} = K_{C\ell 6} \cdot \frac{\delta_{LEL} - \delta_{LER}}{\delta_{LEMAX}}$$

$$\Delta C_{\ell LG} = K_{C\ell 7} \cdot (\overset{*}{\delta}_{LGR} - \overset{*}{\delta}_{LGL})$$

$\Delta C_{\ell FSP}$	ROLL MOMENT COEF.	DC1SF	AM	
15	SPLIT FLAP			
$\Delta C_{\ell LE}$	ROLL MOMENT COEF.	DC1LE	AM	
15	LE FLAP			
$\Delta C_{\ell LG}$	ROLL MOMENT COEF.	DC1LG	AM	
15	LANDING GEAR			

EQUATION NO: F110

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	DS	STICK DEFLECTION	δ_S
A000		STRETCHED	09
AM	FSC	PILOT APLIED	F_{SC}
A000			07
CA	KS1	COEF.KS1	K_{S1}
			18
CA	KSG	COEF.KSG	K_{SG}
			07
AM	Q	DYNAMIC PRESSURE	q
F320			03
AM	F1A	$f(\delta''s)$	f_{1A}
			07
AM	K	INTEG CONST	K
MONITOR			00
CA	KSA	COEF. KSA	K_{SA}
			10
AM	F4770	$f(q)$	f_{4770}
			06
AM	F2A	$f(\delta's)$	f_{2A}
			15
AM	F5110	$f(M)$	f_{5110}
			15

ITERATION RATE: 100/SEC

TITLE

LONGITUDINAL CONTROL SYSTEM

EQUATION:

$$\delta's = \delta s$$

$$\dot{\delta s} = 0$$

$$F_{SG} = 0[\delta's < f(q)] + K_{SG}[\delta's \geqq f(q)]$$

WHERE

$$f(q) = \left\{\frac{q}{3.75} + 4.23\right\}[\delta's \geqq 0] + \left\{\frac{q}{2.26} + 7.04\right\}[\delta's < 0]$$

$$F_{SCS} = f_{1A}$$

WHERE

$$\delta''s = \delta's + K_{S3}\dot{\delta s}$$

$$F_{SA} = K_{SA} \cdot f_{4770} \cdot Ch_{TC}$$

WHERE

$$Ch_{TC} = 1.22 f_{2A} \cdot f_{5110} + f_{3A}$$

$$F_{SVF} = -K_{SVF} \cdot \dot{\delta s}$$

$$F_{SCF} = K_{SCF}$$

PROGRAM NO. F130

PAGE NO. 1 OF 3

$\delta's$	STICK DEFLECTION	DSS	AM
09	UNSTRETCHED (~ deg)		
F_{SG}	STICK TAB LIMIT	FSG	AM
07	FORCE ON GROUND		
F_{SCS}	CENTERING SPRING	FSCS	AM
07	FORCE		
F_{SA}	AERODYNAMIC FORCE	FSA	AM
07			
F_{SVF}	VISCOUS FRICTION	FSVF	AM
07			
F_{SCF}	COLLOMB FRICTION	FSCF	AM
07			
F_S	STICK FORCE	FS	AM
07			
$\delta''s$	$\delta''s$	DS2S	AM
09			
Ch_{TC}	Ch_{TC}	CHTC	AM
15			

EQUATION NO: F130

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: LONGITUDINAL CONTROL SYSTEM

PROGRAM NO.: F130

PAGE NO.: 2 OF 3

AM	F3A	$f(\delta's)$	$f3A$ / 15
CA	KSVF	COEF.KSVF	K_{SVF} / 15
CA	KSCF	COEF.KSCF	K_{SCF} / 09
CA	DSMAX	δs UPPER LIMIT	δ_{SMAX} / 09
CA	DSSMX	$\delta's$ UPPER LIMIT	δ'_{SMAX} / 09
CA	DSSMN	$\delta's$ LOWER LIMIT	δ'_{SMIN} / 09
CA	KDE1	COEF. KDE1	K_{DE1} / 13
AM	F5120	$f(\delta s, \delta_{FW})$	f_{5120} / 14
CA	DEMAX	δe UPPER LIMIT	δ_{eMAX} / 09
CA	DEMIN	δe LOWER LIMIT	δ_{eMIN} / 09
CA	KDET	COEF.KDET	K_{DET} / 11

ITERATION RATE:

EQUATION:

$F_S = F_{SG} + F_{SCS} + F_{SA} + F_{SVF}$

[POSITIVE FORCE MOVE THE STICK FORWARD]

[LIMITATION]

$\delta_{SMAX} \geqq \delta s \geqq -\delta_{SMAX}$ $\quad \delta'_{SMAX} \geqq \delta's \geqq \delta'_{SMIN}$

(δs POSITIVE FORWARD)

$\delta e = K_{DE1} \cdot \delta's + f_{5120}$

WHERE $\quad \delta_{eMAX} \geqq \delta e \geqq \delta_{eMIN}$

$\delta et = K_{DET}\delta's + \delta e - 3$

$\delta_{SABS} = |\delta s|$

δe / 09	ELEVATOR DEFLECTION	DE	AM
δet / 09	ELEVATOR TAB DEFLECTION	DET	AM
δ_{SABS} / 09	STICK DEF. ABSOLUTE VALUE	ABSDS	AM

EQUATION NO: F130

CORE TYPE / CORE LOCATION		SYMBOL	TITLE	PROGRAM NO.	F130
INPUT SOURCE		SCALE	LONGITUDINAL CONTROL SYSTEM	PAGE NO.	3 OF 3

CA	KS3	COEF. KS3	K_{S3}
			15

EQUATION:

ITERATION RATE:

EQUATION NO:

F130

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	DW	WHEEL DEFLECTION	δw
A000		STRETCHED	08
CA	KW1	COEF.KW1	K_{W1}
			15
AM	FWC	PILOT APPLIED	Fwc
A000		WHEEL FORCE	07
AM	F12A	$f(\delta_{FW})$	f_{12A}
			07
AM	F1750	$f(\delta w'')$	f_{1750}
			10
AM	F14A	$f(\delta w'')$	f_{14A}
			12
AM	DFWN	DELTA FLAP	δ_{FWN}
F150		NORMALIZED	15
AM	K	INTEG CONST.	K
MONITOR			00
CA	KW2	COEF.KW2	KW2
			11
AM	DTTA	AILERON TRIM TAB	δtta
A030		DEFLECTION	09
AM	Q	DYNAMIC PRESSURE	q
F320			03

ITERATION RATE: 100/SEC

TITLE

LATERAL CONTROL SYSTEM

EQUATION:

$$\delta' w = \delta w \qquad (f_{12A} \geqq \delta w \geqq -f_{12A})$$

$$\dot{\delta w} = 0$$

$$F_{WCS} = f_{1750} + f_{14A} \cdot (0.6 - \delta_{FWN})^{\oplus}$$

WHERE

$$\delta w'' = \delta' w + K_{S3} \cdot \dot{\delta w} + K_{W2} \cdot \delta tta$$

$$F_{WA} = -q f_A(\delta_{FW}) \left\{ \delta' w + K_{WA} \cdot (|\delta' w| - f_{11A})^{\oplus} \frac{\delta' w}{|\delta' w|} \right\}$$

WHERE

$$f_A(\delta_{FW}) = 0.00151 + 0.00079(1.667\ \delta_{FWN})^{\oplus}$$

$$F_{WVF} = -K_{WVF} \cdot \dot{\delta w}$$

$$F_{WCF} = -K_{WCF} \frac{\dot{\delta w}}{|\dot{\delta w}|}$$

$$F_{WG} = 0[q \geqq 4.0] + f_{31}[q < 4.0]$$

PROGRAM NO.	F132
PAGE NO.	1 OF 3

$\delta' w$	WHEEL DEFLECTION	DWS	AM
08	UNSTRETCHED		
FWCS	CENTERING SPRING	FWCS	AM
07	FORCE		
FWA	AERODYNAMIC FORCE	FWA	AM
07			
FWVF	VISCOUS FRICTION	FWVF	AM
07			
FWCF	COULOMB FRICTION	FWCF	AM
07			
FWG	WHEEL TAB LIMIT	FWG	AM
07	FORCE ON GROUND		
FW	WHEEL FORCE	FW	AM
07			
$\delta w''$	DELTA WHEEL 2	DW2S	AM
08			

EQUATION NO:

F132

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	KWA	COEF. KWA	KWA 12
AM	F11A	$f(\delta FW)$	f_{11A} 07
CA	KS3	COEF. KS3	KS3 15
CA	KA3	COEF. KA3	KA3 15
CA	KWVF	COEF. KWVF	KWVF 15
CA	KWCF	COEF.KWCF	KWCF 11
AM	F31	$f(\delta w')$	f_{31} 10
CA	KA1	COEF. KA1	KA1 15
CA	KA2	COEF.KA2	KA2 15
AM	DFWIN	DELTA FLAP INBD	δFWIN 15
	F150	NORMALIZED	
AM	F5140	$f(\delta FWO)$	f_{5140} 14

ITERATION RATE:

TITLE

LATERAL CONTROL SYSTEM

EQUATION:

$$Fw = FwCS + FwA + FwVF + FwCF + FwG$$

[POSITIVE FORCE MOVES THE CONTROL WHEEL COUNTERCLOCKWISE]

$$\delta aI = \frac{\delta' w}{|\delta' w|}\left\{KA1 \cdot |\delta' w| - KA2(|\delta' w| - 40.0)^{\oplus} - [KA3|\delta' w| - KA2(|\delta' w| - 40.0)^{\oplus}](\frac{\delta FWIN}{0.6})^{\oplus}\right\}$$

$$\delta aO = \delta aI \cdot f_{5140} \qquad (f_{5160} \geqq \delta aI \geqq -f_{5160})$$

$$\delta aOABS = |\delta aO|$$

PROGRAM NO. F132

PAGE NO. 2 OF 3

δaI 09	INBORD AILERON DEFLECTION	DAI	AM
δao 09	OUTBORD AILERON DEFLECTION	DAO	AM
δaOABS 09		ABSDAO	AM

EQUATION NO:

F132

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: LATERAL CONTROL SYSTEM

PROGRAM NO.: F132

PAGE NO.: 3 OF 3

AM	F5160	$f(\delta_{FW})$	f_{5160}
			10
CA	DSB	SPEED BRAKE	δ_{SB}
		DEFLECTION	09
CA	KSP1	COEF. KSP1	K_{SP1}
			15
CA	KSP2	COEF. KSP2	K_{SP2}
			08
AM	F5150	f(VE)	f_{5150}
			09
AM	F11A	$f(\delta_{FW})$	f_{11A}
			07

ITERATION RATE:

EQUATION:

$$\delta_{SPIL} = \delta_{SPOL} = \delta_{SB} + \frac{\delta'_W}{|\delta'_W|} \cdot K_{SP1}(|\delta'_W| - K_{SP2})^{\oplus}$$

$$\delta_{SPIR} = \delta_{SPOR} = \delta_{SB} - \frac{\delta'_W}{|\delta'_W|} \cdot K_{SP1}(|\delta'_W| - K_{SP2})^{\oplus}$$

$$\delta_{SPIL}, \delta_{SPIR}, \delta_{SPOL}, \delta_{SPOR} \leqq f_{5150}$$

δ_{SPIL}	INBORD LEFT SPOILER	DSPIL	AM
09	DEFLECTION		
δ_{SPOL}	OUTBORD LEFT SPOILER	DSPOL	AM
09	DEFLECTION		
δ_{SPIR}	INBORD RIGHT SPOILER	DSPIR	AM
09	DEFLECTION		
δ_{SPOR}	OUTBORD SPOILER	DSPOR	AM
09	DEFLECTION		

EQUATION NO.: F132

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: DIRECTIONAL CONTROL SYSTEM

PROGRAM NO.: F134

PAGE NO.: 1 OF 3

AM	DP	PEDAL DEFLECTION	δ_P
A000		STRETCHED	11
CA	KP1	COEF.KP1	K_{P1}
			15
AM	FPC	PILOT APLIED PEDAL	F_{PC}
A000		FORCE	06
AM	F18A	$f(\delta_P'')$	f_{18A}
			06
CD	BST	RUDDER BOOST ON	BST
			ON=1
AM	F5040	f(M)	f_{5040}
			11
CA	KP2	COEF. KP2	K_{P2}
			15
AM	DTTR	RUDDER TRIM TAB	δttr
A030		DEFLECTION	09
CA	KP3	COEF. KP3	K_{P3}
			15
CA	DPMAX	DELTA P MAX	δ_{PMAX}
			11
AM	F4760	f(q)	f_{4760}
			15

ITERATION RATE: 100/SEC

EQUATION:

$$\delta'_P = \delta_P \qquad \left[\begin{array}{l} -\delta_{PMAX} \leqq \delta_P \leqq \delta_{PMAX} \\ \delta_P' \leqq 12.00[BST] + f_{5040} \cdot \overline{[BST]} \end{array} \right]$$

$$F_{PCS} = f_{18A}[BST] + 0\overline{[BST]}$$

$$\dot{\delta}_P = 0$$

WHERE

$$\delta''_P = \{\delta'_P + K_{P2} \cdot \delta ttr + K_{P3} \cdot \dot{\delta}_P\}[BST] + \{\delta'_P + 1.08 \cdot f_{4760} \cdot (|\delta ttr| - 1.0)^{\oplus}\}\overline{[BST]}$$

$$F_{PTS} = 0[BST] + f_{22A} \cdot [q > 4.0]\overline{[BST]} + f_{40A}[q \leq 4.0]\overline{[BST]}$$

WHERE

$$\delta'''_P = \delta'_P - 0.41\delta_{TCL} + 0.405\delta ttr$$

$$\delta_{TCL} = \delta_{TCL(n-1)} + 0.108\{|F_{PC}| - 72 + 8|\delta_{TCL(n-1)}|\}\frac{F_{PC}}{|F_{PC}|}$$

$$F_{PA} = -K_{PA1}(q - 50)^{\oplus}\underbrace{\delta''_P}_{\text{LIMITED } \pm 4.0}[BST] + K_{PA2} \cdot q \cdot Chrp\overline{[BST]}$$

WHERE

$$Chrp = 1.3411 \cdot f_{26A} \cdot f_{5100} + f_{4620} \cdot \beta$$

δ_P'	PEDAL DEFLECTION	DPS	AM
11	UNSTRETCHED		
F_{PCS}	CENTERING SPRING	FPCS	AM
06	FORCE		
δ_P''	δ_P''	DP2S	AM
11			
F_{PTS}	TRIM SPRING FORCE	FPTS	AM
06			
δ_P'''	δ_P'''	DP3S	AM
11			
δ_{TCL}	δ_{TCL}	DRCL	AM
09			
F_{PA}	AERODYNAMIC FORCE	FPA	AM
06			
Chrp	Chrp	CHTP	AM
15			

EQUATION NO: F134

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	F22A	$f(\delta_P'')$	f_{22A}
			06
AM	F40A	$f(\delta_P''')$	f_{40A}
			06
AM	Q	DYNAMIC PRESSURE	q
F320			03
CA	KPCF	COEF.KPCF	K_{PCF}
			10
CA	KPA1	COEF.KPA1	K_{PA1}
			15
CA	KPA2	COEF.KPA2	K_{PA2}
			09
AM	F26A	$f(\delta_P'')$	f_{26A}
			15
AM	F5100	$f(M)$	f_{5100}
			15
AM	F4620	$f(M)$	f_{4620}
			23
AM	BETA	BETA	β
F040			09
CA	KPVF	COEF.KVF	K_{PVF}
			12

ITERATION RATE:

TITLE

DIRECTIONAL CONTROL SYSTEM

EQUATION:

$$F_{PVF} = -K_{PVF} \cdot \dot{\delta}_P$$

$$F_{PCF} = -K_{PCF} \frac{\dot{\delta}_P}{|\dot{\delta}_P|}$$

$$F_{PG} = 0[q \geq 4.0] + \{f_{30}[BST] + F_{PTS}[\overline{BST}]\}[q < 4.0]$$

$$F_P = F_{PCS} + F_{PTS} + F_{PA} + F_{PVF} + F_{PCF}$$

PROGRAM NO. F134

PAGE NO. 2 OF 3

F_{PVF}	VISCOUS FRICTION	FPVF	AM
06			
F_{PCF}	COULOMB FRICTION	FPCF	AM
06			
F_{PG}	PEDAL TAB LIMIT	FPG	AM
06	FORCE ON GROUND		
F_P	PEDAL FORCE	FP	AM
06			

EQUATION NO:

F134

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: DIRECTIONAL CONTROL SYSTEM

PROGRAM NO.: F134

PAGE NO.: 3 OF 3

AM	F30	$f(\delta_P'')$	f_{30} 06
CA	KR1	COEF. KR1	K_{r1} 11
CA	KR2	COEF. KR2	K_{r2} 12
AM	F5050	$f(\delta p, M)$	f_{5050} 12
AM	F5060	$f(M)$	f_{5060} 16
DM	WOW	WEIGHT ON WHEEL	WOW ON GROUND = 1
AM	F5010	$f(Ve)$	f_{5010} 10
AM	K	INTEG CONST.	K 00
MONITOR			

ITERATION RATE:

EQUATION:

$$\delta_r = K_{r1} \cdot \delta'_P[BST]$$

$$+\frac{\delta'_P}{|\delta'_P|}\left\{K_{r2}(|\delta'_P| - K_1)^{\oplus} - f_{5050} + (f_{5060} - .01)\beta\right\}\overline{[BST]}$$

WHERE

$$K_1 = 0[WOW] + 1.15\overline{[WOW]}$$

$$|\delta r| \leqq \left\{f_{5010} - 3.0\right\}[BST] + 13\overline{[BST]}$$

$$\delta_{PABS} = |\delta_P|$$

$$\delta_{rABS} = |\delta r|$$

δr 09	RUDDER DEFLECTION	DR	AM
δ_{rABS} 09	ABSOLUTE DELTA R	ABSDR	AM
δ_{PABS} 11	ABSOLUTE DELTA P	ABSDP	AM

EQUATION NO: F134

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	DFWIR	RT INBD TE FLAP	δ_{FWIR}
A030		POS.	09
AM	DFWIL	LT INBD TE FLAP	δ_{FWIL}
A030		POS.	09
AM	DFWOR	RT OTBD TE FLAP	δ_{FWOR}
A030		POS.	09
AM	DEWOL	LT OTBD TE FLAP	δ_{FWOL}
A030		POS.	09
AM	DSPIR	RT INBD SPOILER	δ_{SPIR}
F132		POS.	09
AM	DSPOR	RT OTBD STOILER	δ_{SPOR}
F132		POS.	09
AM	DSPIL	LT INBD SPOILER	δ_{SPIL}
F132		POS.	09
AM	DSPOL	LT. OTBD SPOILER	δ_{SPOL}
F132		POS.	09
AM	DLER	RT LE FLAP POS.	δ_{LER}
A030			09
AM	DLEL	LT LE FLAP POS.	δ_{LEL}
A030			09
CA	DFWIM	INBD FLAP MAX	δ_{FWIMAX}
			09

ITERATION RATE: 12.5/SEC

TITLE

NORMALIZED VALUE

EQUATION:

$$\delta_{FWI} = \frac{\delta_{FWIR} + \delta_{FWIL}}{2} \qquad \delta_{FWIN} = \frac{\delta_{FWI}}{\delta_{FWIMAX}}$$

$$\delta_{FWO} = \frac{\delta_{FWOR} + \delta_{FWOL}}{2} \qquad \delta_{FWON} = \frac{\delta_{FWO}}{\delta_{FWOMAX}}$$

$$\delta_{FW} = \frac{\delta_{FWI} + \delta_{FWO}}{2} \qquad \delta_{FWN} = \frac{\delta_{FWIN} + \delta_{FWON}}{2}$$

$$\delta^{*}_{FW1} = K_{FW1} \cdot \delta_{FWN} + K_{FW2} \cdot (\delta_{FWN} - K_{FW3})^{\oplus} + K_{FW4} \cdot (\delta_{FWN} - K_{FW5})^{\oplus}$$

$$\delta_{SPR} = K_{SP3} \cdot \delta_{SPIR} + (1.0 - K_{SP3}) \cdot \delta_{SPOR}$$

$$\delta_{SPL} = K_{SP3} \cdot \delta_{SPIL} + (1.0 - K_{SP3}) \cdot \delta_{SPOL}$$

$$\delta_{LE} = \left(\frac{\delta_{LEL} + \delta_{LER}}{2 \cdot \delta_{LEMAX}} \right) \overline{[TEST]} + \left\{ 0[\delta_{FW=0}] + 1[\delta_{FW>0}] \right\} [TEST]$$

$$\delta_{SP} = \frac{\delta_{SPR} + \delta_{SPL}}{2}$$

PROGRAM NO. F150

PAGE NO. 1 OF 3

δ_{FWI}	DELTA FLAP INBD	DFWI	AM
09			
δ_{FWO}	DELTA FLAP OTBD	DFWO	AM
09			
δ_{FW}	DELTA FLAP	DFW	AM
09			
δ^{*}_{FW1}	DELTA FLAP 1	DFW1	AM
15			
δ_{SPR}	DELTA SPOILER RT	DSPR	AM
09			
δ_{SPL}	DELTA SPOILER LT	DSPL	AM
09			
δ_{LE}	DELTA LE FLAP	DLE	AM
15			
δ_{SP}	DELTA SPOILER	DSP	AM
09			

EQUATION NO: F150

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: NORMALIZED VALUE

PROGRAM NO.: F150

PAGE NO.: 2 OF 3

CA	DFWOM	OTBD FLAP MAX	δ_{FWOMAX}
			09
CA	DLEM	LE FLAP MAX	δ_{LEMAX}
			09
CA	KFW1	FLAP CONST KEW1	K_{FW1}
			15
CA	KFW2	FLAP CONST KFW2	K_{FW2}
			15
CA	KFW3	FLAP CONST KFW3	K_{FW3}
			15
CA	KFW4	FLAP CONST KEW4	K_{EW4}
			15
CA	KFW5	FLAP CONST KFW5	K_{FW5}
			15
CA	KSP3	SPOILER CONST KSP1	K_{SP3}
			15
CD	TEST	TEST MODE	TEST
			TEST=1
CA	KLG1	L.G. CONST KLG1	K_{LG1}
			14
CA	KLG2	L.G. CONST KLG2	K_{LG2}
			14

ITERATION RATE:

EQUATION:

$$\delta^*_{LGN} = \left(\frac{\delta_{LGN} + K_{LG1}}{1 + K_{LG1}}\right)^{\oplus}$$

$$\delta^*_{LGR} = \left(\frac{\delta_{LGR} + K_{LG2}}{1 + K_{LG2}}\right)^{\oplus}$$

$$\delta^*_{LGL} = \left(\frac{\delta_{LGL} + K_{LG2}}{1 + K_{LG2}}\right)^{\oplus}$$

$$\delta_{LG} = K_{LG3} \cdot (\delta^*_{LGR} + \delta^*_{LGL}) + K_{LG4} \cdot \delta^*_{LGN}$$

δ^*_{LGN}	NORM NOSE GEAR	NDLGN	AM
11			
δ^*_{LGR}	NORM. RT GEAR	NDLGR	AM
11			
δ^*_{LGL}	NORM. LT GEAR	NDLGL	AM
11			
δ_{LG}	DELTA LG	DLG	AM
11			
δ_{FWIN}	NORMALIZED DELTA	DFWIN	AM
15	FLAP INBD		
δ_{FWON}	NORMALIZED DELTA	DFWON	AM
15	FLAP OTBD		
δ_{FWN}	NORMALIZED DELTA	DFWN	AM
15	FLAP		

EQUATION NO: F150

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	KLG3	L.G. CONST KLG3	K_{LG3}
			14
CA	KLG4	L.G. CONST KLG4	K_{LG4}
			14
CA	DLGN	NOSE GEAR POS.	δ_{LGN}
			15
CA	DLGR	RT GEAR POS.	δ_{LGR}
			15
CA	DLGL	LT GEAR POS.	δ_{LGL}
			15

ITERATION RATE:

TITLE

NORMALIZED VALUE

EQUATION:

PROGRAM NO. F150

PAGE NO. 3 OF 3

EQUATION NO:

F150

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: MODE CONTROL

PROGRAM NO.: F300

PAGE NO.: 1 OF 4

AM	VI	INDICATED AIRSPEED	Vi
F400			05
CD	HAI	Vi HOLD BY ACCEL.	HAI
			HOLD = 1
CD	HTHVI	Vi HOLD BY PITCH	HθVI
			HOLD = 1
CD	SVI	Vi SET	SVI
			SET = 1
CA	DVIST	Vi SET VALUE	DVIST
			05
AM	HPD	RATE OF CHANGE OF	ḣp
F040		ALT.	02
CD	SRC	RATE OF CLIMB SET	SRC
			SET = 1
CD	HRC	RATE OF CLIMB HOLD	HRC
			HOLD = 1
CA	DRCST	R/C SET VALUE	DRCST
			02
AM	HP	PRESSURE ALTITUDE	hp
F040			-02

ITERATION RATE: 1.19/SEC

EQUATION:

$$D_{VI} = \left[Vi\{ \overline{[H_{AI}] + [H_{\theta VI}]} \} + D_{VI(n-1)} \cdot \{ [H_{AI}] + [H_{\theta VI}] \} \right] \overline{[S_{VI}]} + D_{VIST}[S_{VI}]$$

$$D_{RC} = \dot{hp}\{ \overline{[S_{RC}] + [H_{RC}]} \} + D_{RC(n-1)}[H_{RC}]\,\overline{[S_{RC}]} + D_{RCST}[S_{RC}]$$

$$Dhp = \dot{hp}\{ \overline{[S_{HP}] + [H_{HP}]} \} + Dhp_{(n-1)}[H_{HP}]\,\overline{[S_{HP}]} + D_{HPST}[S_{HP}]$$

$$D\alpha = \sin\alpha\{ \overline{[H\alpha] + [S\alpha]} \} + D\alpha_{(n-1)} \cdot [H\alpha]\,\overline{[S\alpha]} + D\alpha_{SET}[S\alpha]$$

$$D\beta = \sin\beta\{ \overline{[H\beta] + [S\beta]} \} + D\beta_{(n-1)} \cdot [H\beta]\,\overline{[S\beta]} + D\beta_{SET}[S\beta]$$

$$D\phi = \sin\phi\,\overline{[H\phi]} + D\phi_{(n-1)}[H\phi]\,\overline{[S\phi]} + D\phi_{SET}[S\phi]$$

$$D\theta = \sin\theta\,\overline{[H\theta]} + D\theta_{(n-1)}[H\theta]\,\overline{[S\theta]} + D\theta_{SET}[S\theta]$$

DVI	DEMANDED Vi	DVI	AM
05			
DRC	DEMANDED R/C	DRC	AM
02			
Dhp	DEMANDED hp	DHP	AM
-02			
Dα	DEMANDED ALPHA	DALPH	AM
15			
Dβ	DEMANDED BETA	DBETA	AM
15			
Dφ	DEMANDED PAI	DPAI	AM
15			
Dθ	DEMANDED THETA	DTHE	AM
15			

EQUATION NO: F300

CORE TYPE / CORE LOCATION / INPUT SOURCE		SYMBOL / SCALE
CD SHP	hp SET	SHP SET=1
CD HHP	hp HOLD	HHP HOLD = 1
CA DHPST	hp SET VALUE	DHPST −02
AM SINA F040	SIN ALPHA	sin α 15
CD HALPH	ALPHA HOLD	H α HOLD = 1
CD SALPH	ALPHA SET	Sα SET = 1
CA DALST	SIN ALPHA SET VALUE	DαSET 15
AM SINB F040	SIN BETA SIDE SLIP	sin β 15
CD HBETA	BETA HOLD	Hβ HOLD = 1
CD SBETA	BETA SET	S β SET = 1
CA DBSET	SIN BETA SET VALUE	DBSET 15

ITERATION RATE:

TITLE

MODE CONTROL

EQUATION:

$$[B1] = [H\theta v_I] + [H_{RC}] + [H_\alpha] + [S_{RC}] + [S_\alpha]$$

$$E_{IAS} = \{ 2^3 \cdot (D_{VI} - V\dot{i}) - \dot{U}A \}$$

$$\dot{\sin\theta c} = \left[\frac{1}{2^{13}} (\dot{We} + D_{RC} - \dot{hp}) \{ [H_{RC}] + [S_{RC}] \} \right.$$

$$+ \frac{1}{2^{17}} (\dot{We} + Dhp - hp) \{ [H_{HP}] + [S_{HP}] \}$$

$$\left. + \frac{1}{2^{13}} (-E_{IAS}) \{ \overline{[H_{RC}] + [S_{RC}] + [H_{HP}] + [S_{HP}]} \} \right]$$

$$\{ \overline{[S_\alpha] + [H_\alpha]} \} + (D_\alpha - \sin\alpha - \dot{\alpha}) \{ [S_\alpha] + [H_\alpha] \}$$

$$\sin\theta c = \left(\sin\theta c_{(n-1)} + \frac{0.05}{16} \dot{\sin\theta c} \right) [B_1] \overline{[H\theta]}$$

$$+ \sin\theta \overline{[B_1]} \overline{[H\theta]} + D\theta [H\theta]$$

PROGRAM NO. F300

PAGE NO. 2 OF 4

EIAS 05	Vi ERROR SIGNAL	EIAS AM
$\dot{\sin\theta c}$ 15	SIN THETAC DOT	STHCD AM
sin θc 15	COMMANDED SIN THETAC	STHC AM

EQUATION NO:

F300

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	PA	ROLL RATE-ACFT	p_A
F010		AXIS	13
AM	QA	PITCH RATE-ACFT	q_A
F010		AXIS	13
AM	RA	YAW RATE-ACFT	r_A
F010		AXIS	13
AM	BETAD	BETA–DOT	$\dot{\beta}$
F040			15

ITERATION RATE:

TITLE

MODE CONTROL

EQUATION:

PROGRAM NO. F300

PAGE NO. 3 OF 4

EQUATION NO:

F300

CORE TYPE / CORE LOCATION / INPUT SOURCE		SYMBOL / SCALE
AM SINPI (F020)	SIN PAI	$\sin\phi$ / 15
CD HPAI	PAI HOLD	$H\phi$ / HOLD = 1
CD SPAI	PAI SET	$S\phi$ / SET = 1
CA DPSET	SIN PAI SET VALUE	$D\phi_{SET}$ / 15
AM SINTH (F020)	SIN THETA	$\sin\theta$ / 15
CD HTHE	THETA HOLD	$H\theta$ / HOLD = 1
CD STHE	THETA SET	$S\theta$ / SET = 1
CA DTHST	SIN THETA SET VALUE	$D\theta_{SET}$ / 15
AM UAD (F040)	LONG ACCEL ACFT AXIS	$\dot{U}_A$
AM WED (F030)	VERT ACCEL EARTH AXIS	$\dot{W}_e$ / 02
AM ALPHD (F040)	ALPHA DOT	$\dot{\alpha}$ / 15

ITERATION RATE:

TITLE: MODE CONTROL

EQUATION:

$$\dot{p}_{AM} = 2\left\{(D\phi - \sin\phi) - \frac{1}{4} p_A\right\}[H\phi] + 0\cdot\overline{[H\phi]}$$

$$\dot{q}_{AM} = \left[2\left\{(\sin\theta c - \sin\theta) - \frac{1}{4} q_A\right\}\{[B_1] + [H\theta]\} + 0\left\{\overline{[B_1] + [H\theta]}\right\}\right]$$

$$\dot{r}_{AM} = \left[\left\{(\sin\theta c - \sin\theta) - \frac{1}{4} r_A\right\}\{[B_1] + [H\theta]\} + 0\left\{\overline{[B_1] + [H\theta]}\right\}\right]$$

$$M_{AXA} = \frac{E_{IAS}}{2^{11}}[H_{AI}] + 0\cdot\overline{[H_{AI}]}$$

$$M_{AYA} = 2^2\cdot(D\beta - \sin\beta - \dot{\beta})[H\beta] + 0\cdot\overline{[H\beta]}$$

$$M_{AZA} = 0$$

PROGRAM NO. F300

PAGE NO. 4 OF 4

$\dot{p}_{AM}$ / 13	PA DOT MODE TERM	PAMD	AM
$\dot{q}_{AM}$ / 13	QA DOT MODE TERM	QAMD	AM
$\dot{r}_{AM}$ / 13	RA DOT MODE TERM	RAMD	AM
M_{AXA} / 13	AXA MODE TERM	MAXA	AM
M_{AYA} / 13	AYA MODE TERM	MAYA	AM
H_{AZA} / 13	AZA MODE TERM	MAZA	AM

EQUATION NO: F300

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: ENVIRONMENT

PROGRAM NO.: F320

PAGE NO.: 1 OF 2

AM	F2600	f (hp)	$f2600$
			15
AM	F2610	f (hp)	$f2610$
			15
AM	F2620	f (hp)	$f2620$
			15
CA	LSET	L. RATE SET	LSET
			22
CA	HGSET	Hg SET	HgSET
			08
CA	TRSET	T_R SET	TRSET
			07
AM	HFP	FIELD PRESSURE	hfp
	F040	ALTITUDE	02
CD	ENVSET	ENVIRONMENT SET SW.	ENVSET
			SET = 1

ITERATION RATE: 4.76/SEC

EQUATION:

$LR = -0.001981 + L_{SET}\,[ENVSET] \qquad (-.005 \leq LR \leq .001)$

$\delta_{AMB} = f_{2600} - f_{2610} - f_{2620}$

$Hg = 29.92 + Hg_{SET}\,[ENVSET]$

$h_{BARO} = 930 \cdot (29.92 - Hg) \quad |h_{BARO} - h_{BARO(n-1)}| \leq 2.0$

$T_{SL} = 15 + T_{RSET}\,[ENVSET]$

$T_{OA} = T_{SL} + LR \cdot \underbrace{hp}_{\text{LIMIT TO 36089 FT}} \qquad |T_{OA}| \leq 50°$

$T_F = T_{SL} + LR \cdot hfp$

$T_K = T_{OA} + 273.16$

$P_{AMB1} = 14.7\,\delta_{AMB}$

$P_{AMB} = 144.0\,P_{AMB1}$

LR	LAPSE RATE	LR	AM
22			
δ_{AMB}	DELTA AMBIENT	DAMB	AM
14			
Hg	BAROMETRIC PRESSURE	HG	AM
08			
h_{BARO}	BAROMETRIC PRESSURE	HBARO	AM
-02	ALT. DEVIATION		
T_{SL}	REFERENCE	TSL	AM
07	TEMPERATURE		
T_{OA}	OUTSIDE AIR TEMP. °C	TOA	AM
07			
T_F	INDICATED FIELD TEMP.	TF	AM
08			
T_K	OUTSIDE AIR TEMP °K	TK	AM
05			
P_{AMB1}	AMBIENT PRESSURE PSI	PAMB1	AM
10			
P_{AMB}	AMBIENT PRESS. LB/FT^2	PAMB	AM
03			

EQUATION NO: F320

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE ,

TITLE: ENVIRONMENT

PROGRAM NO.: F320

PAGE NO.: 2 OF 2

AM	VP1	TRUE AIR SPEED 1	V_{P1}
	F030		02
CD	MSET	TEST MACH SET	M_{SET}
			SET = 1
CD	VISET	TEST Vi SET	V_{ISET}
			SET = 1

EQUATION:

$\overline{[MSET]}\ \overline{[VISET]}$

$$M = \frac{0.0152047 \cdot V_{P1}}{\sqrt{Tk}}$$

$$q = 0.7 \cdot P_{AMB} \cdot M^2$$

$$V_E = 17.18 \cdot \sqrt{q}$$

$$V_P = V_{P1}$$

IF [MSET] $\overline{[VISET]}$

$$V_P = 65.769 \cdot \sqrt{Tk} \cdot M$$

$$q = 0.7 \cdot P_{AMB} \cdot M^2$$

$$V_E = 17.18 \cdot \sqrt{q}$$

IF [VISET]

$$M = 0.069571 \cdot \frac{V_E}{\sqrt{P_{AMB}}}$$

$$V_P = 65.769 \cdot \sqrt{Tk} \cdot M$$

$$q = 0.7 \cdot P_{AMB} \cdot M^2$$

} (TEST ROUTINE)

M	MACH NUMBER	M	AM
13			
q	DINAMIC PRESSURE	Q	AM
03	(~ LBS/FT^2)		
V_E	EQUIVALENT AIR SPEED	VE	AM
02			
V_P	TRUE AIR SPEED	VP	AM
02			

ITERATION RATE:

EQUATION NO: F320

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CD	WT1	NO 1 TANK FUEL	W_{T1}
			-04
CA	WT2	NO 2 TANK FUEL	W_{T2}
			-04
CA	WT3	NO 3 TANK FUEL	W_{T3}
			-04
CA	WT4	NO 4 TANK FUEL	W_{T4}
			-04
CA	WTR1	NO 1 RES. TANK FUEL	W_{TR1}
			-02
CA	WTR2	NO 2 RES. TANK FUEL	W_{TR2}
			-02
CA	WTC	CENTER TANK FUEL	W_{TC}
			-02
CA	DICE	SURFACE ICE-WING	δ_{ICE}
			15
CA	WEMP	ACFT. WEIGHT	W_{EMP}
			-08
CA	WP	PAY LOAD WEIGHT	W_P
			-02
CA	WGS	GROSS WEIGHT SET	W_{GS}
		VALUE	-08

ITERATION RATE: 1.19/SEC

TITLE

WEIGHT AND BALANCE

EQUATION:

$$W_{TTOT} = W_{T1} + W_{T2} + W_{T3} + W_{T4} + W_{TR1} + W_{TR2} + W_{TC}$$

$$W_G = [W_{EMP} + W_P + W_{TTOT}]\,\overline{[W_{GSET}]} + W_{GS} \cdot [W_{GSET}]$$

$$\ell_{XCG} = \frac{1}{W_G}\left\{ K\ell_{X1} \cdot (W_{T1} + W_{T4}) - K\ell_{X2} \cdot (W_{T2} + W_{T3}) + K\ell_{X3} \cdot (W_{TR1} + W_{TR2}) - K\ell_{X4} \cdot W_{TC} + K\ell_{X5} \cdot W_P + K\ell_{X6} \cdot W_{EMP} \right\} \overline{[\ell_{CGS}]} + \ell_{XS}[\ell_{CGS}]$$

$$\%CG = \left\{ \frac{100}{C} \cdot \ell_{XCG} + 25.0 \right\} \overline{[CGSET]} + \%CGSET[CGSET]$$

$$\ell_{YCG} = \frac{1}{W_G}\left\{ K\ell_{Y1}(W_{T4} - W_{T1}) + K\ell_{Y2} \cdot (W_{T3} - W_{T2}) + K\ell_{Y3} \cdot (W_{TR1} - W_{TR2}) \right\} \overline{[\ell_{CGS}]} + \ell_{YS}[\ell_{CGS}]$$

（説明図 6 参照）

PROGRAM NO. F340

PAGE NO. 1 OF 5

W_{TTOT}	FUEL TOTAL WEIGHT	WTTOT	AM
-08			
W_G	GROSS WEIGHT	WG	AM
-08			
ℓ_{XCG}	LONG. CG. LOC.	LYCG	AM
11			
%CG	PERCENT CG.	PCG	AM
09			
ℓ_{YCG}	LAT. CE. LOC.	LYCG	AM
11			

EQUATION NO:

F340

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: WEIGHT AND BALANCE

PROGRAM NO. F340

PAGE NO. 2 OF 5

CD	WGSET	WG SET SW.	WGSET
			SET = 1
CA	LXS	ℓXCG SET VALUE	ℓXS
			11
CD	LCGS	CG POS SET SW.	ℓCGS
			SET = 1
CA	LYS	ℓYCG SET VALUE	ℓYS
			11
CD	CGSET	PERCENT CG SET SW	CGSET
			SET = 1
CA	IXBDY	ACFT ROLL MOMENT	IXXBODY
		OF INERTIA	-09
CD	ISET	MOMENT OF INERTIA	ISET
		SET SW.	SET = 1
CA	IXXS	ROLL MOMENT OF	IXXS
		INERTIA SET VALUE	-09
CA	IYYS	PITCH MOMENT OF	IYYS
		INERTIA SET VALUE	-09
CA	IZZS	YAW MOMENT OF	IZZS
		INERTIA SET VALUE	-09
CA	IXZS	CROSS PRODUCT	IXZS
		SET VALUE	-09

ITERATION RATE:

EQUATION:

$$I_{XX} = \{I_{XXBODY} + K_{IX1}\cdot(W_{T1} + W_{T4}) + K_{IX2}\cdot(W_{T2} + W_{T3}) + K_{IX3}\cdot(W_{TR1} + W_{TR2}) + K_{IX4}\cdot W_P + K_{IX5}\cdot W_{TC}\}\,\overline{[ISET]} + I_{XXS}\cdot[ISET]$$

$$I_{YY} = \{I_{YYBODY} + K_{IY1}\cdot(W_{T1} + W_{T4}) + K_{IY2}\cdot(W_{T2} + W_{T3}) + K_{IY3}\cdot(W_{TR1} + W_{TR2}) + K_{IY4}\cdot W_P + K_{IY5}\cdot W_{TC}\}\,\overline{[ISET]} + I_{YYS}\cdot[ISET]$$

$$I_{ZZ} = \{I_{ZZBODY} + K_{IZ1}\cdot(W_{T1} + W_{T4}) + K_{IZ2}\cdot(W_{T2} + W_{T3}) + K_{IZ3}\cdot(W_{TR1} + W_{TR2}) + K_{IZ4}\cdot W_P + K_{IZ5}\cdot W_{TC}\}\,\overline{[ISET]} + I_{ZZS}\cdot[ISET]$$

$$I_{XZ} = \left(K_{IXZ1}\frac{I_{XX}}{I_{ZZ}} - K_{IXZ2}\right)\times 10^6\cdot\overline{[ISET]} + I_{XZS}[ISET]$$

IXX	ROLL MOMENT OF	IXX	AM
-09	INERTIA		
IYY	PITCH MOMENT OF	IYY	AM
-09	INERTIA		
IZZ	YAW MOMENT OF	IZZ	AM
-09	INERTIA		
IXZ	CROSS PRODUCT OF	IXZ	AM
-09	INERTIA		

EQUATION NO: F340

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	KLX1	NO 1 & NO 4 TANK POSITION KℓX1	$K\ell_{X1}$ 11
CA	KLX2	NO 2 & NO 3 TANK POSITION KℓX2	$K\ell_{X2}$ 10
CA	KLX3	RES. TANK POSITION KℓX3	$K\ell_{X3}$ 08
CA	KLX4	CENTER TANK POSITION	$K\ell_{X4}$ 08
CA	KLX5	PAY LOAD CG.	$K\ell_{X5}$ 09
CA	KLX6	ACFT CG.	$K\ell_{X6}$ 14
AM	C	MEAN AERO CHORD	C 08
CA	KLY1	NO 1 & NO 4 TANK POSITION KℓY1	$K\ell_{Y1}$ 06
CA	KLY2	NO 2 & NO 3 TANK POSITION KℓY2	$K\ell_{Y2}$ 07
CA	KLY3	RES. TANK POSITION KℓY3	$K\ell_{Y3}$ 04
CA	PCGS	PERCENT CG.SET VALUE	%CGSET 09

ITERATION RATE:

TITLE

WEIGHT AND BALANCE

EQUATION:

PROGRAM NO. F340

PAGE NO. 3 OF 5

EQUATION NO:

F340

CORE TYPE / CORE LOCATION / INPUT SOURCE		SYMBOL / SCALE
AM KIX1	IXX CONST. KIX1	K_{IX1} 09
AM KIX2	" KIX2	K_{IX2} 10
AM KIX3	" KIX3	K_{IX3} 08
AM KIX4	" KIX4	K_{IX4} 14
AM KIX5	" KIX5	K_{IX5} 08
AM KIY1	IYY CONST. KIY1	K_{IY1} 10
AM KIY2	" KIY2	K_{IY2} 10
AM KIY3	" KIY3	K_{IY3} 08
AM KIY4	" KIY4	K_{IY4} 10
AM KIY5	" KIY5	K_{IY5} 08

ITERATION RATE:

TITLE: WEIGHT AND BALANCE

EQUATION:

PROGRAM NO. F340

PAGE NO. 4 OF 5

EQUATION NO: F340

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	KIZ1	IZZ CONST KIZ1	K_{IZ1}
			09
CA	KIZ2	IZZ CONST KIZ2	K_{IZ2}
			10
CA	KIZ3	IZZ CONST KIZ3	K_{IZ3}
			08
CA	KIZ4	IZZ CONST KIZ4	K_{IZ4}
			10
CA	KIZ5	IZZ CONST KIZ5	K_{IZ5}
			08
CA	KIXZ1	IXZ CONST KIXZ1	K_{IXZ1}
			15
CA	KIXZ2	IXZ CONST KIXZ2	K_{IXZ2}
			15
AM	IYBDY	ACFT PITCH MOMENT	I_{YYBODY}
		OF INERTIA	-09
AM	IZBDY	ACFT YAW MOMENT	I_{ZZBODY}
		OF INERTIA	-09

ITERATION RATE:

TITLE

WEIGHT AND BALANCE

EQUATION:

PROGRAM NO. F340

PAGE NO. 5 OF 5

EQUATION NO:

F340

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	F3710	$f(\alpha, \delta_{FW})$	$f3710$
			12
AM	F3700	$f(hp, V_E)$	$f3700$
			11
AM	F3670	$f(M, hp)$	$f3670$
			05
AM	F3570	$f(M)$	$f3570$
			15
CA	KBALL	BALL CONST KB	K_{BALL}
			11
AM	RAD	YAW ACCEL -ACFT AXIS	$\dot{r}_A$
F010			13
AM	AYA	ACCEL -Y ACFT AXIS	A_{YA}
F010			13
AM	QAD	PITCH ACCEL -ACFT AXIS	$\dot{q}_A$
F010			13
AM	AZA	ACCEL -Z ACFT AXIS	A_{ZA}
F010			13
AM	UA	LONG. VEL. ACFT AXIS	U_A
F030			02
CA	TURN	TURN IND CONST	T_{URN}
			11

ITERATION RATE:
4.76/SEC

TITLE
INDICATED PARAMETER

EQUATION:

$$V_i = -\{f_{3710} - 2.5 + f_{3700} - 0.5\} + f_{3670}$$

$$M_i = f_{3570}$$

$$\begin{cases} \dot{\lambda}_B = K_{BALL} \cdot (AYA + \lambda_{B(n-1)} \cdot AZA) & (<4) \\ \lambda_B = \lambda_{B(n-1)} + \dfrac{K}{100} \cdot \dot{\lambda}_B \\ \lambda_{BI} = \lambda_B [|U_\alpha| > 4.0] + 0 \cdot \overline{[|U_\alpha| > 4.0]} \end{cases}$$

$$I = T_{URN} \cdot r_A \qquad (\text{TURN-MINUTS TURN IND})$$

PROGRAM NO. F400

PAGE NO. 1 OF 2

Vi	INDICATED AIR SPEED	VI	AM
05			
Mi	INDICATED MACH	MI	AM
12			
$\dot{\lambda}_B$	RAMDA B DOT	RBD	AM
13			
λ_{BI}	INDICATED RAMDA B	RBI	AM
13			
I	INDICATED RATE OF	I	AM
12	TURN		

EQUATION NO:
F400

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE

INDICATED PARAMETER

PROGRAM NO. F400

PAGE NO. 2 OF 2

AM	HP	PRESSURE ALT	hp
F040			-02
AM	F4160	f (hp, V_E)	f4160
			05
AM	F4170	f (V_E)	f4170
			10
AM	K	INTEG. CONST	K
MONITOR			00
AM	ALPHA	ALPHA	α
F040			07
DM	WOW	WEIGHT ON WHEEL	iwow
F050			ON GROUND = 1
AM	SINPI	SIN PAI	sin ϕ
F020			15
AM	HPD	RATE OF CHANGE OF	hp
F040		ALT.	02

ITERATION RATE:

EQUATION:

$$hi = hp - \left\{ (f_{4160} - 6) + f_{4170} \cdot (f_{3710} - 2.5) \right\}$$

$$\Delta R/C\alpha = \left\{ \underbrace{(\alpha - 3)^{\oplus}[WOW] + 0[\overline{WOW}]}_{\text{LIMIT 1.0}} - \Delta R/C\alpha_{(n-1)} \right\} + \Delta R/C\alpha_{(n-1)} \qquad (\Delta R/C\alpha \leqq 24)$$

$$\Delta R/C\phi = -14.0625 \cdot \sin\phi$$

$$A = R/Ci_{(n-1)} - \Delta R/C\phi$$

$$R/Ci = A + \left[\frac{K}{100} \left\{ 60 - (1.0 + A_{XA}) + \dot{hp} \right\} - A \right] - \Delta R/C\phi - \Delta R/C\alpha$$

hi	INDICATED PRESS. ALT	HI	AM
-01			
$\Delta R/C\phi$		DRCP	AM
07			
$\Delta R/\alpha$		DRCA	AM
07			
R/Ci	INDICATED RATE OF	RCI	AM
02	CLIMB		

EQUATION NO:

F400

第3部　エンジン力学

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

AM DAMB	DELTA AMBIENT	δ_{amb}	
F320		14	
AM M	MACH NUMBER	M	
F320		13	
AM TK	OUTSIDE AIR TEMP.	T_K	
F320	~ DEG-K	05	

ITERATION RATE: 4.76/SEC

TITLE

COMPRESSOR INLET TEMPERATURE & PRESSURE RATIO

EQUATION:

$$\delta_{T2} = \delta amb \cdot (1.0 + 0.2\,M^2)^{3.5}$$

$$T_{T2} = Tk \cdot (1.0 + 0.2\,M^2) - 273.16 \qquad (\sim °C)$$

$$\theta_{T2} = 0.00347 \cdot (T_{T2} + 273.16)$$

$$\sqrt{\theta_{T2}} = \sqrt{0.00347 \cdot (T_{T2} + 273.16)}$$

PROGRAM NO. E003

PAGE NO. 1 OF 1

δ_{T2}	DELATA T2	EDT2	AM
13			
T_{T2}	RAM AIR TEMP.	TT2	AM
08			
θ_{T2}	TEMP. CORRECTION	THETA2	AM
14	FACTOR		
$\sqrt{\theta_{T2}}$	SQUARE ROOT	RTHE2	AM
14	THETA T2		

EQUATION NO: E003

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	RTHE2	SQUARE ROOT	$\sqrt{\theta_{T2}}$
E003			14
AM	F740i	f (CSAi, TT2)	f_{740i}
			01
AM	F744i	f (CSAi, TT2)	f_{744i}
			01
AM	N21	ENG #1 HIGH PRESS.	N_{21}
E104		ROTOR SPEED	01
AM	N22	ENG #2 HIGH PRESS.	N_{22}
E104		ROTOR SPEED	01
AM	N23	ENG #3 HIGH PRESS.	N_{23}
E104		ROTOR SPEED	01
AM	N24	ENG #4 HIGH PRESS.	N_{24}
E104		ROTOR SPEED	01
AM	N25	ENG #5 HIGH PRESS.	N_{25}
E104		ROTOR SPEED	01
AM	N26	ENG #6 HIGH PRESS.	N_{26}
E104		ROTOR SPEED	01
CD	TEST	TEST	TEST
			TEST = 1

ITERATION RATE: 4.76/SEC

TITLE

HIGH PRESSURE ROTOR SPEED
(N2 DEMANDED)

EQUATION:

$$N_{2Di} = \sqrt{\theta_{T2}} \cdot \{f_{740i} + f_{744i}\}$$

$$\Delta N_{2i} = N_{2Di} - N_{2i}$$

$(i : 1 \sim 6)$

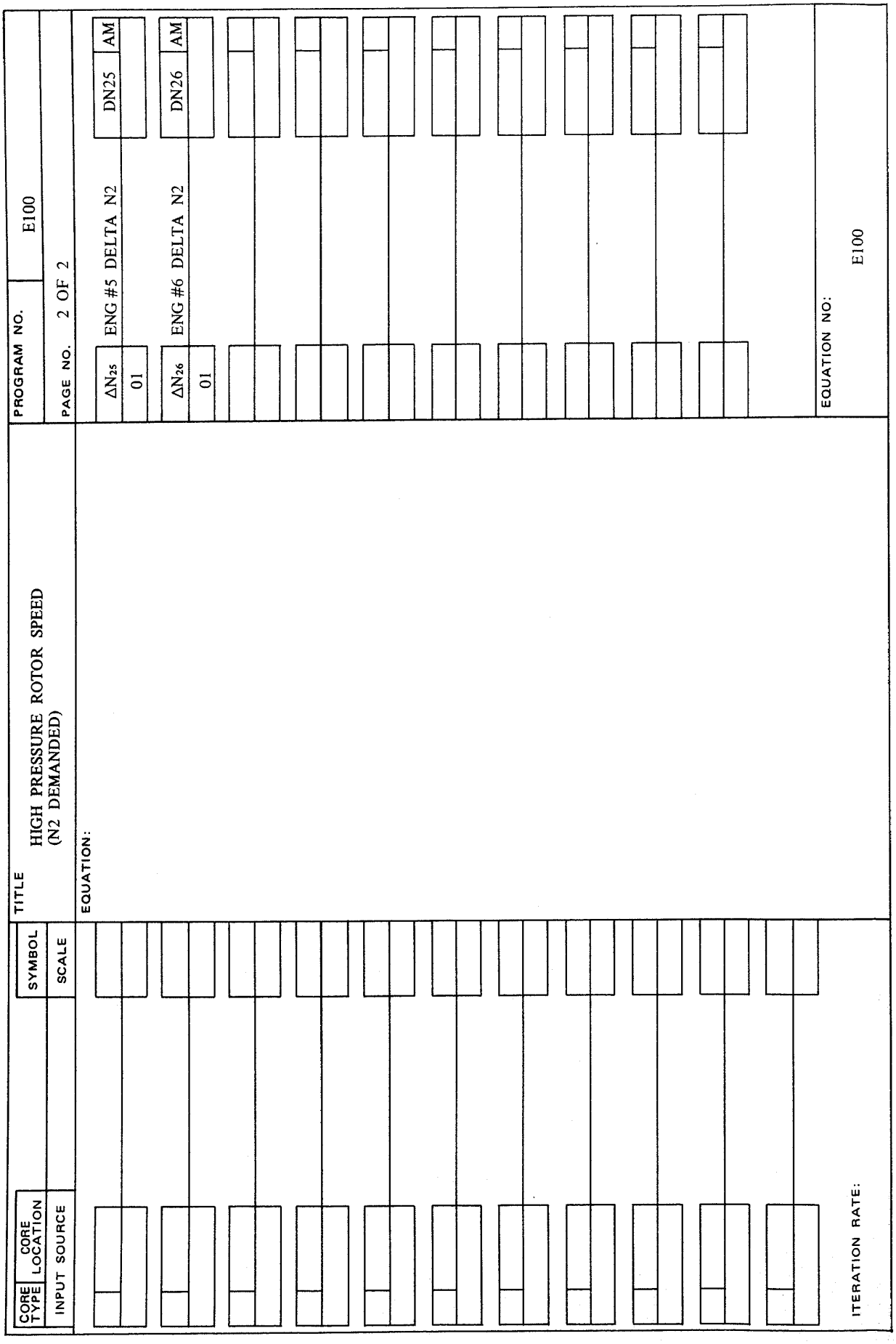
IF [TEST] $N_{2i} = N_{2Di}$

PROGRAM NO. E100

PAGE NO. 1 OF 2

N_{2D1}	ENG #1 N2 DEMANDED	N2D1	AM
01			
N_{2D2}	ENG #2 N2 DEMANDED	N2D2	AM
01			
N_{2D3}	ENG #3 N2 DEMANDED	N2D3	AM
01			
N_{2D4}	ENG #4 N2 DEMANDED	N2D4	AM
01			
ΔN_{21}	ENG #1 DELTA N2	DN21	AM
01			
ΔN_{22}	ENG #2 DELTA N2	DN22	AM
01			
ΔN_{23}	ENG #3 DELTA N2	DN23	AM
01			
ΔN_{24}	ENG #4 DELTA N2	DN24	AM
01			
N_{2D5}	ENG #5 N2 DEMANDED	N2D5	AM
01			
N_{2D6}	ENG #6 N2 DEMANDED	N2D6	AM
01			

EQUATION NO: E100



CORE TYPE	CORE LOCATION	INPUT SOURCE	SYMBOL / SCALE
CA	N2PT	1/(100% N2 RPM)	N2PT / 21
AM	N21	ENG #1 HIGH PRESS. ROTOR SPEED	N21 / 01
E104			08
AM	N22	ENG #2 〃	N22 / 01
E104			08
AM	N23	ENG #3 〃	N23 / 01
E104			08
AM	N24	ENG #4 〃	N24 / 01
E104			08
AM	N25	ENG #5 〃	N25 / 01
E104			08
AM	N26	ENG #6 〃	N26 / 01
E104			08

ITERATION RATE: 4.76/SEC

TITLE: PERCENT HIGH PRESSURE ROTOR SPEED

EQUATION:

$$\%N_{2i} = N2PT \cdot N_{2i} \qquad (i : 1 \sim 6)$$

PROGRAM NO. E103

PAGE NO. 1 OF 1

%N21	ENG #1 PERCENT HIGH PRESS ROTOR SPEED	PN21	AM
08			
%N22	ENG #2 〃	PN22	AM
08			
%N23	ENG #3 〃	PN23	AM
08			
%N24	ENG #4 〃	PN24	AM
08			
%N25	ENG #5 〃	PN25	AM
08			
%N26	ENG #6 〃	PN26	AM
08			

EQUATION NO: E103

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	RTHE2	SQUARE ROOT	$\sqrt{\theta_{T2}}$
E003		THETA T2	14
CD	FIRE1	ENG #1 FIRE	F_{IRE1}
			FIRE = 1
CD	FIRE2	ENG #2 FIRE	F_{IRE2}
			FIRE = 2
CD	FIRE3	ENG #3 FIRE	F_{IRE3}
			FIRE = 3
CD	FIRE4	ENG #4 FIRE	F_{IRE4}
			FIRE = 4
CD	FIRE5	ENG #5 FIRE	F_{IRE5}
			FIRE = 5
CD	FIRE6	ENG #6 FIRE	F_{IRE6}
			FIRE = 6
AM	WF1	ENG #1 FUEL FLOW	W_{f1}
E121			01
AM	WF2	ENG #2 FUEL FLOW	W_{f2}
E121			01
AM	WF3	ENG #3 FUEL FLOW	W_{f3}
E121			01

ITERATION RATE: 2.38/SEC

TITLE

ENGINE HIGH PRESSURE ROTOR SPEED AND ACCELERATION

EQUATION:

$$\text{IF}\begin{cases} [F_{IRE}i]\cdot A_{2}i \quad \dot{N}_{2i} = [Xi + Yi]\left\{1.0 - (45 - N_{2i})^{\oplus} \times 16\right\}^{(4)} \\ [\overline{F_{IRE}i}]\cdot A_{2}i \quad \dot{N}_{2i} = [Yi]\left\{1.0 - (45 - N_{2i})^{\oplus} \times 16\right\}^{(4)} \\ [\overline{F_{IRE}i}]\cdot \overline{A_{2}i} \quad \dot{N}_{2i} = \left\{-0.40 W_{fssi}\right\}\left\{1.0 - (45 - N_{2i})^{\oplus} \times 16\right\}^{(4)} \\ [F_{IRE}i]\cdot \overline{A_{2}i} \quad \dot{N}_{2i} = [Xi]\left\{1.0 - (45 - N_{2i})^{\oplus} \times 16\right\}^{(4)} \times 1.21 \end{cases}$$

$$Xi = 0.40(W_{fi} - W_{fssi}) - f_{710}i$$

$$\begin{cases} Zi = 290 - 0.13271 \cdot N_{2i} \\ Yi = \left\{\dfrac{P_{MAN} - P_{AMB1}}{24}(Z)\right\}^{\oplus} \end{cases}$$

$$N_{2i} = \int \dot{N}_{2i} dt = N_{2i(n-1)} + \frac{K}{100}\dot{N}_{2i}$$

WHERE $A_{2i} = [SVALV_i]\ [Z > 0]$ (4) $\geqq 0.25$

$N_{2i} \geqq \sqrt{\theta_{T2}} \cdot f_{7660}$

PROGRAM NO. E104

PAGE NO. 1 OF 3

$\dot{N}_{21}$	ENG #1 N2 DOT	N21D	AM
01			
$\dot{N}_{22}$	ENG #2 N2 DOT	N22D	AM
01			
$\dot{N}_{23}$	ENG #3 N2 DOT	N23D	AM
01			
$\dot{N}_{24}$	ENG #4 N2 DOT	N24D	AM
01			
N_{21}	ENG #1 HIGH PRESS.	N21	AM
01	ROTOR SPEED		
N_{22}	ENG #2 HIGH PRESS.	N22	AM
01	ROTOR SPEED		
N_{23}	ENG #3 HIGH PRESS.	N23	AM
01	ROTOR SPEED		
N_{24}	ENG #4 HIGH PRESS.	N24	AM
01	ROTOR SPEED		
N_{25}	ENG #5 HIGH PRESS.	N25	AM
01	ROTOR SPEED		
N_{26}	ENG #6 HIGH PRESS.	N26	AM
01	ROTOR SPEED		

EQUATION NO: E104

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	WF4	ENG #4 FUEL FLOW	Wf4
E121			01
AM	WF5	ENG #5 〃	Wf5
E121			01
AM	WF6	ENG #6 〃	Wf6
E121			01
AM	WFSS1	ENG #1 STEADY STATE	Wfss1
E120		FUEL FLOW	01
AM	WFSS2	ENG #2 〃	Wfss2
E120			01
AM	WFSS3	ENG #3 〃	Wfss3
E120			01
AM	WFSS4	ENG #4 〃	Wfss4
E120			01
AM	WFSS5	ENG #5 〃	Wfss5
E120			01
AM	WFSS6	ENG #6 〃	Wfss6
E120			01
AM	F710i	$f(N_{2i}/\sqrt{\theta_{T2}})$	f710i
			06
CA	PMAN	MANIFOLD AIR PRESS	PMAN
			08

ITERATION RATE:

TITLE

ENGINE HIGH PRESSURE ROTOR SPEED AND ACCELERATION

EQUATION:

$$CN_{2i} = N_{2i}/\sqrt{\theta_{T2}} \qquad (i = 1 \sim 6)$$

PROGRAM NO. F104

PAGE NO. 2 OF 3

$\dot{N}_{25}$	ENG #5 N2 DOT	N25D	AM
01			
$\dot{N}_{26}$	ENG #6 N2 DOT	N26D	AM
01			
CN21	ENG 1 CORRECTED N2	CN21	AM
01			
CN22	ENG 2 〃	CN22	AM
01			
CN23	ENG 3 〃	CN23	AM
01			
CN24	ENG 4 〃	CN24	AM
01			
CN25	ENG 5 〃	CN25	AM
01			
CN26	ENG 6 〃	CN26	AM
01			

EQUATION NO:

E104

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	PAMB1	AMBIENT PRESSURE	P_{AMB1}
F320		~PSI	10
AM	F7660	r (M, hp)	f_{7660}
			02
CD	SVALV1	ENG #1 START VALVE	S_{VALV1}
		OPEN	OPEN = 1
CD	SVALV2	ENG #2 START VALVE	S_{VALV2}
		OPEN	OPEN = 1
CD	SVALV3	ENG #3 START VALVE	S_{VALV3}
		OPEN	OPEN = 1
CD	SVALV4	ENG #4 START VALVE	S_{VALV4}
		OPEN	OPEN = 1
CD	SVALV5	ENG #5 START VALVE	S_{VALV5}
		OPEN	OPEN = 1
CD	SVALV6	ENG #6 START VALVE	S_{VALV6}
		OPEN	OPEN = 1
AM	K	INTEG CONST	K
MONITOR			00

ITERATION RATE:

TITLE

ENGINE HIGH PRESSURE ROTOR SPEED AND ACCELERATION

EQUATION:

PROGRAM NO. E104

PAGE NO. 3 OF 3

EQUATION NO: E104

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
DM	VSB1	ENG #1 SURGE BLEED	V_{sb1}
E144		VALVE	OPEN = 1
DM	VSB2	ENG #2 SURGE BLEED	V_{sb2}
E144		VALVE	OPEN = 1
DM	VSB3	ENG #3 SURGE BLEED	V_{sb3}
E144		VALVE	OPEN = 1
DM	VSB4	ENG #4 SURGE BLEED	V_{sb4}
E144		VALVE	OPEN = 1
AM	F734i	$f(N2i/\sqrt{\theta_{T2}})$	f_{734i}
			07
AM	F730i	$f(N2i/\sqrt{\theta_{T2}})$	f_{730i}
			12
AM	N21	ENG #1 HIGH PRESS.	N_{21}
E104		ROTOR SPEED	01
AM	N22	ENG #2 HIGH PRESS.	N_{22}
E104		ROTOR SPEED	01
AM	N23	ENG #3 HIGH PRESS.	N_{23}
E104		ROTOR SPEED	01
AM	N24	ENG #4 HIGH PRESS.	N_{24}
E104		ROTOR SPEED	01
AM	F7650	f (M, hp)	f_{7650}
			09

ITERATION RATE: 2.38/SEC

TITLE

PERCENT LOW PRESSURE ROTOR SPEED

EQUATION:

$$\text{IF} \begin{cases} Vsb_i & B_i = 0.985\left\{f_{734i} + M \cdot f_{730i}\right\} \\ \overline{Vsb_i} & B_i = 1.015\left\{f_{734i} + M \cdot f_{730i}\right\} \end{cases}$$

$$K_i = \left\{ 0.0018(N_{2i} - 1150)^{\oplus} \right\} \quad (\leqq 1.0)$$

$$L_i = \left[[B_i + K_i] > f_{7650} \right]$$

$$\text{IF} \begin{cases} L_i & \%N_{1i} = B_i \cdot \sqrt{\theta_{T2}} \\ \overline{L_i} & \%N_{1i} = f_{7650} \cdot \sqrt{\theta_{T2}} \end{cases}$$

PROGRAM NO. E111

PAGE NO. 1 OF 2

$\%N_{11}$	ENG #1 PERCENT N1	PN11	AM
08			
$\%N_{12}$	ENG #2 PERCENT N1	PN12	AM
08			
$\%N_{13}$	ENG #3 PERCENT N1	PN13	AM
08			
$\%N_{14}$	ENG #4 PERCENT N1	PN14	AM
08			
$\%N_{15}$	ENG #5 PERCENT N1	PN15	AM
08			
$\%N_{16}$	ENG #6 PERCENT N1	PN16	AM
08			

EQUATION NO: E111

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	RTHE2	SQUARE ROOT	$\sqrt{\theta_{T2}}$
E003		THETA T2	14
DM	VSB5	ENG #5 SURGE BLEED	V_{sb5}
E144		VALVE	open = 1
DV	VSB6	ENG #6 〃	V_{sb6}
E144			open = 1
AM	N25	ENG #5 HIGH PRESS.	N_{25}
E104		ROTOR SPEED	01
AM	N26	ENG #6 〃	N_{26}
E104			01

ITERATION RATE:

TITLE

PERCENT LOW PRESSURE ROTOR SPEED

EQUATION:

PROGRAM NO. E111

PAGE NO. 2 OF 2

EQUATION NO:

E111

CORE TYPE / CORE LOCATION		SYMBOL
INPUT SOURCE		SCALE

TITLE

STEADY STATE FUEL FLOW

PROGRAM NO. E120

PAGE NO. 1 OF 1

AM DT2	DELTA T2	δ_{T2}	
E003		13	
AM RTHE2	SQUARE ROOT	$\sqrt{\theta_{T2}}$	
E003	THETA T2	14	
AM F720i	f (N2i/$\sqrt{\theta_{T2}}$, M)	f_{720i}	
E003		04	
AM F724i	f (N2i/$\sqrt{\theta_{T2}}$, M)	f_{724i}	
		01	
AM F5070	f (M)	f_{5070}	
		04	

EQUATION:

$$Wfss_i = \delta_{T2}\sqrt{\theta_{T2}}\left\{f_{720i} + f_{724i} - f_{5070}\right\}$$

(i : 1 ~ 6)

$Wfss_1$	ENG #1 STEADY STATE	WFSS1	AM
01	FUEL FLOW		
$Wfss_2$	ENG #2 STEADY STATE	WFSS2	AM
01	FUEL FLOW		
$Wfss_3$	ENG #3 STEADY STATE	WFSS3	AM
01	FUEL FLOW		
$Wfss_4$	ENG #4 STEADY STATE	WFSS4	AM
01	FUEL FLOW		
$Wfss_5$	ENG #5 STEADY STATE	WFSS5	AM
01	FUEL FLOW		
$Wfss_6$	ENG #6 STEADY STATE	WFSS6	AM
01	FUEL FLOW		

ITERATION RATE: 2.38/SEC

EQUATION NO: E120

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE

FUEL FLOW & FUEL FLOW DOT

PROGRAM NO.	E121
PAGE NO.	1 OF 3

CD	FAVE1	FUEL AVAIL ON ENG #1	F_{AVE1}
			AVAIL = 1
CD	FAVE2	FUEL AVAIL ON ENG #2	F_{AVE2}
			AVAIL = 1
CD	FAVE3	FUEL AVAIL ON ENG #3	F_{AVE3}
			AVAIL = 1
CD	FAVE4	FUEL AVAIL ON ENG #4	F_{AVE4}
			AVAIL = 1
CD	FBPS	ENGINE FIELD BYPASS	F_{BPS}
			BYPASS = 1
AM	DN21	ENG #1 DELTA N2	ΔN_{21}
E100			01
AM	DN22	ENG #2 DELTA N2	ΔN_{22}
E100			01
AM	DN23	ENG #3 DELTA N2	ΔN_{23}
E100			01
AM	DN24	ENG #4 DELTA N2	ΔN_{24}
E100			01
AM	WFSS1	ENG #1 STEADY STATE	W_{fss1}
E120		FUEL FLOW	01
AM	WFSS2	ENG #2 STEADY STATE	W_{fss2}
E120		FUEL FLOW	01

ITERATION RATE: 4.76/SEC

EQUATION:

$$\text{IF}\ \begin{cases} \overline{[FAVEi]} \cdot \overline{[FBPS]} & Wfi = 0 \\ [FAVEi] + [FBPS] & Wfi = Wfssi + Wfai - Wfdi \quad (\geqq 800) \end{cases}$$

$$\text{IF}\ \begin{cases} [\Delta N_{2i} \geq 0] & \begin{cases} Wfai = (f_{600}i + f_{610}i)(\delta_{T2}\sqrt{\theta_{T2}}) \cdot \underbrace{\frac{|\Delta N_{2i}|}{1000}}_{(\leqq 1)} \\ Wfdi = 0 \end{cases} \\ [\Delta N_{2i} < 0] & \begin{cases} Wfai = 0 \\ Wfdi = 0.375\ Wfssi \cdot \underbrace{\frac{|\Delta N_{2i}|}{1000}}_{(\leqq 1)} \end{cases} \end{cases}$$

$$\Delta Wfi = Wfi - Wfssi$$

Wf_1	ENG #1 FUEL FLOW	WF1	AM
01			
Wf_2	ENG #2 FUEL FLOW	WF2	AM
01			
Wf_3	ENG #3 FUEL FLOW	WF3	AM
01			
Wf_4	ENG #4 FUEL FLOW	WF4	AM
01			
Wf_{a1}	ENG #1 ACCELERATION	WFA1	AM
01	FUEL FLOW		
Wf_{a2}	ENG #2 ACCELERATION	WFA2	AM
01	FUEL FLOW		
Wf_{a3}	ENG #3 ACCELERATION	WFA3	AM
01	FUEL FLOW		
Wf_{a4}	ENG #4 ACCELERATION	WFA4	AM
01	FUEL FLOW		
Wf_{d1}	ENG #1 DECELERATION	WFD1	AM
01	FUEL FLOW		
Wf_{d2}	ENG #2 DECELERATION	WFD2	AM
01	FUEL FLOW		

EQUATION NO: E121

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: FUEL FLOW & FUEL FLOW DOT

PROGRAM NO.: E121

PAGE NO.: 2 OF 3

EQUATION:

AM	WFSS3	ENG #3 STEADY STATE	Wf_{SS3}
E120		FUEL FLOW	01
AM	WFSS4	ENG #4 〃	Wf_{SS4}
E120			01
CD	FAVE5	FUEL AVAIL ON ENG #5	F_{AVE5}
			AVAIL = 1
CD	FAVE6	〃 ENG #6	F_{AVE6}
			〃
AM	DN25	ENG #5 DELTA N2	ΔN_{25}
E100			01
AM	DN26	ENG #6 〃	ΔN_{26}
E100			01
AM	WFSS5	ENG #5 STEADY STATE	Wf_{SS5}
E120		FUEL FLOW	01
AM	WFSS6	ENG #6 〃	Wf_{SS6}
E120			01
AM	F600i	$f(N2i/\sqrt{\theta_{T2}})$	f_{600i}
			03
AM	F610i	$f(N2i/\sqrt{\theta_{T2}})$	f_{610i}
			03
AM	EDT2	DELTA T2	δ_{T2}
E003			13

ITERATION RATE:

Wf_{d3}	ENG #3 DECELERATION	WFD3	AM
01	FUEL FLOW		
Wf_{d4}	ENG #4 〃	WFD4	AM
01			
Wf_{d5}	ENG #5 〃	WFD5	AM
01			
Wf_{d6}	ENG #6 〃	WFD6	AM
01			
Wf_{a5}	ENG #5 ACCELERATION	WFA5	AM
01	FUEL FLOW		
Wf_{a6}	ENG #6 〃	WFA6	AM
01			
ΔWf_1	ENG #1 DELT WF	DWF1	AM
01			
ΔWf_2	ENG #2 〃	DWF2	AM
01			
ΔWf_3	ENG #3 〃	DWF3	AM
01			
ΔWf_4	ENG #4 〃	DWF4	AM
01			

EQUATION NO.: E121

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	RTHE2	SQUARE ROOT	$\sqrt{\theta_{T2}}$
	E003	THETA T2	14

ITERATION RATE:

TITLE

FUEL FLOW & FUEL FLOW DOT

EQUATION:

PROGRAM NO.	E121		
PAGE NO. 3 OF 3			
ΔW_{f5}	ENG #5 DELTA WF	DFW5	AM
01			
ΔW_{f6}	ENG #6 DELTA WF	DFW6	AM
01			

EQUATION NO:

E121

CORE TYPE	CORE LOCATION	INPUT SOURCE	SYMBOL / SCALE
AM	F770i	f (N2i/$\sqrt{\theta_{T2}}$, M)	f_{770i} / 14
AM	F534i	f (N2i/$\sqrt{\theta_{T2}}$, M)	f_{534i} / 13
AM	F471i	f (M)	f_{471i} / 14
AM	F664i	f (N2i/$\sqrt{\theta_{T2}}$, M)	f_{664i} / 19
AM	F604i	f (N2i/$\sqrt{\theta_{T2}}$)	f_{604i} / 17
CA	WBLP1	ENG #1 LOW PRESSURE BLEED	$\%W_{bLp1}$ / 11
CA	WBLP2	ENG #2 LOW PRESSURE BLEED	$\%W_{bLp2}$ / 11
CA	WBLP3	ENG #3 LOW PRESSURE BLEED	$\%W_{bLp3}$ / 11
CA	WBLP4	ENG #4 LOW PRESSURE BLEED	$\%W_{bLp4}$ / 11
CA	WBHP1	ENG #1 HIGH PRESSURE BLEED	$\%W_{bHp1}$ / 12
CA	WBHP2	ENG #2 HIGH PRESSURE BLEED	$\%W_{bHp2}$ / 12

ITERATION RATE: 2.38/SEC

TITLE

ENGINE PRESSURE RATIO

EQUATION:

$$EPRi = \{ f_{770i} + f_{534i} - f_{471i0} \} - f_{664i}$$

$$- f_{604i} \underbrace{[0.14285(\%\, W_{bLpi})]}_{\leq 1.0} + \underbrace{[0.2857(\%\, W_{bHpi})]}_{\leq 2.0}$$

(i : ENG. NUMBER (1 ~ 6))

PROGRAM NO. E130

PAGE NO. 1 OF 2

EPR_1 / 13	ENG #1 PRESSURE RATIO	EPR1	AM
EPR_2 / 13	ENG #2 PRESSURE RATIO	EPR2	AM
FPR_3 / 13	ENG #3 PRESSURE RATIO	EPR3	AM
EPR_4 / 13	ENG #4 PRESSURE RATIO	EPR4	AM
EPR_5 / 13	ENG #5 PRESSURE	EPR5	AM
EPR_6 / 13	ENG #6 PRESSURE RATIO	EPR6	AM

EQUATION NO: E130

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
CA	WBHP3	ENG #3 HIGH PRESSURE BLEED	$\%W_{bHp3}$ 12
CA	WBHP4	ENG #4 HIGH PRESSURE BLEED	$\%W_{bHp4}$ 12
CA	WBHP5	ENG #5 HIGH PRESSURE BLEED	$\%W_{bHp5}$ 12
CA	WBHP6	ENG #6 HIGH PRESSURE BLEED	$\%W_{bHp6}$ 12
CA	WBLP5	ENG #5 LOW PREESURE BLEED	$\%W_{bLp5}$ 12
CA	WBLP6	ENG #6 LOW PRESSURE BLEED	$\%W_{bLp6}$ 12

ITERATION RATE:

TITLE

ENGINE PRESSURE RATIO

EQUATION:

PROGRAM NO. E130

PAGE NO. 2 OF 2

EQUATION NO:

E130

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: EXHAUST GAS TEMPERATURE

PROGRAM NO.: E140

PAGE NO.: 1 OF 2

EQUATION:

$$EGTss_i = \theta_{T2}\{f_{750i} + f_{660i} - M \cdot f_{614i} + 0.0015(hp - 25000)^{\oplus}\} - 273.16$$

IF $\overline{[FIRE_i]}$ $EGT_i = [\int -0.3\,dt]^{\oplus}$

$[FIRE_i]$ $[\Delta Wf_i > 0]$ $EGT_i = EGTss_i + 0.1\,\Delta Wf_i$

$[FIRE_i]$ $[\Delta Wf_i \leqq 0]$ $EGT_i = EGTss_i - 0.008\,\Delta Wf_i$

(i : ENGINE NUMBER (1 ~ 6))

AM	THETA2	TEMP. CORRECTION	θ_{T2}				
E003		FACTOR	14				
AM	F750i	f (N2i/$\sqrt{\theta_{T2}}$)	f_{750i}				
			05				
AM	F660i	f (N2i/$\sqrt{\theta_{T2}}$)	f_{660i}				
			06				
AM	F614i	f (N2i/$\sqrt{\theta_{T2}}$)	f_{614i}				
			10				
AM	M	MACH NUMBER	M				
F320			12				
AM	HP	PRESSURE ALT	hp				
F040			−02				
AM	DWF1	DELTA WF1	ΔWf_1				
E121			01				
AM	DWF2	DELTA WF2	ΔWf_2				
E121			01				
AM	DWF3	DELTA WF3	ΔWf_3				
E121			01				
AM	DWF4	DELTA WF4	ΔWf_4				
E121			01				
CD	FIRE1	ENG #1 FIRE	$FIRE_1$				
			FIRE = 1				

$EGTss_1$	ENG #1 STEADY STATE	EGTSS1	AM
05	EGT		
$EGTss_2$	ENG #2 STEADY STATE	EGTSS2	AM
05			
$EGTss_3$	ENG #3 STEADY STATE	EGTSS3	AM
05	EGT		
$EGTss_4$	ENG #4 STEADY STATE	EGTSS4	AM
05	EGT		
EGT_1	ENG #1 EXHAUST GAS	EGT1	AM
05	TEMP.		
EGT_2	ENG #2 EXHAUST GAS	EGT2	AM
05	TEMP.		
EGT_3	ENG #3 EXHAUST GAS	EGT3	AM
05	TEMP.		
EGT_4	ENG #4 EXHAUST GAS	EGT4	AM
05	TEMP.		
$EGTss_5$	ENG #5 STEADY STATE	EGTSS5	AM
05	EGT		
$EGTss_6$	ENG #6 STEADY STATE	EGTSS6	AM
05	EGT		

ITERATION RATE: 1.19/SEC

EQUATION NO.: E140

CORE TYPE	CORE LOCATION	INPUT SOURCE	SYMBOL	SCALE
CD	FIRE2	ENG #2 FIRE	F_{IRE2}	FIRE = 1
CD	FIRE3	ENG #3 FIRE	F_{IRE3}	FIRE = 1
CD	FIRE4	ENG #4 FIRE	F_{IRE4}	FIRE = 1
CD	FIRE5	ENG #5 FIRE	F_{IRE5}	FIRE = 1
CD	FIRE6	ENG #6 FIRE	F_{IRE6}	FIRE = 1
AM	DWF5	DELTA WF5	ΔWf_5	01
	E121			
AM	DWF6	DELTA WF6	ΔWf_6	01
	E121			

ITERATION RATE:

TITLE

EXHAUST GAS TEMPERATURE

EQUATION:

PROGRAM NO. E140

PAGE NO. 2 OF 2

EGT_5	ENG #5 EXHAUST GAS	EGT5	AM
05	TEMP.		
EGT_6	ENG #6 EXHAUST GAS	EGT6	AM
05			

EQUATION NO:

E140

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	F7140	f (M, hp)	f7140
			08
AM	RTHE2	SQUARE ROOT	$\sqrt{\theta_{T2}}$
E003		THETA T2	14
AM	PN11	ENG #1 PERCENT N1	%N11
E111			08
AM	PN12	ENG #2 "	%N12
E111			08
AM	PN13	ENG #3 "	%N13
E111			08
AM	PN14	ENG #4 "	%N14
E111			08
AM	PN15	ENG #5 "	%N15
E111			08
AM	PN16	ENG #6 "	%N16
E111			08

ITERATION RATE: 1.19/SEC

TITLE

SURGE BLEED VALVE

EQUATION:

$$C_{SBi} = \%N_{1i} - f_{7140}\sqrt{\theta_{T2}}$$

IF (1) $[C_{SBi} < 0] + [V_{Sbi(n-1)}]\ [\ C_{SBi} < 12.0]$

$Vsbi = 1$ (OPEN)

IF (2) $[C_{SBi} \geqq 2.0] + \overline{[Vsbi_{(n-1)}]}\ [(C_{SBi} \geqq 0]$

$Vsbi = 0$ (CLOSE)

except (1) (2)

$Vsbi = Vsbi_{(n-1)}$ (HOLD)

(i : ENG. NUMBER (1 ~ 6))

PROGRAM NO.	E144
PAGE NO.	1 OF 1

Vsb1	ENG #1 SURGE BLEED	VSB1	DM
open=1	VALVE		
Vsb2	ENG #2 "	VSB2	DM
open=1			
Vsb3	ENG #3 "	VSB3	DM
open=1			
Vsb4	ENG #4 "	VSB4	DM
open=1			
Vsb5	ENG #5 "	VSB5	DM
open=1			
Vsb6	ENG #6 "	VSB6	DM
open=1			

EQUATION NO: E144

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE

ENGINE THRUST

PROGRAM NO. E160

PAGE NO. 1 OF 2

AM	DAMB	DELTA AMBIENT	δamb
F320			14
AM	F760i	f (EPRi, M)	f_{760i}
			01
AM	F754i	f (EPRi, M)	f_{754i}
			00
AM	CSD1	ENG #1 CLAM SHELL	CSD1
E170		DOOR POSITION	15
AM	CSD2	ENG #2 〃	CSD2
E170			15
AM	CSD3	ENG #3 〃	CSD3
E170			15
AM	CSD4	ENG #4 〃	CSD4
E170			15
CD	FIRE1	ENG #1 FIRE	FIRE1
			FIRE = 1
CD	FIRE2	ENG #2 〃	FIRE2
			〃
CD	FIRE3	ENG #3 〃	FIRE3
			〃
CD	FIRE4	ENG #4 〃	FIRE4
			〃

ITERATION RATE: 4.76/SEC

EQUATION:

$$F_{Ni} = \delta amb[f_{760i} - 5000 + f_{754i}]\,[1.0 - 1.49\,CSD_i]$$

IF $\overline{[FIRE_i]}$ $\quad F_{Ni} \geqq 0$

$(i : 1 \sim 6)$

F_{N1}	ENG #1 THRUST	FN1	AM
00			
F_{N2}	ENG #2 THRUST	FN2	AM
00			
F_{N3}	ENG #3 THRUST	FN3	AM
00			
F_{N4}	ENG #4 THRUST	FN4	AM
00			
F_{N5}	ENG #5 THRUST	FN5	AM
00			
F_{N6}	ENG #6 THRUST	FN6	AM
00			

EQUATION NO: E160

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	CSD5	ENG#5 CLAM SHELL	CSD_5
E170		DOOR POSITION	15
AM	CSD6	ENG#6 〃	CSD_6
E170			15
CD	FIRE5	ENG#5 FIRE	$FIRE_5$
			FIRE = 1
CD	FIRE6	ENG#6 〃	$FIRE_6$
			FIRE = 1

ITERATION RATE:

TITLE

ENGINE THRUST

EQUATION:

PROGRAM NO. E160

PAGE NO. 2 OF 2

EQUATION NO:

E160

CORE TYPE / CORE LOCATION		SYMBOL
INPUT SOURCE		SCALE
AM CSA1 / A030	ENG #1 CROSS SHAFT ANGLE	CSA1 07
AM CSA2 / A030	ENG #2 CROSS SHAFT ANGLE	CSA2 07
AM CSA3 / A030	ENG #3 CROSS SHAFT ANGLE	CSA3 07
AM CSA4 / A030	ENG #4 CROSS SHAFT ANGLE	CSA4 07
AM PN21 / E103	ENG #1 HIGH PRESS. ROTOR SPEED	%N21 08
AM PN22 / E103	ENG #2 〃	%N22 08
AM PN23 / E103	ENG #3 〃	%N23 08
AM PN24 / E103	ENG #4 〃	%N24 08
AM CSA5 / A030	ENG #5 CROSS SHAFT ANGLE	CSA5 07
AM CSA6 / A030	ENG #6 〃	CSA6 07
AM PN25 / E103	ENG #5 HIGH PRESS. ROTOR SPEED	%N25 08

ITERATION RATE: 1.19/SEC

TITLE

ENGINE THRUST REVERSER

EQUATION:

$$CSD_i = [\int \dot{CSD}dt]^{\oplus} = (CSD_{i(n-1)} + \frac{K}{100} \cdot \dot{CSD}_i) \quad (< 1.0)$$

$$\text{IF} \begin{cases} [CSA_i < 51]\,[\%N_{2i} > 11] & \dot{CSD}_i = 1.0 \\ \overline{[CSA_i < 51]}\,[\%N_{2i} > 11] & \dot{CSD}_i = -1.0 \\ \overline{[\%N_{2i} > 11]} & \dot{CSD}_i = 0.0 \end{cases}$$

$(i = 1 \sim 6)$

PROGRAM NO. E170

PAGE NO. 1 OF 2

CSD1 / 15	ENG #1 CLAMSHELL DOOR POSITION	CSD1 AM
CSD2 / 15	ENG #2 〃	CSD2 AM
CSD3 / 15	ENG #3 〃	CSD3 AM
CSD4 / 15	ENG #4 〃	CSD4 AM
CSD5 / 15	ENG #5 〃	CSD5 AM
CSD6 / 15	ENG #6 〃	CSD6 AM

EQUATION NO: E170

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	PN26	ENG#6 HIGH PRESS.	%N_{26}
E103		ROTOR SPEED	08
AM	K	INTEG. CONST.	K
MONITOR			00

ITERATION RATE:

TITLE

ENGINE THRUST REVERSER

EQUATION:

PROGRAM NO. E170

PAGE NO. 2 OF 2

EQUATION NO:

E170

第4部　外部機器インタフェイス

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: CONTROL LOADING ANALOGUE INPUT/OUTPUT

PROGRAM NO.: A000

PAGE NO.: 1 OF 2

AI	DSAI	STICK DEFLECTION	δ_{SAI}
CH./81		ANALOGUE INPUT	00
AI	FSCAI	PILOT APPLIED STICK	F_{SCAI}
CH./87		FORCE ANALOGUE INPUT	00
AM	FS	STICK FORCE	F_S
F130			07
AI	DWAI	WHEEL DEFLECTION	δ_{WAI}
CH./80		ANALOGUE INPUT	00
AI	FWCAI	PILOT APPLIED WHEEL	F_{WCAI}
CH./86		FORCE ANALOGUE INPUT	00
AM	FW	WHEEL FORCE	F_W
F132			07
AI	DPAI	PEDAL DEFLECTION	δ_{PAI}
CH./82		ANALOGUE INPUT	00
AI	FPCAI	PILOT APPLIED PEDAL	F_{PCAI}
CH./88		FORCE ANALOGUE INPUT	00
AM	FP	PEDAL FORCE	F_P
F134			06

ITERATION RATE: 100/SEC

EQUATION:

STICK

$$\delta_{S1}@09 = \left\{ -\frac{\delta_{SAI}@0}{13140@0} - \frac{\delta_{SAI}^{\oplus}@0}{9371@0} + \frac{\delta_{SAI}@0^{\oplus}}{13140@0} \right\} \cdot \delta_{SMAX}@09$$

$$F_{SC}@07 = 220.46@07 \cdot \frac{F_{SCAI}@0}{3277@0}$$

$$F_{SAO}@0 = 3277@0 \cdot \frac{F_S@07}{220.46@07}$$

$$\delta_S@09 = \delta_{S1}@09$$

WHEEL

$$\delta_{W1}@08 = -\frac{\delta_{WAI}@0}{13107@0} \cdot \delta_{WMAX}@08$$

$$F_{WC}@07 = 220.46@07 \cdot \frac{F_{WCAI}@0}{3277@0}$$

$$F_{WAO}@0 = 3277@0 \cdot \frac{F_W@07}{220.46@07}$$

$$\delta_W@08 = \delta_{W1}@08$$

δ_S	STICK DEFLECTION	DS	AM	
09	STRETCHED			
F_{SC}	PILOT APPLIED STICK	FSC	AM	
07	FORCE			
F_{SAO}	STICK FORCE	FSAO	AO	
00	ANALOGUE OUTPUT	CH./90		
δ_W	WHEEL DEFLECTION	DW	AM	
08	STRETCHED			
F_{WC}	PILOT APPLIED WHEEL	FWC	AM	
07	FORCE			
F_{WAO}	WHEEL FORCE	FWAO	AO	
00	ANALOGUE OUTPUT	CH./8F		
δ_P	PEDAL DEFLECTION	DP	AM	
11	STRETCHED			
F_{PC}	PILOT APPLIED PEDAL	FPC	AM	
06	FORCE			
F_{PAO}	PEDAL FORCE	FPAO	AM	
00	ANALOGUE OUTPUT	CH./91		

EQUATION NO: A000

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: CONTROL LOADING ANALOGUE INPUT/OUTPUT

PROGRAM NO.: A000

PAGE NO.: 2 OF 2

CA	DSMAX	STICK DEF. MAX.	δ_{SMAX}
			09
CA	DWMAX	WHEEL DEF. MAX.	δ_{WMAX}
			08
CA	DPMAX	PEDAL DEF. MAX.	δ_{PMAX}
			11

ITERATION RATE:

EQUATION:

PEDAL

$$\delta p_1@11 = \frac{\delta_{PAI}@0}{13107@0} \cdot \delta_{PMAX}@11$$

$$Fpc@06 = 220.46@06 \frac{F_{PCAI}@0}{3277@0}$$

$$F_{PAO}@0 = 3277@0 \cdot \frac{Fp@06}{220.46@06}$$

$$\delta p@11 = \delta_{P1}@11$$

EQUATION NO.: A000

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	HI	INDICATED PRESSURE	h_i
F400		ALTITUDE	−01
AM	VI	INDICATED AIRSPEED	V_i
F400			05
AM	RCI	INDICATED RATE OF	R/C_i
F400		CLIMB	02
AM	RBI	INDICATED BALL	λ_{Bi}
F400		ANGLE	10
AM	I	YAW RATE-ACFT AXIS	I
F400			12

ITERATION RATE: 4.76/SEC

TITLE

FLIGHT AND ENGINE INSTRUMENT

EQUATION:

PRESSURE ALTITUDE

$$hm@0 = hi@ - 01/3.281@13$$

$$h_{PAO}@0 = 32767@0 \cdot \frac{hm@0}{10000@0} \qquad (hm \leqq 10000)$$

INDICATED AIRSPEED

$$V_{IAO}@0 = 32767@0 \cdot \frac{Vi@5}{270@5} \qquad (Vi \leqq 270)$$

RATE OF CLIMB

$$RCm@10 = RCi@02/(60 \times 3.281)@07$$

$$RC_{AO}@0 = 32767@0 \cdot \frac{RCm@10}{20@10} \qquad (|RCm| \leqq 20.0)$$

TURN AND SLIP

$$\lambda_{BAO}@0 = 32767@0 \cdot \frac{\lambda_{BI}@10}{20@10} \qquad (|\lambda_{BI}| \leqq 20)$$

$$r_{AAO}@0 = 32767@0 \cdot \frac{\left\{\frac{180}{3.14} I\right\}@10}{20@10} \qquad (|I| \leqq 0.348)$$

PROGRAM NO.	A010
PAGE NO.	1 OF 4

h_{PAO}	PRESSURE ALTITUDE	HPAO	AO
00	ANALOGUE OUTPUT	CH./85	
V_{IAO}	INDICATED AIRSPEED	VIAO	AO
00	ANALOGUE OUTPUT	CH./83	
RC_{AO}	RATE OF CLIMB	RCAO	AO
00	ANALOGUE OUTPUT	CH./8B	
λ_{BAO}	RAMDA B	RBAO	AO
00	ANALOGUE OUTPUT	CH./89	
r_{AAO}	RA ANALOGUE	RAAO	AO
00	OUTPUT	CH./8A	

EQUATION NO:

A010

CORE TYPE	CORE LOCATION	INPUT SOURCE	SYMBOL	SCALE
AM	THETA	THETA (~ DEG)	θ	06
AM	PAI	PAI (~ DEG)	ϕ	06
AM	PSI	PSI (~ DEG)	ψ	06

ITERATION RATE:

TITLE

FLIGHT AND ENGINE INSTRUMENT

EQUATION:

ATTITUDE

PITCH (θ)

$$\theta_{AO}@0 = 32767@0 \cdot \frac{\theta@6}{90@6} \qquad (|\theta| \leqq 90°)$$

ROLL (ϕ)

$$\phi_{AO}@0 = 32767@0 \cdot \frac{\phi@6}{90@6} \qquad (|\phi| \leqq 90°)$$

COMPASS

$$\psi_{AO}@0 = 32767@0 \cdot \frac{\psi@6}{400@6}$$

PROGRAM NO. A010

PAGE NO. 2 OF 4

θ_{AO}	INDICATED PITCH ANGLE ANALOGUE OUTPUT	THAO AO CH./87
ϕ_{AO}	INDICATED ROLL ANGLE ANALOGUE OUTPUT	PAIAO AO CH./86
ψ_{AO}	INDICATED YAW ANGLE ANALOGUE OUTPUT	PSIAO AO CH./88

EQUATION NO:

A010

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	EPR1	ENG 1 PRESSURE	EPR_1
E130		RATIO	13
AM	EPR2	ENG 2 PRESSURE	EPR_2
E130		RATIO	13
AM	EPR3	ENG 3 PRESSURE	EPR_3
E130		RATIO	13
AM	EPR4	ENG 4 PRESSURE	EPR_4
E130		RATIO	13
AM	EPR5	ENG 5 PRESSURE	EPR_5
E130		RATIO	13
AM	EPR6	ENG 6 PRESSURE	EPR_6
E130		RATIO	13
AM	PN21	ENG 1 PERCENT N2	$\%N_{21}$
E103			08
AM	PN22	ENG 2 PERCENT N2	$\%N_{22}$
E103			08
AM	PN23	ENG 3 PERCENT N2	$\%N_{23}$
E103			08
AM	PN24	ENG 4 PERCENT N2	$\%N_{24}$
E103			08
AM	PN25	ENG 5 PERCENT N2	$\%N_{25}$
E103			08

ITERATION RATE:

TITLE

FLIGHT AND ENGINE INSTRUMENT

EQUATION:

ENGINE PRESSURE RATIO

$$EPR_{RAO}@0 = 32767@0 \cdot \frac{EPR_R@13}{2.5@13} \qquad (EPR_R \leqq 2.5)$$

$$EPR_R = EPR_1\,[ENGR = 1] + EPR_2\,[ENGR = 2] + EPR_3\,[ENGR = 3] + EPR_4\,[ENGR = 4] + EPR_5\,[ENGR = 5] + EPR_6\,[ENGR = 6]$$

$$EPR_{LAO}@0 = 32767@0 \cdot \frac{EPR_L@13}{2.5@13} \qquad (EPR_L \leqq 2.5)$$

$$EPR_L = EPR_1\,[ENGL = 1] + EPR_2\,[ENGL = 2] + EPR_3\,[ENGL = 3] + EPR_4\,[ENGL = 4] + EPR_5\,[ENGL = 5] + EPR_6\,[ENGL = 6]$$

ENGINE N_2 RPM PERCENT

$$N_{2RAO}@0 = 32767@0 \cdot \frac{\%N_{2R}@8}{120@8} \qquad (\%N_{2R} \leqq 120)$$

$$\%N_{2R} = \%N_{21} \cdot [ENGR = 1] + \%N_{22}\,[ENGR = 2] + \%N_{23}\,[ENGR = 3] + \%N_{24} \cdot [ENGR = 4] + \%N_{25}\,[ENGR = 5] + \%N_{26}\,[ENGR = 6]$$

$$N_{2LAO}@0 = 32767@0 \cdot \frac{\%N_{2L}@8}{120@8} \cdot (\%N_{2L} \leqq 120)$$

$$\%N_{2L} = \%N_{21} \cdot [ENGL = 1] + \%N_{22}\,[ENGL = 2] + \%N_{23}\,[ENGL = 3] + \%N_{24} \cdot [ENGL = 4] + \%N_{25}\,[ENGL = 5] + \%N_{26}\,[ENGL = 6]$$

PROGRAM NO. A010

PAGE NO. 3 OF 4

EPR_{RAO}	EPR RIGHT ANALOGUE	EPRAO	AO
00	OUTPUT	CH./F0	
EPR_{LAO}	EPR LEFT ANALOGUE	EPLAO	AO
00	OUTPUT	CH./F1	
N_{2RAO}	PERCENT N2 RIGHT	N2RAO	AO
00	ANALOGUE OUTPUT	CH./F2	
N_{2LAO}	PERCENT N2 LEFT	N2LAO	AO
00	ANALOGUE OUTPUT	CH./F3	

EQUATION NO:

A010

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	PN26	ENG 6 PERCENT N2	$\%N_{26}$
E103			08
AM	EGT1	ENG 1 EXHAUST GAS	EGT_1
E140		TEMP.	05
AM	EGT2	ENG 2 EXHAUST GAS	EGT_2
E140		TEMP.	05
AM	EGT3	ENG 3 EXHAUST GAS	EGT_3
E140		TEMP.	05
AM	EGT4	ENG 4 EXHAUST GAS	EGT_4
E140		TEMP.	05
AM	EGT5	ENG 5 EXHAUST GAS	EGT_5
E140		TEMP.	05
AM	EGT6	ENG 6 EXHAUST GAS	EGT_6
E140		TEMP.	05
CA	ENGL	LEFT ENG.	ENG_L
		CONNECTION NUMBER	00
CA	ENGR	RIGHT ENG.	ENG_R
		CONNECTION NUMBER	00

ITERATION RATE:

TITLE

FLIGHT AND ENGINE INSTRUMENT

EQUATION:

EXHAUST GAS TEMPERATURE

$$EGT_{RAO}@0 = 32767@0 \cdot \frac{EGT_R@5}{700@5} \cdot (EGT_R \leqq 700)$$

$$EGT_R = EGT_1[ENGR = 1] + EGT_2[ENGR = 2] + EGT_3[ENGR = 3] + EGT_4[ENGR = 4] + EGT_5[ENGR = 5] + EGT_6[ENGR = 6]$$

$$EGT_{LAO}@0 = 32767@0 \cdot \frac{EGT_L@5}{700@5} \quad (EGT_L \leqq 700)$$

$$EGT_L = EGT_1[ENGL = 1] + EGT_2[ENGL = 2] + EGT_3[ENGL = 3] + EGT_4[ENGL = 4] + EGT_5[ENGL = 5] + EGT_6[ENGL = 6]$$

ただし変数には「1次遅れ」をほどこす。

$$X_{AO} = X_{AO_{-1}} + \frac{1}{n} \cdot (X_{AO} - X_{AO_{-1}})$$

PROGRAM NO. A010

PAGE NO. 4 OF 4

EGT_{RAO}	EGT RIGHT ANALOGUE	EGRAO	AO
00	OUTPUT	CH./F4	
EGT_{LAO}	EGT LEFT ANALOGUE	EGLAO	AO
00	OUTPUT	CH./F5	

EQUATION NO:

A010

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: COCKPIT MOTION, FLIGHT TABLE, VISUAL DISPLAY OUT

PROGRAM NO.: A020

PAGE NO. 1 OF 4

AM	FTHM	f_{THM} (θ)	f_{THM}
			00
AM	FPIM	f_{PIM} (ϕ)	f_{PIM}
			00
AM	THETA	THETA (DEG)	θ
F020			06
AM	PAI	PAI (DEG)	ϕ
F020			06
AM	PSI	PSI (DEG)	ψ
F020			06
AM	X	ACFT POSITION	X
F030		−X (M)	02
AM	Y	ACFT POSITION	Y
F030		−Y (M)	02
AM	Z	ACFT POSITION	Z
F030		−Z (M)	02
CA	KVSC	SCREEN ANGLE RATIO	Kvsc
			15

ITERATION RATE: 100/SEC

EQUATION:

COCKPIT MOTION

$\theta_M = f_{THM}$

θ@06	−11.0	−10.8	−10.1	−9.5	9.5	10.1	10.9	11.1
f_{THM}@00	−32768	−26214	−19660	−16383	16383	19660	26214	32767
	⇑ −10V							⇑ +10V

$\phi_M = f_{PIM}$

ϕ@06	−13.8	−13.0	−11.8	−10.4	10.4	12.2	13.6	14.3
f_{PIM}@00	−32768	−26214	−19660	−16383	16383	19660	26214	32767
	⇑ −10V							⇑ +10V

θ_M	MOTION PITCH	THETM	AO
00	ANGLE ANALOG OUTPUT	CH./81	
ϕ_M	MOTION ROLL ANGLE	PAIM	AO
00	ANALOG OUTPUT	CH./80	

EQUATION NO.: A020

CORE TYPE / CORE LOCATION	SYMBOL
INPUT SOURCE	SCALE

TITLE

COCKPIT MOTION, FLIGHT TABLE, VISUAL DISPLAY OUT

PROGRAM NO. A020

PAGE NO. 2 OF 4

EQUATION:

FLIGHT TABLE

$$\theta_{FT}@0 = 32767@0 \cdot \frac{\theta@6}{120@6} \qquad (|\theta| \leqq 120)$$

$$\phi_{FT}@0 = 32767@0 \cdot \frac{\phi@6}{120@6} \qquad (|\phi| \leqq 120)$$

$$\psi_{FT}@0 = 32767@0 \cdot \frac{\psi@6}{120@6} \qquad (|\psi| \leqq 120)$$

VISUAL DISPLAY SCREEN

$$\theta_{VD1}@0 = 32767@0 \cdot \frac{(Kvsc \cdot \theta)@13}{2.5@13} \qquad (|Kvsc \cdot \theta| \leqq 2.5)$$

$$\phi_{VD1}@0 = 32767@0 \cdot \frac{\phi@6}{90@6} \qquad (|\phi| \leqq 90)$$

$$\psi_{VD1}@0 = 32767@0 \cdot \frac{(Kvsc \cdot \psi)@13}{5.0@13} \qquad (|Kvsc \cdot \psi| \leqq 5.0)$$

θ_{FT} 00	THETFT AO CH./A1
ϕ_{FT} 00	PAIFT AO CH./A0
ψ_{FT} 00	PSIFT AO CH./A2
θ_{VD1} 00	THEVD1 AO CH./93
ϕ_{VD1} 00	PAIVD1 AO CH./92
ψ_{VD1} 00	PSIVD1 AO CH./94

ITERATION RATE:

EQUATION NO: A020

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE

TITLE: COCKPIT MOTION, FLIGHT TABLE, VISUAL DISPLAY OUT

PROGRAM NO.: A020

PAGE NO. 3 OF 4

AM	K	INTEG. CONST.	K
MONITOR			00

EQUATION:

VISUAL DISPLAY TELEVISION

$$\theta_{VD2}@0 = 32767@0 \cdot \frac{\theta@6}{20@6} \qquad (|\theta| \leqq 20)$$

$$\phi_{VD2}@0 = 32767@0 \cdot \frac{\phi@6}{45@6} \qquad (|\phi| \leqq 45)$$

$$\psi_{VD2}@0 = 32767@0 \cdot \frac{\psi@6}{30@6} \qquad (|\psi| \leqq 30)$$

$$X_{VD2}@0 = 32767@0 \cdot \frac{X@2}{1500@2} \qquad (|X| \leqq 1500)$$

$$Y_{VD2}@0 = 32767@0 \cdot \frac{Y@2}{62.5@2} \qquad (|Y| \leqq 62.5)$$

$$Z_{VD2}@0 = 32767@0 \cdot \frac{Z@2}{125@2} \qquad (4 \leqq Z \leqq 125)$$

上記の変数を次の形式で累積する。

$X = X_{-1} + (X - X_{-1})$

ただし $(X - X_{-1})$ の部分は次頁に示す範囲に制限する。

θ_{VD2} 00	THEVD2 AO CH./96
ϕ_{VD2} 00	PAIVD2 AO CH./95
ψ_{VD2} 00	PSIVD2 AO CH./97
X_{VD2} 00	XVD2 AO CH./98
Y_{VD2} 00	YVD2 AO CH./99
Z_{VD2} 00	ZVD2 AO CH./9A

ITERATION RATE:

EQUATION NO: A020

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE

TITLE

COCKPIT MOTION, FLIGHT TABLE, VISUAL DISPLAY OUT

PROGRAM NO. A020

PAGE NO. 4 OF 4

EQUATION:

$$-18783@0\,\frac{K}{100} \leqq (\theta_{VD2} - \theta_{VD2(-1)}) \leqq 18783@0\cdot\frac{K}{100}\ (1/5\ \text{RAD/SEC})$$

$$-8348@0\,\frac{K}{100} \leqq (\phi_{VD2} - \phi_{VD2(-1)}) \leqq 8348@0\cdot\frac{K}{100}\ (1/5\ \text{RAD/SEC})$$

$$-6261@0\,\frac{K}{100} \leqq (\psi_{VD2} - \psi_{VD2(-1)}) \leqq 6261@0\cdot\frac{K}{100}\ (1/10\text{RAD/SEC})$$

$$-1310@0\,\frac{K}{100} \leqq (X_{VD2} - X_{VD2(-1)}) \leqq 1310@0\cdot\frac{K}{100}\ (60\text{m/SEC})$$

$$-5242@0\,\frac{K}{100} \leqq (Y_{VD2} - Y_{VD2(-1)}) \leqq 5242@0\cdot\frac{K}{100}\ (10\text{m/SEC})$$

$$-2621@0\,\frac{K}{100} \leqq (Z_{VD2} - Z_{VD2(-1)}) \leqq 2621@0\cdot\frac{K}{100}\ (10\text{m/SEC})$$

ITERATION RATE:

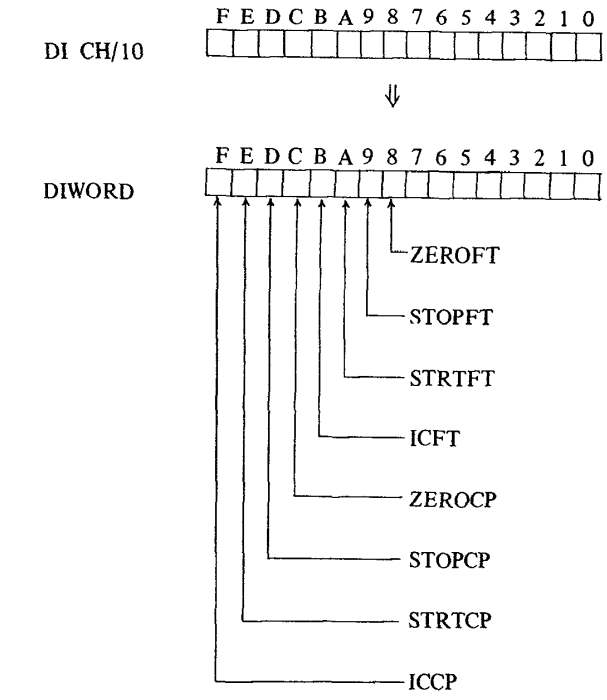
EQUATION NO: A020

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
DI	ICCP	COCKPIT DESK INITIAL	ICCP
CH./10F		CONDITION ON	ON=1
DI	STRTCP	COCKPIT DESK START ON	STRTCP
CH./10E			ON=1
DI	STOPCP	COCKPIT DESK STOP ON	STOPCP
CH./10D			ON=1
DI	ZEROCP	COCKPIT DESK ZERO	ZEROCP
CH./10C			ON=1
DI	ICFT	FLIGHT TABLE INITIAL	ICFT
CH./10B		CONDITION ON	ON=1
DI	STRTFT	FLIGHT TABLE STARTON	STRTFT
CH./10A			ON=1
DI	STOPFT	FLIGHT TABLE STOP ON	STOPFT
CH./109			ON=1
DI	ZEROFT	FLIGHT TABLE ZERO	ZEROFT
CH./108			ON=1
	DIWORD	DISCRETE INPUT WORD	
DI.CH./10			

ITERATION RATE: 2.38/SEC

TITLE: SYSTEM INPUT

EQUATION:



[RESET] = [ICCP] + [ICFT]

[START] = [STRTCP] + [STRTFT]

[FREEZ] = [STOPCP] + [STOPFT]

PROGRAM NO. A030

PAGE NO. 1 OF 3

RESET	SIMULATION RESET	RESET	DM
RESET = 1			
START	SIMULATION START	START	DM
START = 1			
FREEZ	SIMULATION FREEZE	FREEZ	DM
FREEZ = 1			
CSAL	LEFT ENG. CROSS	CSAL	AM
07	SHAFT ANG.		
CSAR	RIGHT ENG. CROSS	CSAR	AM
07	SHAFT ANG.		
δLEL	LEFT L.E. FLAP POS.	DLEL	AM
09			
δLER	RIGHT L.E. FLAP POS.	DLER	AM
09			

EQUATION NO: A030

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AI	DT1	LEFT ENG. THROTTLE	δ_{T1}
CH./8E			00
AI	DT2	RIGHT ENG. THROTTLE	δ_{T2}
CH./8F			00
AI	FLP	FLAP POSITION INPUT	F_{LP}
CH./8D			00
CA	ENGL	LEFT ENG.	ENGL
		CONNECTION NUMBER	00
CA	ENGR	RIGHT ENG.	ENGR
		CONNECTION NUMBER	00
CA	DFWMAX	DELTA FLAP MAXIMUM	δ_{FWMAX}
			09
CA	DLEMAX	LE FLAP MAXIMUM	δ_{LEMAX}
			09

ITERATION RATE:

TITLE

SYSTEM INPUT

EQUATION:

$$CSA_{L1}@7 = 74@7 \cdot \frac{\delta_{T1}@0}{32767@0} + 56@7$$

$$CSA_{R1}@7 = 74@7 \cdot \frac{\delta_{T2}@0}{32767@0} + 56@7$$

$$CSA_L = CSA_{L1}$$

$$CSA_R = CSA_{R1}$$

$$\begin{cases} CSA_1 = CSA_L\,[ENGL = 1] + CSA_R\,[ENGR = 1] \\ \quad + CSA_{1(n-1)}\,[ENGL \neq 1]\,[ENGR \neq 1] \\ CSA_2 = CSA_L\,[ENGL = 2] + CSA_R\,[ENGR = 2] \\ \quad + CSA_{2(n-1)}\,[ENGL \neq 2]\,[ENGR \neq 2] \\ CSA_3 = CSA_L\,[ENGL = 3] + CSA_R\,[ENGR = 3] \\ \quad + CSA_{3(n-1)}\,[ENGL \neq 3]\,[ENGR \neq 3] \\ CSA_4 = CSA_L\,[ENGL = 4] + CSA_R\,[ENGR = 4] \\ \quad + CSA_{4(n-1)}\,[ENGL \neq 4]\,[ENGR \neq 4] \\ CSA_5 = CSA_L[ENGL = 5] + CSA_R[ENGR = 5] \\ \quad + CSA_{5(n-1)}\,[ENGL \neq 5]\,[ENGR \neq 5] \\ CSA_6 = CSA_L\,[ENGL = 6] + CSAR\,[ENGR = 6] \\ \quad + CSA_{6(n-1)}\,[ENGL \neq 6]\,[ENGR \neq 6] \end{cases}$$

$$\delta_{FWIR}@9 = \delta_{FWIL}@9 = \delta_{FWOR}@9 = \delta_{FWOL}@9 = \delta_{FWMAX}@9 \cdot \frac{FLP@0}{32767@0}$$

$$\delta_{LEL}@9 = \delta_{LEL(n-1)} + \left\{ \frac{1}{X_C} \left(\delta_{LEMAX}\,[FLP > 0] + \overline{0\,[FLP > 0]} \right) - \delta_{LEL(n-1)} \right\}$$

$$\delta_{LER}@9 = \delta_{LER(n-1)} + \left\{ \frac{1}{X_C} \left(\delta_{LEMAX}\,[FLP > 0] + \overline{0\,[FLP > 0]} \right) - \delta_{LER(n-1)} \right\}$$

（X_Cは調整項で2～16である。）

PROGRAM NO.	A030
PAGE NO.	2 OF 3

CSA_1	ENG 1 CROSS SHAFT	CSA1	AM
07	ANGLE		
CSA_2	ENG 2 CROSS SHAFT	CSA2	AM
07	ANGLE		
CSA_3	ENG 3 CROSS SHAFT	CSA3	AM
07	ANGLE		
CSA_4	ENG 4 CROSS SHAFT	CSA4	AM
07	ANGLE		
CSA_5	ENG 5 CROSS SHAFT	CSA5	AM
07	ANGLE		
CSA_6	ENG 6 CROSS SHAFT	CSA6	AM
07	ANGLE		
δ_{FWIR}	RT INBD. T. E. FLAP	DFWIR	AM
09	POSITION		
δ_{FWIL}	LT INBD. T. E. FLAP	DFWIL	AM
09	POSITION		
δ_{FWOR}	RT OTBD. T. E. FLAP	DFWOR	AM
09	POSITION		
δ_{FWOL}	LT. OTBD. T. E. FLAP	DFWOL	AM
09	POSITION		

EQUATION NO:

A030

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE

SYSTEM INPUT

PROGRAM NO. A030

PAGE NO. 3 OF 3

AI	SFRLAI	STABILIZER DEFLECTION	S_{FRLAI}
CH./8A		ANALOGUE INPUT	00
AI	DTTAAI	AILERON TAB	δ_{ttaAI}
CH./89		ANALOGUE INPUT	00
AI	DTTRAI	RUDDER TAB	δ_{ttrAI}
CH./8B		ANALOGUE INPUT	00

ITERATION RATE:

EQUATION:

STABILIZER

$$S_{FRL1}@11 = 0.5@11 \frac{S_{FRLAI}@0}{6553@0} [S_{FRLAI} \geqq 0] + 14.0@11 \times \frac{S_{FRLAI}@0}{6553@0} [S_{FRLAI} < 0]$$

$$S_{FRL} = S_{FRL(n-1)} + (S_{FRL1} - S_{FRL1(n-1)})$$

AILERON CONTROL TAB

$$\delta tta_1@09 = 20@09 \frac{\delta ttaAI@0}{6553@0}$$

$$\delta tta = \delta tta_{(n-1)} + (\delta tta_1 - \delta tta_{1(n-1)})$$

RUDDER CONTROL TAB

$$\delta ttr_1@09 = -20@09 \cdot \frac{\delta ttrAI@0}{6553@0}$$

$$\delta ttr = \delta ttr_{(n-1)} + (\delta ttr_1 - \delta ttr_{1(n-1)})$$

S_{FRL}	STABILIZER DEFLECTION	SFRL	AM
11			
δ_{tta}	AILERON TAB	DTTA	AM
09	DEFLECTION		
δ_{ttr}	RUDDER TAB	DTTR	AM
09	DEFLECTION		

EQUATION NO:

A030

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE

TITLE: INITIAL CONDITION SET

PROGRAM NO. A040

PAGE NO. 1 OF 3

AM PAD	ROLL ANGULAR	$\dot{p}_A$
F010	ACCELERATION	13
AM QAD	PITCH ANGULAR	$\dot{q}_A$
F010	ACCELERATION	13
AM RAD	YAW ANGULAR	$\dot{r}_A$
F010	ACCELERATION	13
AM PA	ROLL ANGULE	p_A
F010	VELOCITY	13
AM QA	PITCH "	q_A
F010		13
AM RA	YAW "	r_A
F010		13
AM E1	NO 1 QUATERNION	E1
F020		14
AM E2	NO 2 QUATERNION	E2
F020		14
AM E3	NO 3 QUATERNION	E3
F020		14
AM E4	NO 4 QUATERNION	E4
F020		14
AM UET	LONG. VEL. ERTH	UET
F030	AXIS	02

ITERATION RATE: 12.5/SEC

EQUATION:

[RESET = 0] SKIP THIS PROGRAM

IF [READY = 1] [RESET = 1]

IPAD	=	$\dot{p}_A$
IQAD	=	$\dot{q}_A$
IRAD	=	$\dot{r}_A$
IPA	=	p_A
IQA	=	q_A
IRA	=	r_A
IE1	=	E1
IE2	=	E2
IE3	=	E3
IE4	=	E4
IUE	=	UET
IVE	=	VET
IWE	=	WET
IX	=	X
IY	=	Y
IZ	=	Z
IHPD	=	$\dot{h}p$
IHP	=	hp
READY	=	0

IPAD 13	IPAD AM
IQAD 13	IQAD AM
IRAD 13	IRAD AM
IPA 13	IPA AM
IQA 13	IQA AM
IRA 13	IRA AM
IE1 14	IE1 AM
IE2 14	IE2 AM
IE3 14	IE3 AM
IE4 14	IE4 AM

EQUATION NO:

CORE TYPE	CORE LOCATION		SYMBOL
INPUT SOURCE			SCALE
AM	VET	LAT. VEL ERTH AXIS	VET
F030			02
AM	WET	VERT. VEL ERTH AXIS	WET
F030			02
AM	X	LONG POSITION ERTH	X
F030		AXIS	02
AM	Y	LAT. 〃	Y
F030			02
AM	Z	VERT. 〃	Z
F030			02
AM	HPD	RATE OF CHANGE OF	$\dot{h}_p$
F040		ALT.	02
AM	HP	PRESS ALT.	h_p
F040			−02
AM	HO	PRESS DOUBLE	ho
F040			14
AM	:PA	PA DOUBLE	:PA
F010			18
AM	:QA	QA DOUBLE	:QA
F010			18
AM	:RA	RA DOUBLE	:RA
F010			18

ITERATION RATE:

TITLE: INITIAL CONDITION SET

EQUATION:

[RESET = 0] SKIP THIS PROGRAM

IF [READY = 0] [RESET = 1]

$\dot{p}_A$	=	IPAD	:PA	=	IPA
$\dot{q}_A$	=	IQAD	:QA	=	IQA
$\dot{r}_A$	=	IRAD	:RA	=	IRA
p_A	=	IPA	:E1	=	IE1
q_A	=	IQA	:E2	=	IE2
r_A	=	IRA	:E3	=	IE3
E1	=	IE1	:E4	=	IE4
E2	=	IE2	:UET	=	IUE
E3	=	IE3	:VET	=	IVE
E4	=	IE4	:WET	=	IWE
UET	=	IUE	:X	=	IX
VET	=	IVE	:Y	=	IY
WET	=	IWE	:Z	=	IZ
X	=	IX	ho	=	IHP
Y	=	IY			
Z	=	IZ			
$\dot{h}_p$	=	IHPD			
h_p	=	IHP			

PROGRAM NO. A040

PAGE NO. 2 OF 3

IUE		IUE	AM
02			
IVE		IVE	AM
02			
IWE		IWE	AM
02			
IX		IX	AM
02			
IY		IY	AM
02			
IZ		IZ	AM
02			
READY		READY	DM

EQUATION NO: A040

CORE TYPE	CORE LOCATION	INPUT SOURCE	SYMBOL	SCALE
AM	:E1	E1 DOUBLE	:E1	
	F020		30	
AM	:E2	E2 DOUBLE	:E2	
	F020		30	
AM	:E3	E3 DOUBLE	:E3	
	F020		30	
AM	:E4	E4 DOUBLE	:E4	
	F020		30	
AM	:UET	UET DOUBLE	:UET	
	F030		18	
AM	:VET	VET DOUBLE	:VET	
	F030		18	
AM	:WET	WET DOUBLE	:WET	
	F030		18	
AM	:X	X DOUBLE	:X	
	F030		18	
AM	:Y	Y DOUBLE	:Y	
	F030		18	
AM	:Z	Z DOUBLE	:Z	
	F030		18	

ITERATION RATE:

TITLE: INITIAL CONDITION SET

EQUATION:

PROGRAM NO. A040

PAGE NO. 3 OF 3

EQUATION NO: A040

CORE TYPE	CORE LOCATION	SYMBOL
INPUT SOURCE		SCALE

TITLE: PENRECORDER OUT

PROGRAM NO.: PENREC

PAGE NO. 1 OF 2

UA		Ua
ALPHA		α
THETA		θ
QA		qa
DE		δe
DS		δs
HP		hp
HPD		$\dot{hp}$
PA		pa
RA		ra
PAI		ϕ

ITERATION RATE: 12.5/SEC

EQUATION:

REC1 : 0 = 4Ua
REC1 : 1 = 4α
REC1 : 2 = 4θ
REC1 : 3 = 4qa
REC1 : 4 = 4δe
REC1 : 5 = 4δs
REC1 : 6 = 4hp
REC1 : 7 = 4$\dot{hp}$
REC2 : 0 = 4pa
REC2 : 1 = 4ra
REC2 : 2 = 4ϕ
REC2 : 3 = 4β
REC2 : 4 = 4ψ
REC2 : 5 = 4δr
REC2 : 6 = 4δ_{AI}
REC2 : 7 = 4δ_{AO}

REC1:0		REC1:0 AO CH./E0
REC1:1		REC1:1 AO CH./E1
REC1:2		REC1:2 AO CH./E2
REC1:3		REC1:3 AO CH./E3
REC1:4		REC1:4 AO CH./E4
REC1:5		REC1:5 AO CH./E5
REC1:6		REC1:6 AO CH./E6
REC1:7		REC1:7 AO CH./E7
REC2:0		REC2:0 AO CH./E8
REC2:1		REC2:1 AO CH./E9

EQUATION NO.: PENREC

CORE TYPE / CORE LOCATION	INPUT SOURCE	SYMBOL	SCALE
BETA		β	
PSI		ψ	
DR		δ_r	
DAI		δ_{AI}	
DAO		δ_{AO}	

ITERATION RATE:

TITLE

PENRECORDER OUT

EQUATION:

PROGRAM NO.	PENREC
PAGE NO.	2 OF 2

REC2:2	REC2:2 AO	CH./EA
REC2:3	REC2:3 AO	CH./EB
REC2:4	REC2:4 AO	CH./EC
REC2:5	REC2:5 AO	CH./ED
REC2:6	REC2:6 AO	CH./EE
REC2:7	REC2:7 AO	CH./EF

EQUATION NO:

PENREC

付　録　2

FSPPのLEPパラメータ

```
//EXEC LEP
//CTRL *
MD,1,
WS,1,
ET,
JS,FSPP,FSPP:LB,CACDMODL,
CS,1,84,42,21,8
CS,2,2,2,2,1
TS,F000:,1,37,1
TS,F010:,1,36,1
TS,F020:,1,35,1
TS,F030:,1,34,1
TS,F040:,1,33,1
TS,F050:,1,32,1
TS,F055:,1,0F,0
TS,F056:,1,0E,1
TS,F060:,1,1F,1
TS,F100:,1,3D,1
TS,F101:,1,3C,1
TS,F102:,1,3B,1
TS,F103:,1,3A,1
TS,F104:,1,39,1
TS,F105:,1,38,1
TS,F106:,1,1E,1
TS,F110:,1,1D,1
TS,F130:,2,3E,1
TS,F132:,2,3D,1
TS,F134:,2,3C,1
TS,F150:,1,3F,1
TS,F300:,1,0D,1
TS,F320:,1,2F,1
TS,F340:,1,0C,1
TS,F400:,1,29,1
TS,E003:,1,2E,1
TS,E100:,1,2D,1
TS,E103:,1,2C,1
TS,E104:,1,2B,1
TS,E111:,1,1C,1
TS,E120:,1,1B,1
TS,E121:,1,2A,1
TS,E130:,1,19,1
TS,E140:,1,0B,1
TS,E144:,1,0A,1
TS,E160:,1,28,1
TS,E170:,1,09,1
TS,AC00:,2,3F,1
TS,AC10:,1,27,1
TS,AC20:,2,3B,1
TS,AC30:,1,1A,1
TS,AC40:,1,3F,1
TS,PENREC:,1,31,1
        LS,   DIWORD,DI,10F
        LS,   DWAI,  AI,80
        LS,   DSAI,  AI,81
        LS,   DPAI,  AI,82
        LS,   FWCAI, AI,86
        LS,   FSCAI, AI,87
        LS,   FPCAI, AI,88
        LS,   DTTAAI,AI,89
        LS,   SFRLAI,AI,8A
        LS,   DTTRAI,AI,8B
        LS,   FLP,   AI,8D
        LS,   DT1,   AI,8E
        LS,   DT2,   AI,8F
        LS,   PAIM,  AO,80
        LS,   THETM, AO,81
        LS,   VIAO,  AO,83
        LS,   HPAO,  AO,85
        LS,   PAIAO, AO,86
        LS,   THAO,  AO,87
        LS,   PSIAO, AO,88
        LS,   RBAO,  AO,89
        LS,   RAAO,  AO,8A
        LS,   RCAO,  AO,8B
        LS,   FWAO,  AO,8F
        LS,   FSAO,  AO,90
        LS,   FPAO,  AO,91
        LS,   PAIVD1,AO,92
        LS,   THEVD1,AO,93
        LS,   PSIVD1,AO,94
        LS,   PAIVD2,AO,95
        LS,   THEVD2,AO,96
        LS,   PSIVD2,AO,97
        LS,   XVD2,  AO,98
        LS,   YVD2,  AO,99
        LS,   ZVD2,  AO,9A
        LS,EPRAO,AO,F0
        LS,EPLAO,AO,F1
        LS,N2RAO,AO,F2
        LS,N2LAO,AO,F3
        LS,EGRAO,AO,F4
        LS,EGLAO,AO,F5
        LS,WF2,AO,F6
        LS,WF3,AO,F7
        LS,PN12,AO,F8
        LS,PN13,AO,F9
        LS,REC1:0,AO,E0
        LS,REC1:1,AO,E1
        LS,REC1:2,AO,E2
        LS,REC1:3,AO,E3
        LS,REC1:4,AO,E4
        LS,REC1:5,AO,E5
        LS,REC1:6,AO,E6
        LS,REC1:7,AO,E7
        LS,REC2:0,AO,E8
        LS,REC2:1,AO,E9
        LS,REC2:2,AO,EA
        LS,REC2:3,AO,EB
        LS,REC2:4,AO,EC
        LS,REC2:5,AO,ED
        LS,REC2:6,AO,EE
        LS,REC2:7,AO,EF
LS,GRSW,DI,C0
        ES
PN,
PR,
RD,FSPP,
LD,
EX,
```

付　録　3

FSPPのシンボル・テーブル

PAGE 1 FSPP LINKAGE LISTING 75-12-16

ITERATION COUNT AND MEMORY MAP

COMPUTER NO.	0	1	2	3	4	5	6	7
IT.LEVEL 3		8	1					
IT.LEVEL 2		21	2					
IT.LEVEL 1		42	2					
IT.LEVEL 0		84	2					

LKDI	1000		
LKAI	1013		
INT:0			
1	10C3		
2	10D4		
3			
4			
5			
6			
7			
LKDO	10E0		
LKAO		10E0	10E0
SELF		1102	10EE
TASK		12E2	1115
LIBR		36A9	1656
LMAX		5B18	1C0B

LINKAGE CHANNEL RANGE

DI	00C0	010F
AI	0080	008F
DO		
AO	0080	00F9

USED LIBRARY NAME

FSPP:LB
CACDMODL

PAGE 2 FSPP LINKAGE LISTING

*** COMPUTER NO.1 SYMBOL DEFINITION LIST ***

F000:	12E2.M	F000	12E4.M	FXA	1102.K	FYA	1104.K
FZA	1106.K	MXA	1108.K	MYA	110A.K	MZA	110C.K
B	59EE.L	C	59EF.L	C1	110E.K	CD	110F.K
CL	1110.K	CM	1111.K	CN	1112.K	COSA	1113.K
CY	1114.K	DADD	59E5.L	DIVIDE	59D1.L	FXG	1115.K
FXJ	1116.K	FYG	1117.K	FYJ	1118.K	FZG	1119.K
FZJ	111A.K	LXCG	111B.K	LYCG	111C.K	MXG	111D.K
MXJ	111E.K	MYG	111F.K	MYJ	1120.K	MZG	1121.K
MZJ	1122.K	Q	10C3.G	S	59ED.L	SINA	1123.K
F010:	1402.M	F010	1404.M	AXA	1124.K	AYA	1125.K
AZA	1126.K	PAD	1127.K	QAD	1128.K	RAD	1129.K
PA	112A.K	QA	112B.K	RA	112C.K	:PA	14F8.M
:QA	1501.M	:RA	1507.M	FREEZ	112D.K	INITIAL	112E.K
IXX	112F.K	IXZ	1130.K	IYY	1131.K	IZZ	1132.K
K	01D8.P	MAXA	1133.K	MAYA	1134.K	MAZA	1135.K
PAMD	1136.K	QAMD	1137.K	RAMD	1138.K	RESET	1139.K
SINPI	113A.K	URT	59F3.L	VRT	59F4.L	WG	113B.K
WRT	59F5.L	F020:	150C.M	F020	150E.M	E1D	113C.K
E2D	113D.K	E3D	113E.K	E4D	113F.K	F1	1140.K
E2	1141.K	E3	1142.K	E4	1143.K	L1	1144.K
L2	1145.K	L3	1146.K	M1	1147.K	M2	1148.K
M3	1149.K	N1	114A.K	N2	114B.K	N3	114C.K
CE	114D.K	SINTH	114E.K	COSTH	114F.K	COSPI	1150.K
SINPS	1151.K	COSPS	1152.K	THETA	10C4.G	PAI	10C5.G
PSI	10C6.G	:E1	1591.M	:E2	1596.M	:E3	159B.M
:E4	15A0.M	SQRT	59A9.L	YATN	5954.L	F030:	16FB.M
F030	16FD.M	UED	1153.K	VED	1154.K	WED	1155.K
UET	1156.K	VET	1157.K	WET	1158.K	UEP	1159.K
VEP	115A.K	WEP	115B.K	UA	115C.K	VA	115D.K
WA	115F.K	VPL	1160.K	VP1	1161.K	X	10C7.G
Y	10C8.G	Z	10C9.G	:UET	1788.M	:VET	178F.M
:WET	1793.M	:X	1802.M	:Y	1806.M	:Z	180A.M
UW	59F0.L	VW	59F1.L	WW	59F2.L	F040:	1832.M
F040	1834.M	HFP	1162.K	HPD	1163.K	HQ	1164.K
HPDB	1166.K	HPS	1168.K	HSL	1169.K	HP	116A.K
UAD	116B.K	VAD	116C.K	WAD	116D.K	ALPHD	116E.K
BETAD	116F.K	ALPHA	1170.K	BETA	10CA.G	PS	1171.K
QS	1172.K	RS	1173.K	SINB	1174.K	HFG	59F6.L
HG	1175.K	LR	1176.K	TK	1177.K	TSL	1178.K
VP	1179.K	WOW	10CB.G	F050:	1992.M	F050	1994.M

PAGE 3 FSPP LINKAGE LISTING

*** COMPUTER NO.1 SYMBOL DEFINITION LIST ***

UG	117A.K	VG	117B.K	VM	117C.K	VN	117D.K
UNT	117E.K	VNT	117F.K	DSN	1180.K	DSR	1181.K
DSL	1182.K	TNT	1183.K	TL	1184.K	TR	1185.K
SM	1186.K	FZLM	1187.K	FZRM	1188.K	FZN	1189.K
FYLM	118A.K	FYRM	118B.K	FYNT	118C.K	FYN	118D.K
FXLM	118E.K	FXRM	118F.K	FXNT	1190.K	FXN	1191.K
WOWL	1192.K	WOWR	1193.K	UGDS	1194.K	VGDS	1195.K
ADFG	56F4.L	COSRN	1196.K	F1G	3A41.L	FBL	1197.K
FBR	1198.K	K1	5A05.L	K2	5A06.L	K3	5A07.L
K4	5A08.L	K5	5A09.L	KD	59FA.L	KM1	5A00.L
KM2	5A01.L	KM3	5A02.L	KN1	59FE.L	KN2	59FF.L
LGY	5A03.L	LLG	59F9.L	LLGM	59FC.L	LLGN	59FD.L
LMG	59F7.L	LNG	59F8.L	SINRN	1199.K	SMMAX	5A04.L
SNMAX	59FB.L	F055:	1C0C.M	F055	1C0E.M	RNHD	119A.K
RNCD	119B.K	RNPOS	119C.K	RMDN	119D.K	DL	5A0C.L
HD	5A0B.L	KZN	5A0E.L	PHYD	5A0A.L	PRAMD	5A0D.L
F056:	1CCF.M	F056	1CD1.M	XL	119E.K	XR	119F.K
SL	11A0.K	SR	11A1.K	LLD	11A2.K	LRD	11A3.K
DBL	5A0F.L	DBR	5A10.L	KB	5A11.L	KL1	5A12.L
KL2	5A13.L	F060:	1D68.M	F060	1D6A.M	FNX1	11A4.K
FNX2	11A5.K	FNX3	11A6.K	FNX4	11A7.K	FNX5	11A8.K
FNX6	11A9.K	FNY1	11AA.K	FNY2	11AB.K	FNY3	11AC.K
FNY4	11AD.K	FNY5	11AE.K	FNY6	11AF.K	FNZ1	11B0.K
FNZ2	11B1.K	FNZ3	11B2.K	FNZ4	11B3.K	FNZ5	11B4.K
FNZ6	11B5.K	AL1	11B6.K	AL2	11B7.K	AL3	11B8.K
AL4	11B9.K	AL5	11BA.K	AL6	11BB.K	LX1	11BC.K
LX2	11BD.K	LX3	11BE.K	LX4	11BF.K	LX5	11C0.K
LX6	11C1.K	LY1	11C2.K	LY2	11C3.K	LY3	11C4.K
LY4	11C5.K	LY5	11C6.K	LY6	11C7.K	LZ1	11C8.K
LZ2	11C9.K	LZ3	11CA.K	LZ4	11CB.K	LZ5	11CC.K
LZ6	11CD.K	COSAJ1	5A14.L	COSAJ2	5A15.L	COSAJ3	5A16.L
COSAJ4	5A17.L	COSAJ5	5A18.L	COSAJ6	5A19.L	COSBJ1	5A1A.L
COSBJ2	5A1B.L	COSBJ3	5A1C.L	COSBJ4	5A1D.L	COSBJ5	5A1E.L
COSBJ6	5A1F.L	ENGN	5A2C.L	FN1	11CE.K	FN2	11CF.K
FN3	11D0.K	FN4	11D1.K	FN5	11D2.K	FN6	11D3.K
I11	5A42.L	I12	5A43.L	I13	5A44.L	I14	5A45.L
I15	5A46.L	I16	5A47.L	I21	5A48.L	I22	5A49.L
I23	5A4A.L	I24	5A4B.L	I25	5A4C.L	I26	5A4D.L
KX	5A3F.L	KY	5A40.L	KZ	5A41.L	LXJ1	5A2D.L
LXJ2	5A2E.L	LXJ3	5A2F.L	LXJ4	5A30.L	LXJ5	5A31.L

PAGE FSPP LINKAGE LISTING

*** COMPUTER NO.1 SYMBOL DEFINITION LIST ***

LXJ6	5A32.L	LYJ1	5A33.L	LYJ2	5A34.L	LYJ3	5A35.L
LYJ4	5A36.L	LYJ5	5A37.L	LYJ6	5A38.L	LZJ1	5A39.L
LZJ2	5A3A.L	LZJ3	5A3B.L	LZJ4	5A3C.L	LZJ5	5A3D.L
LZJ6	5A3E.L	N11P	5AF9.L	N21	11D4.K	N22	11D5.K
N23	11D6.K	N24	11D7.K	N25	11D8.K	N26	11D9.K
PN11	11DA.K	PN12	10E0.D	PN13	10E1.D	PN14	11DB.K
PN15	11DC.K	PN16	11DD.K	SINAJ1	5A20.L	SINAJ2	5A21.L
SINAJ3	5A22.L	SINAJ4	5A23.L	SINAJ5	5A24.L	SINAJ6	5A25.L
SINBJ1	5A26.L	SINBJ2	5A27.L	SINBJ3	5A28.L	SINBJ4	5A29.L
SINBJ5	5A2A.L	SINBJ6	5A2B.L	F100:	2054.M	F100	2056.M
CLBA	11DE.K	DCLA	11DF.K	DCLDE	11E0.K	DCLDET	11E1.K
KALPH	11E2.K	CLKAT	11E3.K	CL1	11E5.K	DCLQS	11E6.K
DCLAD	11E7.K	DCLAZA	11E8.K	DCLSP	11E9.K	CLA	11EA.K
CLAD	11EB.K	CLAZA	11EC.K	CLBDF	11ED.K	CLBSC	11EE.K
CLDE	11EF.K	CLQS	11F0.K	D1CL	11F1.K	D2CL	11F2.K
DCLBAF	11F3.K	DCLGE	11F4.K	DCLLE	11F5.K	DCLLG	11F6.K
DCLSF	11F7.K	DCLSKA	11F8.K	DE	10D4.J	DET	10D5.J
F5210	3800.L	F5230	3808.L	F5240	380C.L	F5250	3810.L
F6421	38B3.L	F6422	38B7.L	F6441	38BB.L	F6442	38BF.L
F6451	38C3.L	F6452	38C7.L	F6453	38CB.L	F6454	38CF.L
F6471	38D3.L	F6472	38D8.L	F6531	38DD.L	F6532	38E2.L
F101:	2158.M	F101	215A.M	DCDB	11F9.K	DCDSP	11FA.K
DCDA	11FB.K	CDBSC	11FC.K	DCDGE	11FD.K	DCDLG	11FE.K
DCDM	11FF.K	DCDWM	1200.K	F3660	36EC.L	F6250	3880.L
F6751	3911.L	F6752	3914.L	F6753	3917.L	F6754	391A.L
F7001	391D.L	F7002	3921.L	F7003	3925.L	F7004	3929.L
F7160	3943.L	M	10CC.G	F102:	2189.M	F102	218B.M
CMBA	1201.K	DCMA	1202.K	CMBAF	1203.K	KDE	1204.K
DCMDE	1205.K	DCMDET	1206.K	DCMSFL	1207.K	DCMKA	1208.K
DCMAZA	1209.K	DCMQA	120A.K	DCMQAD	120B.K	DCMAD	120C.K
DCMSP	120D.K	CMA	120E.K	CMAD	120F.K	CMBSA	1210.K
CMQA	1211.K	CMQAD	1212.K	D1CM	1214.K	D2CM	1215.K
DCMGE	1216.K	DCMLG	1217.K	DCMSF	1218.K	DFWIN	10CD.G
DFWON	1219.K	F3620	36DD.L	F3760	370B.L	F4010	3716.L
F4021	371A.L	F4022	371E.L	F4041	3722.L	F4042	3726.L
F4061	372A.L	F4062	372F.L	F4101	3734.L	F4102	3739.L
F4120	373E.L	F6220	3874.L	F6230	3878.L	F6240	387C.L
F7741	3A31.L	F7742	3A35.L	F7743	3A39.L	F7744	3A3D.L
KCM4	5A51.L	KCM5	5A52.L	KCM6	5A53.L	SFRL	121A.K
F103:	2337.M	F103	2339.M	DCYB	121B.K	DCYSP	121C.K

PAGE 5 FSPP LINKAGE LISTING

*** COMPUTER NO.1 SYMBOL DEFINITION LIST ***

DCYRS	121D.K	DCYPS	121E.K	DCYDR	121F.K	CYR	1220.K
CYP	1221.K	CYR	1222.K	DR	10DE.J	DSPL	1223.K
DSPR	1224.K	DTTR	10CE.G	F4340	377C.L	F4470	379D.L
F4660	37CD.L	KCY1	5A54.L	KCY2	5A55.L	KCY3	5A56.L
F104:	23BD.M	F104	23BF.M	DC1B	1225.K	DC1PS	1226.K
DC1DR	1227.K	FLGE	1228.K	DC1DSP	1229.K	DC1DA	122A.K
DC1RS	122B.K	C1B	122C.K	C1DR	122D.K	C1P	122E.K
C1R	122F.K	DAI	10D7.J	DAO	10D8.J	DC1LE	1230.K
DC1LG	1231.K	DC1SF	1232.K	DFWN	10CF.G	F4200	3755.L
F4210	3759.L	F4220	375D.L	F4230	3760.L	F4240	3764.L
F4250	3768.L	F4551	37B2.L	F4552	37B6.L	F4553	37BA.L
F4554	37BE.L	F5000	37DE.L	F5131	37E8.L	F5132	37ED.L
F5133	37F2.L	F5134	37F7.L	F6310	3890.L	KC11	5A57.L
KC12	5A58.L	KC13	5A59.L	KC14	5A68.L	F105:	24C8.M
F105	24CA.M	DCNB	1233.K	DCNRS	1234.K	DCNPS	1235.K
DCNDR	1236.K	DCNSP	1237.K	CNB	1238.K	CNP	1239.K
CNR	123A.K	DCNLG	123B.K	F4430	378D.L	F4440	3791.L
F4640	37C6.L	F4700	37D4.L	KCN1	5A5A.L	KCN3	5A5C.L
KRS	123C.K	F106:	254A.M	F106	254C.M	FLAGE	123D.K
FNGE	123E.K	DLG	123F.K	F3400	36B5.L	F3410	36B9.L
F3420	36BD.L	F3440	36C1.L	F3450	36C4.L	F3460	36C8.L
F3600	36D5.L	F3610	36D9.L	F3630	36E1.L	F3720	36FC.L
F3730	3700.L	F3740	3704.L	F4130	3742.L	F4140	3746.L
F4150	374A.L	F4260	376C.L	F4270	3771.L	F4310	3775.L
F4320	3779.L	F4350	37B0.L	F4360	3783.L	F4370	3786.L
F4400	3789.L	F4450	3794.L	F4460	3799.L	F4500	37A0.L
F4510	37A4.L	F4520	37A8.L	F4530	37AB.L	F4540	37AF.L
F4650	37C9.L	F4670	37D0.L	F5030	37E1.L	F5200	37FC.L
F5220	3804.L	F6270	3888.L	F6300	388C.L	F6320	3894.L
F6330	3898.L	F6340	389B.L	F6370	38A7.L	F6410	38AF.L
F7640	3A0D.L	KCL1	5A4E.L	KCL3	5A60.L	KCM1	5A4F.L
KCM3	5A50.L	KCN2	5A5B.L	KCN4	5A5D.L	NDLGL	1240.K
NDLGR	1241.K	F110:	2741.M	F110	2743.M	CLBUFF	1242.K
CLSTAL	1243.K	DFWIL	1244.K	DFWIM	5A90.L	DFWIR	1245.K
DFWM	5A5E.L	DFWOL	1246.K	DFWOM	5A6D.L	DFWOR	1247.K
DLE	1248.K	DLEL	1249.K	DLEM	5A91.L	DLER	124A.K
F3000	36B2.L	F3540	36CC.L	F3560	36CF.L	F3640	36E5.L
F3650	36E9.L	F3750	3707.L	F3770	3710.L	F4000	3713.L
F4630	37C2.L	F4720	37DA.L	F6260	3884.L	F6350	389F.L
F6360	38A3.L	F6400	38AB.L	KC15	5A69.L	KC16	5A6A.L

PAGE 6 FSPP LINKAGE LISTING

*** COMPUTER NO.1 SYMBOL DEFINITION LIST ***

KC17	5A6B.L	KC18	5A6C.L	KCL2	5A5F.L	KCL4	5A61.L
KCL5	5A62.L	KCL6	5A63.L	KCM7	5A65.L	KCM8	5A66.L
KCM9	5A67.L	KWM	5A64.L	VE	10D0.G	F150:	2868.M
F150	286A.M	DFW1	1248.K	DFWO	10D1.G	DFW	10D2.G
DFW1	124C.K	DSP	124D.K	NDLGN	124E.K	DLGL	5A9F.L
DLGN	5A9D.L	DLGR	5A9E.L	DSPIL	10D9.J	DSPIR	10DB.J
DSPOL	10DA.J	DSPOR	10DC.J	KFW1	5A92.L	KFW2	5A93.L
KFW3	5A94.L	KFW4	5A95.L	KFW5	5A96.L	KLG1	5A99.L
KLG2	5A9A.L	KLG3	5A9B.L	KLG4	5A9C.L	KSP3	5A97.L
TEST	5A98.L	F300:	2936.M	F300	2938.M	DVI	124F.K
DRC	1250.K	DHP	1251.K	DALPH	1252.K	DBETA	1253.K
DPHI	1254.K	DTHE	1255.K	EIAS	1256.K	STHCD	1257.K
STHC	1258.K	DALST	5AAC.L	DBSET	5AAF.L	DHPST	5AA9.L
DPSET	5AB2.L	DRCST	5AA6.L	DTHST	5AB5.L	DVIST	5AA3.L
HAI	5AA0.L	HALPH	5AAA.L	HBETA	5AAD.L	HHP	5AA8.L
HPAI	5AB0.L	HRC	5AA5.L	HTHE	5AB3.L	HTHVI	5AA1.L
SALPH	5AAB.L	SBETA	5AAE.L	SHP	5AA7.L	SPAI	5AB1.L
SRC	5AA4.L	STHE	5AB4.L	SVI	5AA2.L	VI	1259.K
F320:	2A78.M	F320	2A7A.M	DAMB	125A.K	HBARO	125B.K
TOA	125C.K	TF	125D.K	PAMB1	125E.K	PAMB	125F.K
ENVSET	5AB9.L	F2600	36A9.L	F2610	36AC.L	F2620	36AF.L
HGSET	5AB7.L	LSET	5AB6.L	MSET	5ABA.L	TRSET	5AB8.L
VISET	5ABB.L	F340:	2BA5.M	F340	2BA7.M	WTTOT	1260.K
PCG	1261.K	CGSET	5AFB.L	ISET	5AEC.L	IXBDY	5AC9.L
IXXS	5ACC.L	IXZS	5ACF.L	IYBDY	5ACA.L	IYYS	5ACD.L
IZBDY	5ACB.L	IZZS	5ACE.L	KIX1	5ADA.L	KIX2	5ADB.L
KIX3	5ADC.L	KIX4	5ADD.L	KIX5	5ADE.L	KIXZ1	5AE9.L
KIXZ2	5AEA.L	KIY1	5ADF.L	KIY2	5AE0.L	KIY3	5AE1.L
KIY4	5AE2.L	KIY5	5AE3.L	KIZ1	5AE4.L	KIZ2	5AE5.L
KIZ3	5AE6.L	KIZ4	5AE7.L	KIZ5	5AE8.L	KLX1	5AD0.L
KLX2	5AD1.L	KLX3	5AD2.L	KLX4	5AD3.L	KLX5	5AD4.L
KLX6	5AD5.L	KLY1	5AD6.L	KLY2	5AD7.L	KLY3	5AD8.L
LCGS	5AFD.L	LXS	5AC7.L	LYS	5AC8.L	PCGS	5AD9.L
WEMP	5AC4.L	WGS	5AC6.L	WGSET	5AFE.L	WP	5AC5.L
WT1	5ABC.L	WT2	5ABD.L	WT3	5ABE.L	WT4	5ABF.L
WTC	5AC2.L	WTR1	5AC0.L	WTR2	5AC1.L	F400:	2CB8.M
F400	2CBA.M	MI	1262.K	RBD	1263.K	RBI	1264.K
I	1265.K	HI	1266.K	DRCP	1267.K	DRCA	1268.K
RCI	1269.K	RB	2D23.M	F3570	36D2.L	F3670	36F0.L
F3700	36F4.L	F3710	36FB.L	F4160	374E.L	F4170	3752.L

PAGE 7 FSPP LINKAGE LISTING

*** COMPUTER NO.1 SYMBOL DEFINITION LIST ***

KBALL	5AEF.L	TURN	5AF0.L	F003:	2D7F.M	F003	2D81.M
EDT2	126A.K	TT2	126B.K	THETA2	126C.K	RTHE2	126D.K
F100:	2DD7.M	E100	2DD9.M	N2D1	126E.K	N2D2	126F.K
N2D3	1270.K	N2D4	1271.K	N2D5	1272.K	N2D6	1273.K
DN21	1274.K	DN22	1275.K	DN23	1276.K	DN24	1277.K
DN25	1278.K	DN26	1279.K	F7401	3998.L	F7402	399F.L
F7403	39A3.L	F7404	39A7.L	F7405	39AB.L	F7406	39AF.L
F7441	39B3.L	F7442	39B7.L	F7443	39BB.L	F7444	39BF.L
F7445	39C3.L	F7446	39C7.L	E103:	2E58.M	E103	2E5D.M
PN21	127A.K	PN22	127B.K	PN23	127C.K	PN24	127D.K
PN25	127E.K	PN26	127F.K	N2PT	5AF1.L	E104:	2E81.M
E104	2E83.M	N21D	1280.K	N22D	1281.K	N23D	1282.K
N24D	1283.K	N25D	1284.K	N26D	1285.K	CN21	1286.K
CN22	1287.K	CN23	1288.K	CN24	1289.K	CN25	128A.K
CN26	128B.K	F7101	392D.L	F7102	3930.L	F7103	3933.L
F7104	3936.L	F7105	3939.L	F7106	393C.L	F7660	3A15.L
FIRE1	5AF2.L	FIRE2	5AF3.L	FIRE3	5AF4.L	FIRE4	5AF5.L
FIRE5	5AF6.L	FIRE6	5AF7.L	PMAN	5AF8.L	SVALV1	5AFA.L
SVALV2	5AFB.L	SVALV3	5AFC.L	SVALV4	5AFD.L	SVALV5	5AFE.L
SVALV6	5AFF.L	WF1	128C.K	WF2	10E2.D	WF3	10E3.D
WF4	128D.K	WF5	128E.K	WF6	128F.K	WFSS1	1290.K
WFSS2	1291.K	WFSS3	1292.K	WFSS4	1293.K	WFSS5	1294.K
WFSS6	1295.K	E111:	2FC7.M	E111	2FC9.M	F7301	3977.L
F7302	397A.L	F7303	397D.L	F7304	3980.L	F7305	3983.L
F7306	3986.L	F7341	3989.L	F7342	398C.L	F7343	398F.L
F7344	3992.L	F7345	3995.L	F7346	3998.L	F7650	3A11.L
VSR1	1296.K	VSR2	1297.K	VSR3	1298.K	VSR4	1299.K
VSR5	129A.K	VSR6	1298.K	E120:	3087.M	E120	3089.M
F5070	37F5.L	F7201	3947.L	F7202	394B.L	F7203	394F.L
F7204	3953.L	F7205	3957.L	F7206	3958.L	F7241	395F.L
F7242	3963.L	F7243	3967.L	F7244	396B.L	F7245	396F.L
F7246	3973.L	E121:	30DA.M	E121	30DC.M	WFA1	129C.K
WFA2	129D.K	WFA3	129E.K	WFA4	129F.K	WFA5	12A0.K
WFA6	12A1.K	WFD1	12A2.K	WFD2	12A3.K	WFD3	12A4.K
WFD4	12A5.K	WFD5	12A6.K	WFD6	12A7.K	DWF1	12A8.K
DWF2	12A9.K	DWF3	12AA.K	DWF4	12AB.K	DWF5	12AC.K
DWF6	12AD.K	F6001	382C.L	F6002	382F.L	F6003	3832.L
F6004	3835.L	F6005	3838.L	F6006	383B.L	F6101	3850.L
F6102	3853.L	F6103	3856.L	F6104	3859.L	F6105	385C.L
F6106	385F.L	FAVE1	5B00.L	FAVE2	5B01.L	FAVE3	5B02.L

*** COMPUTER NO.1 SYMBOL DEFINITION LIST ***

FAVE4	5B03.L	FAVE5	5B04.L	FAVE6	5B05.L	FBPS	5B17.L
E130:	31B9.M	E130	31BB.M	EPR1	12AE.K	EPR2	12AF.K
EPR3	12B0.K	EPR4	12B1.K	EPR5	12B2.K	EPR6	12B3.K
F4710	37D7.L	F5341	3814.L	F5342	3818.L	F5343	381C.L
F5344	3820.L	F5345	3824.L	F5346	3828.L	F6041	383E.L
F6042	3841.L	F6043	3844.L	F6044	3847.L	F6045	384A.L
F6046	384D.L	F6641	38F9.L	F6642	38FD.L	F6643	3901.L
F6644	3905.L	F6645	3909.L	F6646	390D.L	F7701	3A19.L
F7702	3A1D.L	F7703	3A21.L	F7704	3A25.L	F7705	3A29.L
F7706	3A2D.L	WBHP1	5B0C.L	WBHP2	5B0D.L	WBHP3	5B0E.L
WBHP4	5B0F.L	WBHP5	5B10.L	WBHP6	5B11.L	WBLP1	5B06.L
WBLP2	5B07.L	WBLP3	5B08.L	WBLP4	5B09.L	WBLP5	5B0A.L
WBLP6	5B0B.L	E140:	3242.M	E140	3244.M	EGTSS1	12B4.K
EGTSS2	12B5.K	EGTSS3	12B6.K	EGTSS4	12B7.K	EGTSS5	12B8.K
EGTSS6	12B9.K	EGT1	12BA.K	EGT2	12BB.K	EGT3	12BC.K
EGT4	12BD.K	EGT5	12BE.K	EGT6	12BF.K	F6141	3862.L
F6142	3865.L	F6143	3868.L	F6144	386B.L	F6145	386E.L
F6146	3871.L	F6601	38E7.L	F6602	38EA.L	F6603	38ED.L
F6604	38F0.L	F6605	38F3.L	F6606	38F6.L	F7501	39CB.L
F7502	39CE.L	F7503	39D1.L	F7504	39D4.L	F7505	39D7.L
F7506	39DA.L	E144:	32F9.M	F144	32FB.M	F7140	393F.L
F160:	332E.M	E160	3330.M	CSD1	12C0.K	CSD2	12C1.K
CSD3	12C2.K	CSD4	12C3.K	CSD5	12C4.K	CSD6	12C5.K
F7541	39DD.L	F7542	39E1.L	F7543	39E5.L	F7544	39E9.L
F7545	39ED.L	F7546	39F1.L	F7601	39F5.L	F7602	39F9.L
F7603	39FD.L	F7604	3A01.L	F7605	3A05.L	F7606	3A09.L
E170:	3394.M	E170	3396.M	CSA1	12C6.K	CSA2	12C7.K
CSA3	12C8.K	CSA4	12C9.K	CSA5	12CA.K	CSA6	12CB.K
A010:	33D9.M	A010	33DB.M	HPA0	10F4.D	VIA0	10E5.D
RCA0	10F6.D	RBA0	10E7.D	RAA0	10E8.D	THA0	10F9.D
PAIA0	10EA.D	PSIA0	10EB.D	EPRA0	10EC.D	EPLA0	10FD.D
N2RA0	10EE.D	N2LA0	10EF.D	EGRA0	10F0.D	EGLA0	10F1.D
ENGL	5B12.L	ENGR	5B13.L	A030:	3523.M	A030	3525.M
START	12CC.K	DTTA	1003.G	CSAL	12CD.K	CSAR	12CE.K
CSAL1	3596.M	CSAR1	3597.M	SFRL1	35A8.M	DTTA1	35A9.M
DTTR1	35AA.M	TEMP	3593.M	DIWORD	1010.A	DT1	10A1.B
DT2	10A2.B	DTTAAI	109C.B	DTTRAI	109E.B	FLP	10A0.B
SFRLAI	109D.B	A040:	35F5.M	A040	35F7.M	READY	12CF.K
IPAD	12D0.K	IQAD	12D1.K	IRAD	12D2.K	IPA	12D3.K
IQA	12D4.K	IRA	12D5.K	IE1	12D6.K	IE2	12D7.K

PAGE 9 FSPP LINKAGE LISTING

*** COMPUTER NO.1 SYMBOL DEFINITION LIST ***

IE3	12D8.K	IE4	12D9.K	IUE	12DA.K	IVE	12DB.K
IWF	12DC.K	IX	12DD.K	IY	12DE.K	IZ	12DF.K
IHPD	12E0.K	IHP	12E1.K	PENREC:	3658.M	GRSW	0000.Q
REC1:0	10F2.D	REC1:1	10F3.D	REC1:2	10F4.D	REC1:3	10F5.D
REC1:4	10F6.D	REC1:5	10F7.D	REC1:6	10F8.D	REC1:7	10F9.D
REC2:0	10FA.D	REC2:1	10FB.D	REC2:2	10FC.D	REC2:3	10FD.D
REC2:4	10FE.D	REC2:5	10FF.D	REC2:6	1100.D	REC2:7	1101.D
DGL	0000.N	DGN	0000.N	DGR	0000.N	DS	10D6.J
H260	3A44.L	H261	3A57.L	H262	3A6A.L	H300	3A7D.L
H340	3A86.L	H341	3A88.L	H342	3AF5.L	H344	3B32.L
H345	3B45.L	H346	3B82.L	H354	3B8F.L	H356	3BC8.L
H357	3BDB.L	H360	3BEE.L	H361	3C21.L	H362	3C5E.L
H363	3C91.L	H364	3CC4.L	H365	3CED.L	H366	3D00.L
H367	3D29.L	H370	3D70.L	H371	3DD5.L	H372	3E08.L
H373	3E45.L	H374	3E82.L	H375	3E88.L	H376	3EA5.L
H377	3F5C.L	H400	3F6F.L	H401	3F78.L	H402	3FB5.L
H404	3FE8.L	H406	401B.L	H410	40B6.L	H412	4151.L
H413	4184.L	H414	41C1.L	H415	41FE.L	H416	423B.L
H417	42A0.L	H420	42B3.L	H421	42E6.L	ABSDAD	10DD.J
H422	4323.L	H423	4336.L	H424	4369.L	H425	43A6.L
H426	43D9.L	H427	44FE.L	H431	4531.L	H432	4564.L
H434	4577.L	H435	45AA.L	H436	45BD.L	H437	45D0.L
H440	45D9.L	H443	4620.L	H444	4653.L	H445	465E.L
H446	47BB.L	H447	47EE.L	H450	4801.L	H451	4848.L
H452	487B.L	H453	488E.L	H454	48C1.L	H455	48D4.L
H463	4907.L	H464	493A.L	H465	494D.L	H466	4980.L
H467	4993.L	ABSDR	10DF.J	H470	49C6.L	H471	49D9.L
H472	49EC.L	H500	4A06.L	H503	4A19.L	H507	4A6A.L
H513	4A7D.L	H520	4B18.L	H521	4B55.L	H522	4B92.L
H523	4BCF.L	H524	4C16.L	H525	4C49.L	H534	4C7C.L
H600	4CF1.L	H604	4CF4.L	H610	4D07.L	H614	4D1A.L
H622	4D25.L	H623	4D62.L	H624	4D9F.L	H625	4DDC.L
H626	4E0F.L	H627	4E42.L	H630	4E75.L	H631	4EA8.L
H632	4EDB.L	H633	4F0E.L	H634	4F21.L	H635	4F54.L
H636	4F87.L	H637	4FBA.L	H640	4FD4.L	H641	5007.L
H642	5021.L	H644	5054.L	H645	5087.L	H647	50A6.L
H653	5141.L	H660	51DC.L	H664	51EF.L	H675	5254.L
H700	5267.L	H710	529A.L	H714	52AB.L	H716	5310.L
H720	534D.L	H724	53A8.L	H730	540D.L	H734	5420.L
H740	5433.L	H744	5498.L	H750	54FD.L	H754	5510.L

PAGE 10 FSPP LINKAGE LISTING

*** COMPUTER NO.1 SYMBOL DEFINITION LIST ***

H760	5557.L	H764	55BC.L	H765	55EF.L	H766	562C.L
H770	5669.L	H774	56CE.L	H1G	56ED.L	R2REG	01D7.P
YSIN	5959.L	YCOS	595E.L	KS1	5A6E.L	KSG	5A6F.L
KSA	5A70.L	KSVF	5A71.L	KSCF	5A72.L	DSMAX	5A73.L
DSSMX	5A74.L	DSSMN	5A75.L	KDE1	5A76.L	DEMAX	5A77.L
DEMIN	5A78.L	KDET	5A79.L	KS3	5A7A.L	KW1	5A7B.L
KW2	5A7C.L	KWA	5A7D.L	KWVF	5A7E.L	KWCF	5A7F.L
KA1	5A80.L	KA2	5A81.L	DSB	5A83.L	KSP1	5A84.L
KSP2	5A85.L	KP1	5A86.L	BST	5A87.L	KP2	5A88.L
KP3	5A89.L	KPCF	5A8A.L	KPA1	5A8B.L	KPA2	5A8C.L
KPVE	5A8D.L	KR1	5A8E.L	KR2	5A8F.L	DICE	5AC3.L
KVSC	5B14.L	DWMAX	5B16.L	DPMAX	5B15.L	KA3	5A82.L

PAGE 11 FSPP LINKAGE LISTING

*** COMPUTER NO.2 SYMBOL DEFINITION LIST ***

F130:	1115.M	F130	1117.M	DSS	10FE.K	FSG	10FF.K
FSCS	10F0.K	FSA	10F1.K	FSVF	10F2.K	FSCF	10F3.K
FS	10F4.K	DS2S	10F5.K	CHTC	10F6.K	DE	10D4.G
DET	10D5.G	ABSDS	10F7.K	WORRDS	11D8.M	ADFG	1880.L
DEMAX	1B6A.L	DEMIN	1B6B.L	DS	10D6.G	DSMAX	1B66.L
DSSMN	1B6B.L	DSSMX	1B67.L	F1A	1688.L	F2A	168B.L
F3A	168E.L	F4770	165F.L	F5110	1672.L	F5120	1675.L
FSC	10F8.K	K	01D8.P	KDE1	1B69.L	KDET	1B6C.L
KS1	1B61.L	KS3	1B6D.L	KSA	1B63.L	KSCF	1B65.L
KSG	1B62.L	KSVF	1B64.L	Q	10C3.J	F132:	11D9.M
F132	11DB.M	DWS	10F9.K	FWCS	10FA.K	FWA	10FB.K
FWVF	10FC.K	FWCF	10FD.K	FWG	10FE.K	FW	10FF.K
DW2S	1100.K	DAI	10D7.G	DAO	10D8.G	DSPIL	10D9.G
DSPOL	10DA.G	DSPIR	10DB.G	DSPOR	10DC.G	ABSDAO	10DD.G
WORSDW	122E,M	DFWIN	10CD,J	DFWN	10CF,J	DSB	1B76,L
DTTA	10D3.J	DTTR	10CE.J	DW	1101.K	F11A	1691.L
F12A	1694.L	F14A	1697.L	F1750	1656.L	F31	16A9.L
F5140	1679.L	F5150	167C.L	F5160	167F.L	FWC	1102.K
KA1	1B73.L	KA2	1B74.L	KA3	1B75.L	KSP1	1B77.L
KSP2	1B78.L	KW1	1B6E.L	KW2	1B6F.L	KWA	1B70.L
KWCF	1B72.L	KWVF	1B71.L	F134:	1319.M	F134	1318.M
DPS	1103.K	FPCS	1104.K	DP2S	1105.K	FPTS	1106.K
DP3S	1107.K	DRCL	1108.K	FPA	1109.K	CHTP	110A.K
FPVF	110B.K	FPCF	110C.K	FPG	110D.K	FP	110E.K
DR	10DE.G	ABSDR	10DF.G	ABSDP	110F.K	WORTDP	137A.M
BETA	10CA.J	BST	1B7A.L	DP	1110.K	DPMAX	1C08.L
F18A	169A.L	F22A	169D,L	F26A	16A0.L	F30	16A6.L
F40A	16A3.L	F4620	1659.L	F4760	165C.L	F5010	1662.L
F5040	1665.L	F5050	1668.L	F5060	166C.L	F5100	166F.L
FPC	1111.K	KP1	1B79.L	KP2	1B7B.L	KP3	1B7C.L
KPA1	1B7E.L	KPA2	1B7F.L	KPCF	1B7D.L	KPVF	1B80.L
KR1	1B81.L	KR2	1B82.L	WOW	10CB.J	A000:	14B4.M
A000	14B6.M	FSA0	10F0.D	FWA0	10E1.D	FPA0	10E2.D
DS1	1510.M	DW1	1511.M	DP1	1512.M	DPAI	1095.B
DSAI	1094.B	DWAI	1093.B	DWMAX	1C09.L	FPCAI	109B.B
FSCAI	109A.B	FWCAI	1099.B	A020:	1539.M	A020	153B.M
THETM	10E3.D	PAIM	10E4.D	THETFT	1112.K	PAIFT	1113.K
PSIFT	1114.K	THEVD1	10E5.D	PAIVD1	10E6.D	PSIVD1	10E7.D
THEVD2	10E8.D	PAIVD2	10E9.D	PSIVD2	10EA.D	XVD2	10EB.D
YVD2	10EC.D	ZVD2	10ED.D	FPIM	1685.L	FTHM	1682.L

PAGE 12 FSPP LINKAGE LISTING

*** COMPUTER NO.2 SYMBOL DEFINITION LIST ***

KVSC	1C07.L	PAI	10C5.J	PSI	10C6.J	THETA	10C4.J
X	10C7.J	Y	10C8.J	Z	10C9.J	H175	16AC.L
H462	16B7.L	M	10CC.J	H476	16C6.L	H477	16D9.L
H501	16FC.L	VE	10D0.J	H504	16FF.L	H505	1712.L
H506	174F.L	H510	175C.L	H511	1767.L	DFW	10D2.J
H512	177A.L	DFWO	10D1.J	H514	17AD.L	H515	17BA.L
H516	17CD.L	HTHM	17DA.L	HPIM	17EB.L	H1A	17FC.L
H2A	180D.L	H3A	181E.L	H11A	182F.L	H12A	1834.L
H14A	1839.L	H18A	1840.L	H22A	184D.L	H26A	1854.L
H40A	1861.L	H30	186A.L	H31	1877.L	R2REG	01D7.P
KC18	185F.L	S	1AE0.L	B	1AE1.L	C	1AE2.L
UW	1AE3.L	VW	1AE4.L	WW	1AE5.L	URT	1AE6.L
VRT	1AE7.L	WRT	1AE8.L	HFG	1AE9.L	LMG	1AEA.L
LNG	1AEB.L	LLG	1AEC.L	KD	1AED.L	SNMAX	1AEE.L
LLGM	1AEF.L	LLGN	1AF0.L	KN1	1AF1.L	KN2	1AF2.L
KM1	1AF3.L	KM2	1AF4.L	KM3	1AF5.L	LGY	1AF6.L
SMMAX	1AF7.L	K1	1AF8.L	K2	1AF9.L	K3	1AFA.L
K4	1AFB.L	K5	1AFC.L	PHYD	1AFD.L	HD	1AFE.L
DL	1AFF.L	PRAMD	1B00.L	KZN	1B01.L	DBL	1B02.L
DBR	1B03.L	KB	1B04.L	KL1	1B05.L	KL2	1B06.L
COSAJ1	1B07.L	COSAJ2	1B08.L	COSAJ3	1B09.L	COSAJ4	1B0A.L
COSAJ5	1B0B.L	COSAJ6	1B0C.L	COSBJ1	1B0D.L	COSBJ2	1B0E.L
COSBJ3	1B0F.L	COSBJ4	1B10.L	COSBJ5	1B11.L	COSBJ6	1B12.L
SINAJ1	1B13.L	SINAJ2	1B14.L	SINAJ3	1B15.L	SINAJ4	1B16.L
SINAJ5	1B17.L	SINAJ6	1B18.L	SINBJ1	1B19.L	SINBJ2	1B1A.L
SINBJ3	1B1B.L	SINBJ4	1B1C.L	SINBJ5	1B1D.L	SINBJ6	1B1E.L
ENGN	1B1F.L	LXJ1	1B20.L	LXJ2	1B21.L	LXJ3	1B22.L
LXJ4	1B23.L	LXJ5	1B24.L	LXJ6	1B25.L	LYJ1	1B26.L
LYJ2	1B27.L	LYJ3	1B28.L	LYJ4	1B29.L	LYJ5	1B2A.L
LYJ6	1B2B.L	LZJ1	1B2C.L	LZJ2	1B2D.L	LZJ3	1B2E.L
LZJ4	1B2F.L	LZJ5	1B30.L	LZJ6	1B31.L	KX	1B32.L
KY	1B33.L	KZ	1B34.L	I11	1B35.L	I12	1B36.L
I13	1B37.L	I14	1B38.L	I15	1B39.L	I16	1B3A.L
I21	1B3B.L	I22	1B3C.L	I23	1B3D.L	I24	1B3E.L
I25	1B3F.L	I26	1B40.L	KCL1	1B41.L	KCM1	1B42.L
KCM3	1B43.L	KCM4	1B44.L	KCM5	1B45.L	KCY1	1B47.L
KCY2	1B48.L	KCY3	1B49.L	KC11	1B4A.L	KC12	1B4B.L
KC13	1B4C.L	KCN1	1B4D.L	KCN2	1B4E.L	KCN3	1B4F.L
KCN4	1B50.L	DFWM	1B51.L	KCL2	1B52.L	KCL3	1B53.L
KCL4	1B54.L	KCL5	1B55.L	KWM	1B57.L	KCM7	1B58.L

PAGE 13 FSPP LINKAGE LISTING

*** COMPUTER NO.2 SYMBOL DEFINITION LIST ***

KCM8	1B59.L	KCM9	1B5A.L	KC14	1B5B.L	KC15	1B5C.L
KC16	1B5D.L	KC17	1B5E.L	DFWDM	1B60.L	DFWIM	1B83.L
DLEM	1B84.L	KFW1	1B85.L	KFW2	1B86.L	KFW3	1B87.L
KFW4	1B88.L	KFW5	1B89.L	KSP3	1B8A.L	TEST	1B8B.L
KLG1	1B8C.L	KLG2	1B8D.L	KLG3	1B8E.L	KLG4	1B8F.L
DLGN	1B90.L	DLGR	1B91.L	DLGL	1B92.L	HAI	1B93.L
HTHVI	1B94.L	SVI	1B95.L	DVIST	1B96.L	SRC	1B97.L
HRC	1B98.L	DRCST	1B99.L	SHP	1B9A.L	HHP	1B98.L
DHPST	1B9C.L	HALPH	1B9D.L	SALPH	1B9E.L	DALST	1B9F.L
HBETA	1BA0.L	SBETA	1BA1.L	DBSET	1BA2.L	HPAI	1BA3.L
SPAI	1BA4.L	DPSET	1BA5.L	HTHE	1BA6.L	STHE	1BA7.L
DTHST	1BA8.L	LSET	1BA9.L	HGSET	1BAA.L	TRSET	1BAB.L
ENVSET	1BAC.L	MSET	1BAD.L	VISET	1BAE.L	WT1	1BAF.L
WT2	1BB0.L	WT3	1BB1.L	WT4	1BB2.L	WTR1	1BB3.L
WTR2	1BB4.L	WTC	1BB5.L	DICE	1BB6.L	WEMP	1BB7.L
WP	1BB8.L	WGS	1BB9.L	LXS	1BBA.L	LYS	1BBB.L
IXBDY	1BBC.L	IXXS	1BBF.L	IYYS	1BC0.L	IZZS	1BC1.L
IXZS	1BC2.L	KLX1	1BC3.L	KLX2	1BC4.L	KLX3	1BC5.L
KLX4	1BC6.L	KLX5	1BC7.L	KLX6	1BC8.L	KLY1	1BC9.L
KLY2	1BCA.L	KLY3	1BCB.L	PCGS	1BCC.L	KIZ1	1BD7.L
KIZ2	1BD8.L	KIZ3	1BD9.L	KIZ4	1BDA.L	KIZ5	1BDB.L
KIXZ1	1BDC.L	KIXZ2	1BDD.L	KBALL	1BE2.L	TURN	1BE3.L
N2PT	1BE4.L	FIRE1	1BE5.L	FIRE2	1BE6.L	FIRE3	1BE7.L
FIRE4	1BE8.L	FIRE5	1BE9.L	FIRE6	1BEA.L	PMAN	1BEB.L
SVALV1	1BED.L	SVALV2	1BEE.L	SVALV3	1BEF.L	SVALV4	1BF0.L
SVALV5	1BF1.L	SVALV6	1BF2.L	FAVE1	1BF3.L	FAVE2	1BF4.L
FAVE3	1BF5.L	FAVE4	1BF6.L	FAVE5	1BF7.L	FAVE6	1BF8.L
WBLP1	1BF9.L	WBLP2	1BFA.L	WBLP3	1BFB.L	WBLP4	1BFC.L
WBLP5	1BFD.L	WBLP6	1BFE.L	WBHP1	1BFF.L	WBHP2	1C00.L
WBHP3	1C01.L	WBHP4	1C02.L	WBHP5	1C03.L	WBHP6	1C04.L
ENGL	1C05.L	ENGR	1C06.L	KIX2	1BCE.L	KIX3	1BCF.L
KIX4	1BD0.L	KIX5	1BD1.L	KIY1	1BD2.L	KIY2	1BD3.L
KIY3	1BD4.L	KIY4	1BD5.L	KIY5	1BD6.L	FBPS	1C0A.L
CGSET	1BDE.L	ISET	1BDF.L	LCGS	1BE0.L	WGSET	1BE1.L
N11P	1BEC.L	KCM6	1846.L	KCL6	1B56.L	IYBDY	1BBD.L
IZBDY	1BBE.L	KIX1	1BCD.L				

付　録　4

属　性　テ　ー　ブ　ル

```
BLK ATTRIBUTE
    DCL FXA      K+10;
    DCL FYA      K+10;
    DCL FZA      K+10;
    DCL MXA      K+04;
    DCL MYA      K+04;
    DCL MZA      K+04;
    DCL AXA      J+13;
    DCL AYA      J+13;
    DCL AZA      J+12;
    DCL PAD      J+13;
    DCL QAD      J+13;
    DCL RAD      J+13;
    DCL PA       J+13;
    DCL QA       J+13;
    DCL RA       J+13;
    DCL E1D      J+14;
    DCL E2D      J+14;
    DCL E3D      J+14;
    DCL E4D      J+14;
    DCL E1       J+14;
    DCL E2       J+14;
    DCL E3       J+14;
    DCL E4       J+14;
    DCL L1       J+15;
    DCL L2       J+15;
    DCL L3       J+15;
    DCL M1       J+15;
    DCL M2       J+15;
    DCL M3       J+15;
    DCL N1       J+15;
    DCL N2       J+15;
    DCL N3       J+15;
    DCL CE       J+13;
    DCL SINTH    J+15;
    DCL COSTH    J+15;
    DCL SINPI    J+15;
    DCL COSPI    J+15;
    DCL SINPS    J+15;
    DCL COSPS    J+15;
    DCL THETA    J+06;
    DCL PAI      J+06;
    DCL PSI      J+06;
    DCL UED      J+02;
    DCL VED      J+02;
    DCL WED      J+02;
    DCL UET      J+02;
    DCL VET      J+02;
    DCL WET      J+02;
    DCL UEP      J+02;
    DCL VEP      J+02;
    DCL WEP      J+02;
    DCL UA       J+02;
    DCL VA       K+18;
    DCL WA       J+02;
    DCL VPL      J+02;
    DCL VP1      J+02;
    DCL X        J+02;
    DCL Y        J+02;
    DCL Z        J+02;
    DCL HFP      J+02;
    DCL HPD      J+02;
    DCL HO       K+14;
    DCL HPDB     K+14;
    DCL HPS      J+02;
    DCL HSL      J+07;
    DCL HP       J-02;
    DCL UAD      J+02;
    DCL VAD      J+02;
    DCL WAD      J+02;
    DCL ALPHD    J+15;
    DCL BETAD    J+15;
    DCL ALPHA    J+07;
    DCL BETA     J+09;
    DCL PS       J+13;
    DCL QS       J+13;
    DCL RS       J+13;
    DCL SINA     J+15;
    DCL COSA     J+15;
    DCL SINB     J+15;
    DCL UG       J+02;
    DCL VG       J+02;
    DCL VM       J+02;
    DCL VN       J+02;
    DCL UNT      J+02;
    DCL VNT      J+02;
    DCL DSN      J+15;
    DCL DSR      J+15;
    DCL DSL      J+15;
    DCL TNT      J+15;
    DCL TL       J+15;
    DCL TR       J+15;
    DCL SM       J+15;
    DCL FZLM     J-10;
    DCL FZRM     J-10;
    DCL FZN      J-10;
    DCL FYLM     J-10;
    DCL FYRM     J-10;
    DCL FYNT     J-10;
    DCL FYN      J-10;
    DCL FXLM     J-10;
    DCL FXRM     J-10;
    DCL FXNT     J-10;
    DCL FXN      J-10;
    DCL FXG      J-06;
    DCL FYG      J-06;
    DCL DSS      J+09;
    DCL FZG      J-06;
    DCL MXG      J-11;
    DCL MYG      J-11;
    DCL MZG      J-11;
    DCL WOWL     I    ;
    DCL WOWR     I    ;
    DCL WOW      I    ;
    DCL UGDS     J+02;
    DCL VGDS     J+02;
    DCL RNHD     J+09;
    DCL RNCD     J+09;
    DCL RNPOS    J+09;
    DCL RMDN     J+09;
    DCL COSRN    J+15;
    DCL SINRN    J+15;
    DCL XL       J-10;
    DCL XR       J-10;
    DCL SL       I    ;
    DCL SR       I    ;
    DCL LLO      J-10;
    DCL LRO      J-10;
    DCL FBL      J-10;
    DCL FBR      J-10;
    DCL FNX1     J+00;
```

```
DCL  FNX2    J+00;
DCL  FNX3    J+00;
DCL  FNX4    J+00;
DCL  FNX5    J+00;
DCL  FNX6    J+00;
DCL  FNY1    J+00;
DCL  FNY2    J+00;
DCL  FNY3    J+00;
DCL  FNY4    J+00;
DCL  FNY5    J+00;
DCL  FNY6    J+00;
DCL  FNZ1    J+00;
DCL  FNZ2    J+00;
DCL  FNZ3    J+00;
DCL  FNZ4    J+00;
DCL  FNZ5    J+00;
DCL  FNZ6    J+00;
DCL  FXJ     J-03;
DCL  FYJ     J-03;
DCL  FZJ     J-03;
DCL  AL1     J-09;
DCL  AL2     J-09;
DCL  AL3     J-09;
DCL  AL4     J-09;
DCL  AL5     J-09;
DCL  AL6     J-09;
DCL  LX1     J-09;
DCL  LX2     J-09;
DCL  LX3     J-09;
DCL  LX4     J-09;
DCL  LX5     J-09;
DCL  LX6     J-09;
DCL  DET     J+09;
DCL  ABSDS   J+09;
DCL  DSPOR   J+09;
DCL  DWS     J+08;
DCL  FWCS    J+07;
DCL  FWA     J+07;
DCL  FWVF    J+07;
DCL  FWCF    J+07;
DCL  FWG     J+07;
DCL  FW      J+07;
DCL  DW2S    J+08;
DCL  DAI     J+09;
DCL  DAO     J+09;
DCL  DSPIL   J+09;
DCL  DSPIR   J+09;
DCL  DSPOL   J+09;
DCL  DPS     J+11;
DCL  FPCS    J+06;
DCL  DP2S    J+11;
DCL  FPTS    J+06;
DCL  DP3S    J+11;
DCL  DRCL    J+09;
DCL  FPA     J+06;
DCL  CHTP    J+15;
DCL  FPVF    J+06;
DCL  FPCF    J+06;
DCL  FPG     J+06;
DCL  FP      J+06;
DCL  DR      J+09;
DCL  ABSDR   J+09;
DCL  ABSDP   J+11;
DCL  DFWI    J+09;
DCL  DFWO    J+09;
DCL  DFW     J+09;
DCL  DFW1    J+15;
DCL  DSPR    J+09;
DCL  DSPL    J+09;
DCL  DLE     J+15;
DCL  DSP     J+09;
DCL  CL1     J+13;
DCL  DCL0S   J+13;
DCL  DCLAD   J+13;
DCL  DCLAZA  J+13;
DCL  DCLSP   J+13;
DCL  CL      J+13;
DCL  DCDM    J+13;
DCL  CDBSC   J+16;
DCL  DCDB    J+13;
DCL  DCDSP   J+13;
DCL  DCDA    J+13;
DCL  CD      J+13;
DCL  D2CM    J+13;
DCL  CMBA    J+13;
DCL  DCMA    J+13;
DCL  D1CM    J+13;
DCL  CMBAF   J+13;
DCL  KDE     J+13;
DCL  DCMDE   J+13;
DCL  DCMDET  J+13;
DCL  DCMSFL  J+13;
DCL  DCMKA   J+13;
DCL  DCMAZA  J+13;
DCL  DCM@A   J+13;
DCL  DCM@AD  J+13;
DCL  DCMAD   J+13;
DCL  DCMSP   J+13;
DCL  CM      J+13;
DCL  DCYB    J+15;
DCL  DCYSP   J+15;
DCL  DCYRS   J+15;
DCL  DCYPS   J+15;
DCL  DCYDR   J+15;
DCL  CY      J+15;
DCL  FLBGE   J+07;
DCL  DC1B    J+15;
DCL  DC1PS   J+15;
DCL  DC1DR   J+15;
DCL  FLGE    J+13;
DCL  DC1DSP  J+15;
DCL  DC1DA   J+15;
DCL  DC1RS   J+15;
DCL  C1      J+15;
DCL  FSG     J+07;
DCL  FSCS    J+07;
DCL  FNGE    J+12;
DCL  DCNB    J+15;
DCL  KRS     J+14;
DCL  DCNRS   J+15;
DCL  DCNPS   J+15;
DCL  DCNDR   J+15;
DCL  DCNSP   J+15;
DCL  DCNLG   J+15;
DCL  CN      J+15;
DCL  CLBSC   J+18;
DCL  CLA     J+20;
DCL  CLDE    J+23;
DCL  CLWS    J+08;
DCL  CLAD    J+08;
DCL  CLAZA   J+19;
DCL  CMBSA   J+20;
```

```
DCL CMA      J+20;
DCL CMQA     J+04;
DCL CMQAD    K+15;
DCL CMAD     J+08;
DCL CYB      J+18;
DCL CYR      J+07;
DCL CYP      J+10;
DCL C1B      J+20;
DCL C1P      J+07;
DCL C1DR     J+22;
DCL C1R      J+09;
DCL CNB      J+19;
DCL CNR      J+07;
DCL CNP      J+09;
DCL DCLLE    J+13;
DCL DCLGE    J+13;
DCL DCLLG    J+13;
DCL DCLSF    J+13;
DCL DCDGE    J+13;
DCL DCDLG    J+13;
DCL DCDWM    J+13;
DCL CLBUFF   J+13;
DCL CLSTAL   J+13;
DCL DCMLG    J+13;
DCL DCMGE    J+13;
DCL DCMSF    J+13;
DCL DC1LE    J+15;
DCL DC1SF    J+15;
DCL DC1LG    J+15;
DCL FSA      J+07;
DCL FSVF     J+07;
DCL FSCF     J+07;
DCL FS       J+07;
DCL DS2S     J+09;
DCL DE       J+09;
DCL CHTC     J+15;
DCL  WFA4    J+01;
DCL  WFA5    J+01;
DCL  WFA6    J+01;
DCL  WFD1    J+01;
DCL  WFD2    J+01;
DCL  WFD3    J+01;
DCL  WFD4    J+01;
DCL  WFD5    J+01;
DCL  WFD6    J+01;
DCL  DWF1    J+01;
DCL  DWF2    J+01;
DCL  DWF3    J+01;
DCL  DWF4    J+01;
DCL  DWF5    J+01;
DCL  DWF6    J+01;
DCL EPR1     J+13;
DCL EPR2     J+13;
DCL EPR3     J+13;
DCL EPR4     J+13;
DCL EPR5     J+13;
DCL EPR6     J+13;
DCL EGTSS1   J+05;
DCL EGTSS2   J+05;
DCL EGTSS3   J+05;
DCL EGTSS4   J+05;
DCL EGTSS5   J+05;
DCL EGTSS6   J+05;
DCL EGT1     J+05;
DCL EGT2     J+05;
DCL EGT3     J+05;
DCL EGT4     J+05;
DCL EGT5     J+05;
DCL EGT6     J+05;
DCL VSB1     I   ;
DCL VSB2     I   ;
DCL VSB3     I   ;
DCL VSB4     I   ;
DCL VSB5     I   ;
DCL VSB6     I   ;
DCL FN1      J+00;
DCL FN2      J+00;
DCL FN3      J+00;
DCL FN4      J+00;
DCL FN5      J+00;
DCL FN6      J+00;
DCL CSD1     I   ;
DCL CSD2     I   ;
DCL CSD3     I   ;
DCL CSD4     I   ;
DCL CSD5     I   ;
DCL CSD6     I   ;
DCL DS       J+09;
DCL FSC      J+07;
DCL FSAO     J+00;
DCL DW       J+08;
DCL FWC      J+07;
DCL DP       J+11;
DCL FPC      J+06;
DCL FPAO     J+00;
DCL HPAO     J+00;
DCL VIAO     J+00;
DCL RCAO     J+00;
DCL RBAO     J+00;
DCL RAAO     J+00;
DCL THAO     J+00;
DCL PAIAO    J+00;
DCL PSIAO    J+00;
DCL EPRAO    J+00;
DCL EPLAO    J+00;
DCL N2RAO    J+00;
DCL N2LAO    J+00;
DCL EGRAO    J+00;
DCL EGLAO    J+00;
DCL THET1    J+00;
DCL PAIM     J+00;
DCL THETFT   J+00;
DCL PAIFT    J+00;
DCL PSIFT    J+00;
DCL THEVD1   J+00;
DCL PAIVD1   J+00;
DCL PSIVD1   J+00;
DCL THEVD2   J+00;
DCL PAIVD2   J+00;
DCL PSIVD2   J+00;
DCL XVD2     J+00;
DCL YVD2     J+00;
DCL ZVD2     J+00;
DCL CSAL     J+07;
DCL CSAR     J+07;
DCL RESET    I   ;
DCL START    I   ;
DCL FREEZ    I   ;
DCL DLEL     J+09;
DCL DLER     J+09;
DCL CSA1     J+07;
DCL CSA2     J+07;
```

```
      DCL CSA3        J+07;
      DCL CSA4        J+07;
      DCL CSA5        J+07;
      DCL CSA6        J+07;
      DCL DFWIR       J+09;
      DCL DFWIL       J+09;
      DCL DFWOR       J+09;
      DCL DFWOL       J+09;
      DCL SFRL        J+11;
      DCL DTTA        J+09;
      DCL DTTR        J+09;
      DCL IE1         J+14;
      DCL IE2         J+14;
      DCL IE3         J+14;
      DCL IE4         J+14;
      DCL IX          J+02;
      DCL IY          J+02;
      DCL IZ          J+02;
      DCL IUE         J+02;
      DCL IVE         J+02;
      DCL IWE         J+02;
      DCL IHPD        J+02;
      DCL IHP         J-02;
      DCL IPAD        J+13;
      DCL IQAD        J+13;
      DCL IRAD        J+13;
      DCL IPA         J+13;
      DCL IQA         J+13;
      DCL IRA         J+13;
      DCL S           J+01;
      DCL B           J+07;
      DCL C           J+08;
      DCL UW          J+02;
      DCL KSCF        J+09;
      DCL DSMAX       J+09;
      DCL DSSMX       J+09;
      DCL DSSMN       J+09;
      DCL KDE1        J+13;
      DCL DEMAX       J+09;
      DCL DEMIN       J+09;
      DCL KDET        J+11;
      DCL KS3         J+15;
      DCL KW1         J+15;
      DCL NDLGN       J+11;
      DCL NDLGR       J+11;
      DCL NDLGL       J+11;
      DCL DLG         J+11;
      DCL DFWIN       J+15;
      DCL DFWON       J+15;
      DCL DFWN        J+15;
      DCL DVI         J+05;
      DCL DRC         J+02;
      DCL DHP         J-02;
      DCL DALPH       J+15;
      DCL DBETA       J+15;
      DCL DPHI        J+15;
      DCL DTHE        J+15;
      DCL EIAS        J+02;
      DCL STHCD       J+15;
      DCL STHC        J+15;
      DCL PAMD        J+13;
      DCL QAMD        J+13;
      DCL RAMD        J+13;
      DCL MAXA        J+13;
      DCL MAYA        J+13;
      DCL MAZA        J+13;
      DCL LR          J+22;
      DCL DAMB        J+14;
      DCL HG          J+08;
      DCL HBARO       J-02;
      DCL TSL         J+07;
      DCL TOA         J+07;
      DCL TF          J+08;
      DCL TK          J+05;
      DCL PAMB1       J+10;
      DCL PAMB        J+03;
      DCL M           J+13;
      DCL Q           J+03;
      DCL VE          J+02;
      DCL VP          J+02;
      DCL WTTOT       J-08;
      DCL WG          J-08;
      DCL LXCG        J+11;
      DCL PCG         J+09;
      DCL LYCG        J+11;
      DCL IXX         J-09;
      DCL IYY         J-09;
      DCL IZZ         J-09;
      DCL IXZ         J-09;
      DCL VI          J+05;
      DCL MI          J+12;
      DCL RBD         J+13;
      DCL RBI         J+13;
      DCL I           J+12;
      DCL HI          J-01;
      DCL DRCP        J+07;
      DCL DRCA        J+07;
      DCL RCI         J+02;
      DCL EDT2        J+13;
      DCL TT2         J+08;
      DCL THETA2      J+14;
      DCL RTHE2       J+14;
      DCL N2D1        J+01;
      DCL N2D2        J+01;
      DCL N2D3        J+01;
      DCL N2D4        J+01;
      DCL N2D5        J+01;
      DCL N2D6        J+01;
      DCL DN21        J+01;
      DCL DN22        J+01;
      DCL DN23        J+01;
      DCL DN24        J+01;
      DCL DN25        J+01;
      DCL DN26        J+01;
      DCL PN21        J+08;
      DCL PN22        J+08;
      DCL PN23        J+08;
      DCL PN24        J+08;
      DCL PN25        J+08;
      DCL PN26        J+08;
      DCL N21D        J+01;
      DCL N22D        J+01;
      DCL N23D        J+01;
      DCL N24D        J+01;
      DCL N25D        J+01;
      DCL N26D        J+01;
      DCL N21         J+01;
      DCL N22         J+01;
      DCL N23         J+01;
      DCL N24         J+01;
      DCL N25         J+01;
      DCL N26         J+01;
```

```
DCL CN21    J+01;
DCL CN22    J+01;
DCL CN23    J+01;
DCL CN24    J+01;
DCL CN25    J+01;
DCL CN26    J+01;
DCL PN11    J+08;
DCL PN12    J+08;
DCL PN13    J+08;
DCL PN14    J+08;
DCL PN15    J+08;
DCL PN16    J+08;
DCL WFSS1   J-01;
DCL WFSS2   J-01;
DCL WFSS3   J-01;
DCL WFSS4   J-01;
DCL WFSS5   J-01;
DCL WFSS6   J-01;
DCL WF1     J+01;
DCL WF2     J+01;
DCL WF3     J+01;
DCL WF4     J+01;
DCL WF5     J+01;
DCL WF6     J+01;
DCL WFA1    J+01;
DCL WFA2    J+01;
DCL WFA3    J+01;
DCL LY1     J-09;
DCL LY2     J-09;
DCL LY3     J-09;
DCL LY4     J-09;
DCL LY5     J-09;
DCL LY6     J-09;
DCL LZ1     J-09;
DCL LZ2     J-09;
DCL LZ3     J-09;
DCL LZ4     J-09;
DCL LZ5     J-09;
DCL LZ6     J-09;
DCL MXJ     J-11;
DCL MYJ     J-11;
DCL MZJ     J-11;
DCL CLBA    J+13;
DCL DCLA    J+13;
DCL DCLDE   J+13;
DCL DCLDET  J+13;
DCL DCLBAF  J+13;
DCL DCLSKA  J+13;
DCL KALPH   J+14;
DCL CLKAT   J+13;
DCL D2CL    J+13;
DCL D1CL    J+13;
DCL CLBDF   J+13;
DCL KW2     J+11;
DCL KWA     J+12;
DCL KWVF    J+15;
DCL KWCF    J+11;
DCL KA1     J+15;
DCL KA2     J+15;
DCL KA3     J+15;
DCL DSB     J+09;
DCL KSP1    J+15;
DCL KSP2    J+08;
DCL KP1     J+15;
DCL DICE    J+15;
DCL BST     I   ;
```

```
DCL KP2     J+15;
DCL KP3     J+15;
DCL KPCF    J+10;
DCL KPA1    J+15;
DCL KPA2    J+09;
DCL KPVF    J+12;
DCL KR1     J+11;
DCL KR2     J+12;
DCL DFWIM   J+09;
DCL DLEM    J+09;
DCL KFW1    J+15;
DCL KFW2    J+15;
DCL KFW3    J+15;
DCL KFW4    J+15;
DCL KFW5    J+15;
DCL KSP3    J+15;
DCL TEST    I   ;
DCL KLG1    J+14;
DCL KLG2    J+14;
DCL KLG3    J+14;
DCL KLG4    J+14;
DCL DLGN    J+15;
DCL DLGR    J+15;
DCL DLGL    J+15;
DCL HAI     I   ;
DCL HTHVI   I   ;
DCL SVI     I   ;
DCL DVIST   J+05;
DCL SRC     I   ;
DCL HRC     I   ;
DCL DRCST   J+02;
DCL SHP     I   ;
DCL HHP     I   ;
DCL DHPST   J-02;
DCL HALPH   I   ;
DCL SALPH   I   ;
DCL DALST   J+15;
DCL HBETA   I   ;
DCL SBETA   I   ;
DCL DBSET   J+15;
DCL HPAI    I   ;
DCL SPAI    I   ;
DCL DPSET   J+15;
DCL HTHE    I   ;
DCL STHE    I   ;
DCL DTHST   J+15;
DCL LSET    J+22;
DCL HGSET   J+08;
DCL TRSET   J+07;
DCL ENVSET  I   ;
DCL MSET    I   ;
DCL VISET   I   ;
DCL WT1     J-04;
DCL WT2     J-04;
DCL WT3     J-04;
DCL WT4     J-04;
DCL WTR1    J-02;
DCL WTR2    J-02;
DCL WTC     J-02;
DCL WEMP    J-08;
DCL WP      J-02;
DCL WGS     J-08;
DCL LXS     J+11;
DCL LYS     J+11;
DCL IXBDY   J-09;
DCL IYBDY   J-09;
```

```
DCL IZBDY       J-09;
DCL IXXS        J-09;
DCL IYYS        J-09;
DCL IZZS        J-09;
DCL IXZS        J-09;
DCL KLX1        J+11;
DCL KLX2        J+10;
DCL KLX3        J+08;
DCL KLX4        J+08;
DCL KLX5        J+09;
DCL KLX6        J+14;
DCL KLY1        J+06;
DCL KLY2        J+07;
DCL KLY3        J+04;
DCL PCGS        J+09;
DCL KIX1        J+09;
DCL KIX2        J+10;
DCL KIX3        J+08;
DCL KIX4        J+14;
DCL KIX5        J+08;
DCL KIY1        J+10;
DCL KIY2        J+10;
DCL KIY3        J+08;
DCL KIY4        J+10;
DCL KIY5        J+08;
DCL KIZ1        J+09;
DCL KIZ2        J+10;
DCL KIZ3        J+08;
DCL KIZ4        J+10;
DCL KIZ5        J+08;
DCL KIXZ1       J+15;
DCL KIXZ2       J+15;
DCL CGSET       I   ;
DCL ISET        I   ;
DCL LCGS        I   ;
DCL WGSET       I   ;
DCL KBALL       J+11;
DCL TURN        J+09;
DCL N2PT        J+21;
DCL FIRE1       I   ;
DCL FIRE2       I   ;
DCL FIRE3       I   ;
DCL FIRE4       I   ;
DCL FIRE5       I   ;
DCL FIRE6       I   ;
DCL PMAN        J+08;
DCL N11P        J+01;
DCL SVALV1      I   ;
DCL SVALV2      I   ;
DCL SVALV3      I   ;
DCL SVALV4      I   ;
DCL SVALV5      I   ;
DCL VW          J+02;
DCL WW          J+02;
DCL URT         J+02;
DCL VRT         J+02;
DCL WRT         J+02;
DCL HFG         J+02;
DCL LMG         J+09;
DCL LNG         J+09;
DCL LLG         J+09;
DCL KD          J+15;
DCL SNMAX       J+12;
DCL LLGM        J+07;
DCL LLGN        J+07;
DCL KN1         J+15;
DCL KN2         J+15;
DCL KM1         J+15;
DCL KM2         J+15;
DCL KM3         J+15;
DCL LGY         J+04;
DCL SNMAX       J+12;
DCL K1          J+13;
DCL K2          J-11;
DCL K3          J+13;
DCL K4          J-04;
DCL K5          J+15;
DCL PHYD        J+03;
DCL HD          I   ;
DCL DL          I   ;
DCL PRAMD       J+03;
DCL KZN         J-10;
DCL DBL         J+15;
DCL DBR         J+15;
DCL KB          J-10;
DCL KL1         J+15;
DCL KL2         J+15;
DCL COSAJ1      J+15;
DCL COSAJ2      J+15;
DCL COSAJ3      J+15;
DCL COSAJ4      J+15;
DCL COSAJ5      J+15;
DCL COSAJ6      J+15;
DCL COSBJ1      J+15;
DCL COSBJ2      J+15;
DCL COSBJ3      J+15;
DCL COSBJ4      J+15;
DCL COSBJ5      J+15;
DCL COSBJ6      J+15;
DCL SINAJ1      J+15;
DCL SINAJ2      J+15;
DCL SINAJ3      J+15;
DCL SINAJ4      J+15;
DCL SINAJ5      J+15;
DCL SINAJ6      J+15;
DCL SINBJ1      J+15;
DCL SINBJ2      J+15;
DCL SINBJ3      J+15;
DCL SINBJ4      J+15;
DCL SINBJ5      J+15;
DCL SINBJ6      J+15;
DCL ENGN        J+00;
DCL LXJ1        J+08;
DCL LXJ2        J+08;
DCL LXJ3        J+08;
DCL LXJ4        J+08;
DCL LXJ5        J+08;
DCL LXJ6        J+08;
DCL LYJ1        J+08;
DCL LYJ2        J+08;
DCL LYJ3        J+08;
DCL LYJ4        J+08;
DCL LYJ5        J+08;
DCL LYJ6        J+08;
DCL LZJ1        J+04;
DCL LZJ2        J+04;
DCL LZJ3        J+04;
DCL LZJ4        J+04;
DCL LZJ5        J+04;
DCL LZJ6        J+04;
DCL KX          J-11;
DCL KY          J-11;
```

```
DCL KZ          J-11;
DCL I11         J+00;
DCL I12         J+00;
DCL I13         J+00;
DCL I14         J+00;
DCL I15         J+00;
DCL I16         J+00;
DCL I21         J+00;
DCL I22         J+00;
DCL I23         J+00;
DCL I24         J+00;
DCL I25         J+00;
DCL I26         J+00;
DCL KCL1        J+09;
DCL KCM1        J+14;
DCL KCM3        J+07;
DCL KCM4        J+14;
DCL KCM5        J+14;
DCL KCM6        J+13;
DCL KCY1        J+20;
DCL KCY2        J+20;
DCL KCY3        J+20;
DCL KC11        J+12;
DCL KC12        J+20;
DCL KC13        J+15;
DCL KCN1        J+26;
DCL KCN2        J+20;
DCL KCN3        J+19;
DCL KCN4        J+17;
DCL DFWM        J+09;
DCL KCL2        J+26;
DCL KCL3        J+12;
DCL KCL4        J+21;
DCL KCL5        J+13;
DCL KCL6        J+19;
DCL KWM         J+13;
DCL KCM7        J+15;
DCL KCM8        J+13;
DCL KCM9        J+15;
DCL KC14        J+15;
DCL KC15        J+13;
DCL KC16        J+20;
DCL KC17        J+17;
DCL DFWOM       J+09;
DCL KS1         J+18;
DCL KSG         J+07;
DCL KSA         J+10;
DCL KSVF        J+15;
DCL SVALV6      I   ;
DCL FAVE1       I   ;
DCL FAVE2       I   ;
DCL FAVE3       I   ;
DCL FAVE4       I   ;
DCL FAVE5       I   ;
DCL FAVE6       I   ;
DCL WBLP1       J+11;
DCL WBLP2       J+11;
DCL WBLP3       J+11;
DCL WBLP4       J+11;
DCL WBLP5       J+11;
DCL WBLP6       J+11;
DCL WBHP1       J+12;
DCL WBHP2       J+12;
DCL WBHP3       J+12;
DCL WBHP4       J+12;
DCL WBHP5       J+12;
DCL WBHP6       J+12;
DCL ENGR        J+00;
DCL ENGL        J+00;
DCL KVSC        J+00;
DCL READY       I   ;
DCL DPMAX       J+11;
DCL DWMAX       J+08;
DCL FBPS        I   ;
DCL DSAI        J+00;
DCL DWAI        J+00;
DCL FPCAI       J+00;
DCL FSCAI       J+00;
DCL FWCAI       J+00;
DCL DIWORD      I   ;
DCL DT1         J+00;
DCL DT2         J+00;
DCL DTTAAI      J+00;
DCL DTTRAI      J+00;
DCL FLP         J+00;
DCL SFRLAI      J+00;
DCL ABSDAO      J+09;
DCL :PA         K+29;
DCL :QA         K+29;
DCL :RA         K+29;
DCL :X          J+18;
DCL :Y          J+18;
DCL :Z          J+18;
DCL :E1         K+30;
DCL :E2         K+30;
DCL :E3         K+30;
DCL :E4         K+30;
DCL :UET        K+18;
DCL :VET        K+18;
DCL :WET        K+18;
DCL INITIAL     I   ;
DCL START       I   ;
```

付　録　5

READY テ ー ブ ル

```
BLK READY
-1
READY   =0
HD      =0
DL      =0
TEST    =0
HAI     =0
HTHVI   =0
SVI     =0
SRC     =0
HRC     =0
SHP     =0
HHP     =0
HALPH   =0
SALPH   =0
HBETA   =0
SBETA   =0
HPAI    =0
SPAI    =0
HTHE    =0
STHE    =0
ENVSET  =0
MSET    =0
VISET   =0
BST     =-1
CGSET   =-1
ISET    =-1
LCGS    =-1
WGSET   =-1
FIRE1   =-1
FIRE2   =-1
FIRE3   =-1
FIRE4   =-1
FIRE5   =-1
FIRE6   =-1
SVALV1  =-1
SVALV2  =-1
SVALV3  =-1
SVALV4  =-1
SVALV5  =-1
SVALV6  =-1
FAVE1   =-1
FAVE2   =-1
FAVE3   =-1
FAVE4   =-1
FAVE5   =-1
FAVE6   =-1
FBPS    =0
INITIAL =0
FREE7   =0
START   =0
RESET   =-1
S       =2892.0
B       =142.42
C       =22.68
UW      =0
VW      =0
WW      =0
URT     =0
VRT     =0
WRT     =0
HFG     =0
LMG     =4.66
LNG     =54.33
LLG     =8.0
KD      =0.25
SNMAX   =2.0
LLGM    =9.4
LLGN    =9.4
KN1     =0.25
KN2     =0.5
KM1     =0.25
KM2     =0.5
KM3     =0.5
LGY     =11.05
SMMAX   =2.0
K1      =1.5
K2      =336000
K3      =1.25
K4      =30200
K5      =0.5
PHYD    =0
PRAMD   =0.5
KZN     =-104.0
DBL     =0.
DBR     =0.0
KB      =131072
KL1     =0.223
KL2     =0.420
COSAJ1  =0.99999
COSAJ2  =0.99999
COSAJ3  =0.99999
COSAJ4  =0.99999
COSAJ5  =0.99999
COSAJ6  =0.99999
COSBJ1  =0.99999
COSBJ2  =0.99999
COSBJ3  =0.99999
COSBJ4  =0.99999
COSBJ5  =0.99999
COSBJ6  =0.99999
SINAJ1  =0.0349
SINAJ2  =0.0349
SINAJ3  =0.0349
SINAJ4  =0.0349
SINAJ5  =0.0349
SINAJ6  =0.0349
SINBJ1  =0
SINBJ2  =0
SINBJ3  =0
SINBJ4  =0
SINBJ5  =0
SINBJ6  =0
ENGN    =4
LXJ1    =0
LXJ2    =0
LXJ3    =0
LXJ4    =0
LXJ5    =0
LXJ6    =0
LYJ1    =-51.96
LYJ2    =-33.0
LYJ3    =33.0
LYJ4    =51.96
LYJ5    =0
LYJ6    =0
LZJ1    =5.30
LZJ2    =7.10
LZJ3    =7.10
LZJ4    =5.30
LZJ5    =0
```

LZJ6	=0
KX	=0
KY	=0
KZ	=0
I11	=0.00
I12	=0.00
I13	=0.00
I14	=0.00
I15	=0.00
I16	=0.00
I21	=0.00
I22	=0.00
I23	=0.00
I24	=0.00
I25	=0.00
I26	=0.00
KCL1	=50.0
KCM1	=0.8
KCM3	=48.0
KCM4	=1.725
KCM5	=1.504
KCM6	=0.0234
KCY1	=0.003482
KCY2	=0.001782
KCY3	=0.00047
KC11	=3.5714
KC12	=0.000976
KC13	=0.054054
KCN1	=0.0002
KCN2	=0.01762
KCN3	=0.00222
KCN4	=0.0012
DFWM	=50.0
KCL2	=0.0001355
KCL3	=4.4234
KCL4	=0.004
KCL5	=0.0548
KCL6	=0.000962
KWM	=0
KCM7	=0.02
KCM8	=4.0
KCM9	=0.28
KC14	=0.026
KC15	=0.036
KC16	=0.00374
KC17	=0.0013
DFWOM	=50.0
KS1	=0.0328
KSG	=43
KSA	=15.25
KSVF	=0.377
KSCF	=0
DSMAX	=13.74
DSSMX	=8.49
DSSMN	=-14.1
KDE1	=2.158
DEMAX	=15.0
DEMIN	=-23.5
KDET	=3.547
KS3	=0.99999
KW1	=0.2
KW2	=7.0
KWA	=2.07
KWVF	=0.0563
KWCF	=0
KA1	=0.275
KA2	=0.0833
KA3	=0.06
DSB	=0.0
KSP1	=0.46
KSP2	=2.0
KP1	=0.0184
KP2	=0.405
KP3	=0.99999
KPCF	=0
KPA1	=0.21
KPA2	=23.
KPVF	=1.49
KR1	=4.2
KR2	=1.739
DFWIM	=50.0
DLEM	=50.0
KFW1	=0.44643
KFW2	=0.12176
KFW3	=0.28
KFW4	=-0.31818
KFW5	=0.5
KSP3	=0.5
KLG1	=0.6
KLG2	=0.6
KLG3	=0.375
KLG4	=0.25
DLGN	=1.0
DLGR	=1.0
DLGL	=1.0
DVIST	=0
DRCST	=0
DHPST	=0
DALST	=0
DBSET	=0
DPSET	=0
DTHST	=0
LSET	=0
HGSET	=0
TRSET	=0
WT1	=15000
WT2	=26000
WT3	=26000
WT4	=15000
WTR1	=2800
WTR2	=2800
WTC	=66000
DICE	=0
WEMP	=144721
WP	=20000
WGS	=258321
LXS	=0
LYS	=0
IXBDY	=2978597.
IYBDY	=3906708.
IZBDY	=6734215.
IXXS	=5652000.
IYYS	=5150000.
IZZS	=10590000.
IXZS	=338699
KLX1	=8.624
KLX2	=3.556
KLX3	=22.552
KLX4	=10.348
KLX5	=-4.708
KLX6	=0.4654
KLY1	=37.383

```
 KLY2    =18.042
 KLY3    =59.525
 PCGS    =25.0
 KIX1    =44.970
 KIX2    =10.878
 KIX3    =110.814
 KIX4    =1.411
 KIX5    =0.487
 KIY1    =3.117
 KIY2    =1.332
 KIY3    =16.462
 KIY4    =4.451
 KIY5    =24.458
 KIZ1    =48.076
 KIZ2    =11.991
 KIZ3    =126.652
 KIZ4    =5.344
 KIZ5    =24.570
 KIXZ1   =0.778
 KIXZ2   =0.189
 KBALL   =1.00
 TURN    =13.26
 N2PT    =0.01035
 PMAN    =0
 N11P    =6850
 WBLP1   =0
 WBLP2   =0
 WBLP3   =0
 WBLP4   =0
 WBLP5   =0
 WBLP6   =0
 WBHP1   =0
 WBHP2   =0
 WBHP3   =0
 WBHP4   =0
 WBHP5   =0
 WBHP6   =0
 ENGL    =1.0
 ENGR    =3.0
 KVSC    =0
 DPMAX   =12.36
 DWMAX   =107.5
 SINRN   =0
 COSRN   =0.999999
 PA      =0
 QA      =0
 RA      =0
 PAD     =0
 QAD     =0
 RAD     =0
 E1D     =0
 E2D     =0
 E3D     =0
 E4D     =0
 E1      =0
 E2      =0
 E3      =0
 E4      =0
 UET     =0.
 VET     =0.
 WET     =0.
 HPD     =0.
 HO      =0
 X       =0
 Y       =0
 Z       =0
 TNT     =0.0
 TL      =0.0
 TR      =0.0
 SM      =0.0
 READY   =0
 IPAD    =0
 IQAD    =0
 IRAD    =0
 IPA     =0
 IQA     =0
 IRA     =0
 IE1     =1
 IE2     =0
 IE3     =0
 IE4     =0
 IUE     =0
 IVE     =0
 IWE     =0
 IX      =0
 IY      =0
 IZ      =0
 IHPD    =0
 IHP     =0
 /*
```

付　録　6

HOLD　テ　ー　ブ　ル

```
      BLK HOLD
      B
      S
      C
      UW
      LMG
      LNG
      LLG
      KD
      SNMAX
      LLGM
      LLGN
      KN1
      KN2
      KM1
      KM2
      KM3
      LGY
      SNMAX
      K1
      K2
      K3
      K4
      K5
      PRAMD
      KZN
      KB
      KL1
      KL2
      COSAJ1
      COSAJ2
      COSAJ3
      COSAJ4
      COSAJ5
      COSAJ6
      SINAJ1
      SINAJ2
      LYJ1
      LYJ2
      LYJ4
      LZJ2
      LZJ4
      111
      121
      KCL1
      KCM3
      KCY1
      /*
```

航空宇宙技術研究所資料386号

昭和54年7月発行

発行所 航空宇宙技術研究所
東京都調布市深大寺町1880
電話武蔵野三鷹(0422)47-5911(大代表)〒182

印刷所 株式会社 共進
東京都杉並区久我山4－1－7(羽田ビル)

Printed in Japan