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INDUSTRIAL MODERNIZATION INCENTIVES PROGRAM

COMPUTER-AIDED LOG BOOK

FINAL REPORT

D.K. BAWA

PREPARED FOR
AERONAUTICAL SYSTEMS DIVISION
WRIGHT-PATTERSON AFB, OH 45433

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OCTOBER 1989

TELEDYNE CAE
Turbine Engines

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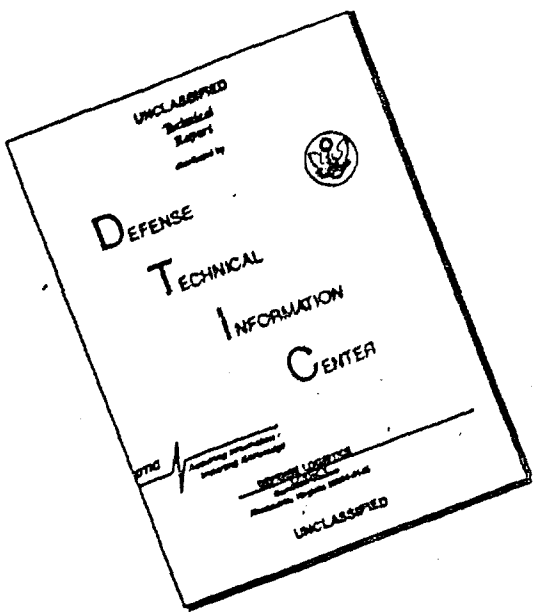

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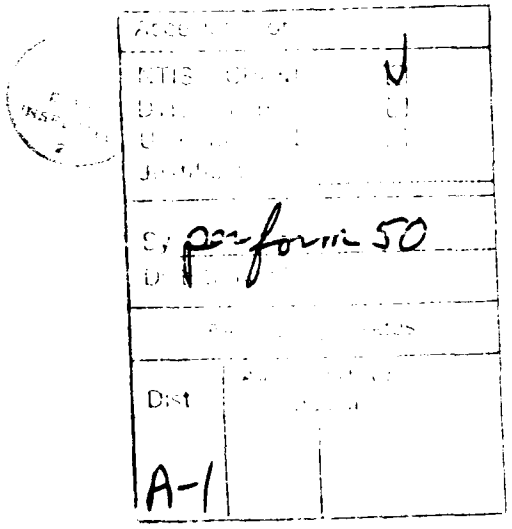

COMPUTER-AIDED LOG BOOK

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Incentives Program

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This report covers the activities of the IMIP Computer Aided Log Book (CALB) Phase II project developed at Teledyne CAE. The objective of the CALB project was to design, develop and demonstrate a computer-based system that provided closed-loop configuration control, engineering change tracking, and "as built" configuration reporting in real time. The system automates collection and verification of engine back-up data during the assembly process and provides component lot traceability. System benefits include reduction in direct and indirect labor costs, reduction in redundant data storage and configuration inconsistencies and improved logistics support of shipped engines.

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FOREWORD

This final report covers work performed under Contract F33657-86-C-2024 from December 1986 through March 1989. The contract with Teledyne CAE (TCAE), Toledo, Ohio was performed under the "Industrial Modernization Incentives Program" (IMIP). This program was funded through Aeronautical Systems Division Wright-Patterson Air Force Base (ASD/YZDC) and administered under direction of Captain Sarah Tandy and Major Dale Clary.

IMIP at TCAE was administered by Mr. Robert Beck. Mr. Devinder K. Bawa was the Project Engineer directly responsible for the Computer Aided Log Book (CALB) effort under direction of Mr. Sanjay Swarup. Technical direction was provided by Mr. Jeff Whaley.

Belcan Corporation of Cincinnati, Ohio was the subcontractor responsible for design, development and demonstration of the "Kit Engine" module of the CALB system. This task was completed by Mr. Shah F. Alam.

Teledyne CAE Information Systems group designed, developed and demonstrated "Assemble Build Book" and "Engine Build Book" modules of the CALB system. These tasks were completed by Mr. Jeff Whaley.

This document is published under Teledyne CAE Report Number 2404 and describes the final design and lessons learned from the Phase II effort.

EXECUTIVE SUMMARY

This report describes the results of Phase II of the Computer Aided Log Book (CALB) project. The project was conducted by Teledyne CAE under the Industrial Modernization Incentives Program (IMIP) sponsored by the United States Air Force/Aeronautical Systems Division. Funds were provided under Contract Number F33657-86-C-2024.

The purpose of the CALB project is to design, develop and demonstrate a computer based system that provides closed-loop configuration control, engineering change tracking, and "as-built" configuration reporting in real time.

The development of the prototype system was based upon requirements established by the project "Statement of Work" (SOW). These requirements led to the preliminary system design for the hardware and software development. Through a process of comprehensive vendor analysis, selection of suppliers resulted in a combination of a subcontractor, Belcan Corporation of Cincinnati, Ohio, and Teledyne CAE's Information Systems (I/S) group.

The prototype that has been subsequently developed utilized a combination of hardware and software resources which includes both DEC and IBM computers, and a software base consisting of a pair of manufacturing systems namely Manufacturing Management (MANMAN) package and Teledyne Information Management System (TIMS) package. MANMAN software resides on DEC hardware located in Teledyne CAE Gainesville (TCAE-G) facility, and TIMS software resides on IBM computer in Teledyne CAE (TCAE) Toledo facility. Furthermore, TCAE-G utilizes

a simplified version of TIMS system called TIMS2. TIMS2 contains all essential data files on engines manufactured in the Gainesville facility. New software built in addition to this combination of MANMAN and TIMS systems has been tested, and successfully demonstrated under the CALB project.

The CALB system was developed to provide a variety of new functionalities for Teledyne CAE - Gainesville facility in the Final Assembly and Test departments. These functionalities are briefly discussed as follows.

1. Assemble Build Book Function. This module developed by the I/S group generates two major documents used in the Assembly and Test area. These documents are Assembly Order Report and Assembly Order Routing Report. The CALB system is capable of producing separate copies of each document by individual engine serial numbers. Anticipated benefits by automating this task include significant reduction in labor spent in assembly of build book documentation.

2. Kitting Process. This module developed by Belcan Corporation automates "picking" of inventory from the Automated Storage and Retrieval System (AS/RS) and reporting exceptions between "as-kitted" and "as-designed" revision letters of picked components. This reporting and verification is essential in assuring that only the acceptable components are assembled into an engine.

3. Component Replacement History (CRH) Record. The CALB system provides for recording revisions in engine configurations necessitated during engine testing, disassembly, reassembly, and retesting cycles prior to engine shipping. Transaction date, build history, run time data for new and replaced part becomes part of the CRH record for historical record and lot traceability.

Demonstration of the prototype system to TCAE management and end-users was completed in early 1989. The learning acquired through the prototype design, testing and in-house demonstration efforts provided the basis for the final design of the CALB system for plant-wide implementation. The final design helped to identify the hardware and the software requirements, and to derive the project benefits analysis. This report includes the final design, the implementation plan and the project benefits.

The CALB system is an effective system to automate collection and verification of engine back-up data during the assembly processes. The system will significantly reduce direct and indirect labor costs, reduce redundant data storage and improve logistics support of the shipped engines.

1.0 PROJECT INTRODUCTION

1.1 PURPOSE

The purpose of the CALB project was to design, develop and demonstrate a computer based assembly log book system to provide closed-loop configuration control, engineering change tracking and "as built" configuration reporting for engines produced in Teledyne CAE-Gainesville facility. The system would significantly reduce documentation costs and delays.

1.2 NEED FOR COMPUTERIZED ASSEMBLY LOG BOOK

Currently, the aerospace industry is seeking faster verification of manufactured configurations. For the most part, current methods are labor intensive, non-integrated and result in degraded response time. Hence, the need for a CALB project that would significantly integrate and automate data collection, verification and document generation tasks.

1.2.1 "As-is" Process Description

1.2.1.1 Kitting Process

Currently, the "pick lists" are configured using the structure that was developed to assemble the end item. This results in: 1) duplication of the same component at various locations in the kitting instructions, 2) added travel time to move back and forth between bin locations, and 3) inconsistency in grouping of parts for pre-assembly kits. In addition, recording of required

data elements (on assembly shop orders) is manual and subsequently prone to errors, including transpositions, numbering errors and illegibility.

1.2.1.2 Engineering Change Order (ECO) Control

The current ECO control procedure is semi-automated but lacks integration with related data elements needed to support closed-loop ECO management and provide acceptable "ranges" of revision levels. The determination of the appropriate configuration of components for kitting is based on first-in-first-out (FIFO). This data is recorded manually, and transmitted to Quality Engineering for manual verification of "as kitted" versus "as designed". Exceptions are recorded and forwarded to Configuration Management for investigation and correction. Exceptions are manually verified against the acceptable range of revision levels which is a time-consuming and labor intensive process. The verification of "as kitted" versus "as built" is labor intensive. The verification of "as designed" versus "as built" is also labor intensive.

1.2.1.3 Preparation of Assembly Log Book and Engine Shipping Book

Assembly Log Books are currently run manually and are transmitted in assembly sequence rather than part number sequence. These procedures are labor intensive and prone to errors and delays.

Because current methods are labor intensive, non-integrated and can result in degraded response time, a computer-based system becomes necessary for an

automatic data collection, verification and document generation in near "real time". Hence, there is a need for a system like CALB.

1.3 OVERALL OBJECTIVES OF CALB

CALB provides the means for integrating many systems, significantly reducing labor cost associated with preparing the assembly log book and shipping book. CALB also improves the quality of these books. The system provides a near real time configuration exception reporting, and control of the assembly process. CALB eliminates the need for making multiple copies of assembly paperwork by providing the ability to display assembly paperwork at workstations.

1.3.1 Specific Objectives of CALB

There are several major objectives of the CALB system. These are provided as follows.

1. Develop an integrated computer system that includes: bill of material, inventory control, engineering change management, configuration control by serial number, and engine log books.

2. Develop reporting of configuration exceptions in near real-time.

3. Develop printing ability of computer generated portions of an assembly log book and engine shipping book. This task includes: a) electronic reproduction of Assembly Order Routings tied to Engine

Serial Numbers, and, b) electronic reproduction of the Manufacturing Bill of Material.

4. Enhance capability for serial number control and verification.

5. Develop capability of on-line storage and retrieval of current engine configuration and Component Replacement History.

2.0 STATEMENT OF WORK

2.1 PROTOTYPE AND DEMONSTRATION

Per the contract, TCAE was required to build a system prototype to evaluate and demonstrate the following tasks within the CALB system.

1. Demonstrate a computer generated assembly log book in original print quality.

2. Demonstrate an integrated computer system to include: bill of material, inventory control engineering change management and engine log book.

3. Compare the "as-built" data to the engineered configuration and generate exception reporting.

4. Collect the "as-built" data via a document scanner or equivalent.

5. Store and retrieve engine configuration and Component Replacement History.

Evaluation and demonstration of these tasks are discussed in later chapters.

2.1.1 Final Design

A detailed design is established to fully define the production operation of the technology based on the results of the prototype and demonstration effort. The impact of applying technology within manufacturing, manufacturing engineering and quality procedures has been made.

2.1.2 Implementation Plans

Plans for plant-wide implementation of the CALB system have been developed. They include: 1) details on needed hardware and software, 2) details of training requirements and 3) assignments of tasks to various functional departments.

2.1.3 Capital Equipment Requirements

Hardware and software requirements for plant-wide implementation of the CALB system in TCAE-Gainesville facility have been identified.

3.0 SUBCONTRACTOR STRUCTURE

In order to meet project objectives and Statement of Work requirements, Teledyne CAE established a subcontractor structure as shown in Figure 3-1.

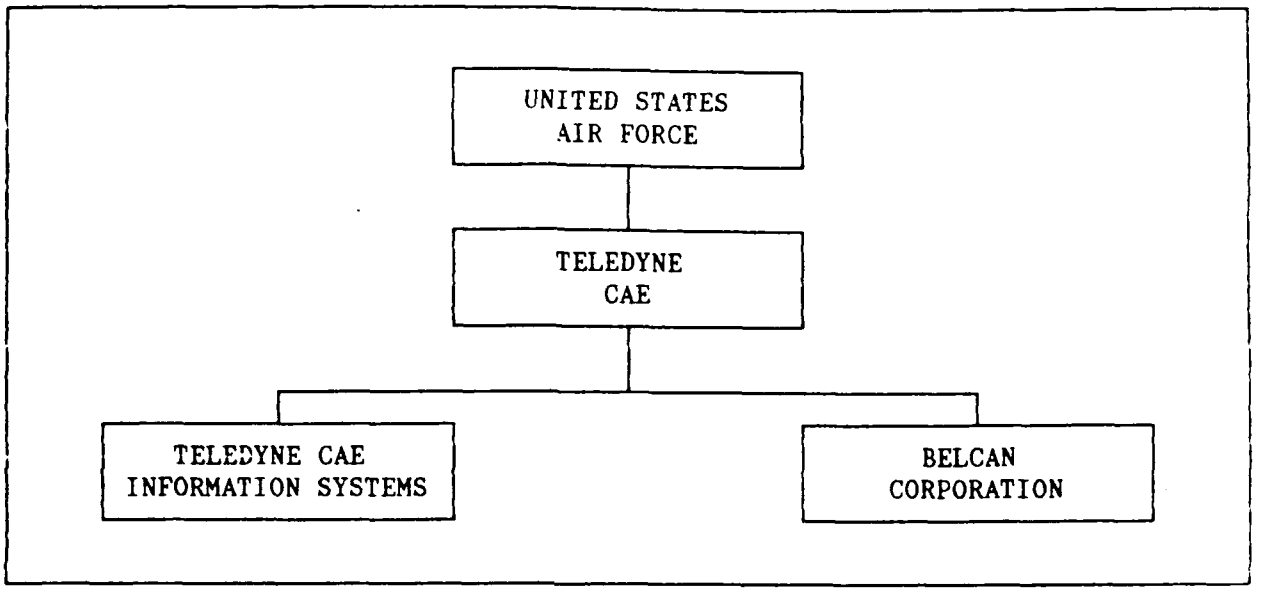

Figure 3-1. CALB Project Subcontractor Structure.

Funds for development of the CALB prototype system were made available to Teledyne CAE by the United States Air Force. Teledyne CAE subcontracted Belcan Corporation to develop and demonstrate "KIT ENGINE" module of the CALB system. Belcan's report/documentation on the subject development effort, which includes user's manual, has been included in this report as Appendix C.

Teledyne CAE further contracted its Information Systems group (I/S) to develop "Assemble Build Book" and "Engine Build Book" modules of the CALB system. TCAE I/S study, which includes user's manual, has been attached to the appendix section of this report as Appendix B.

4.0 CALB SYSTEM OVERVIEW

4.1 GENERAL PROCESSING RULES AND ASSUMPTIONS

The CALB system has been designed under the following processing rules and assumptions:

1. The TIMS system, resident in the Toledo IBM computer, is used to house the Bill of Material (BOM) library.

   NOTE: TIMS2 is a simplified version of TIMS engine database which contains BOM and Quality Operating Instructions (QOI) for all engines manufactured in the TCAE-Gainesville facility. The TIMS2 data set is physically downloaded onto the Gainesville DEC VAX computer once a month, prior to engine build.

2. Assembly Order Routings (AORs) are stored, maintained, and produced from the TIMS2 system.

3. Assembly Shop Orders (ASOs) are kept under separate procedures in the assembly area.

4. CALB tracks serial numbers of all parts (purchased, manufactured, fabricated, etc.) issued directly to the engine assembly.

4.2 ASSEMBLE BUILD BOOK FUNCTION

The build book is used to maintain a historical record of the process of

building and testing an engine through completion. A build book is assembled for each engine scheduled to be built. This assembly process consists primarily of inserting blank documents into proper sections of the book. The documents are then completed at various stages of the build and test processes. The following documents comprise the build book. Departments responsible for maintaining said documents have also been identified. (Reference circle 1.0 on the Data Flow Diagram, Figure 4-1, page 4-3.)

Documents	Maintained By
o Assembly Order Routing (AOR)	TIMS2
o Engine Backup Data Sheets	Production Control
o Assembly Parts List (APL)	CALB
o Nonconformance Log	Quality Assurance
o Engine Assembly Work Sheet	Quality Assurance
o Router Sheet and OK for Test	Quality Assurance
o Nondestructive Inspection Record	Quality Assurance
o Disassembly Inspection Record	Quality Assurance
o Envelop Acceptance Gage	Quality Assurance
o Flow Test Records	Quality Assurance
o F107 Gearbox Assembly	Quality Assurance

Some of the documents identified above travel with material as it moves through the assembly and test process. Additionally, the AOR is maintained in the TIMS2 database. When requesting a copy of the AOR, the terminal operator supplies a starting engine serial number which is printed on the router. Serial numbers are incremented when copies for multiple engines are made. The APL is generated electronically from the configuration established during Green Build. All other documents continue to be prepared manually.

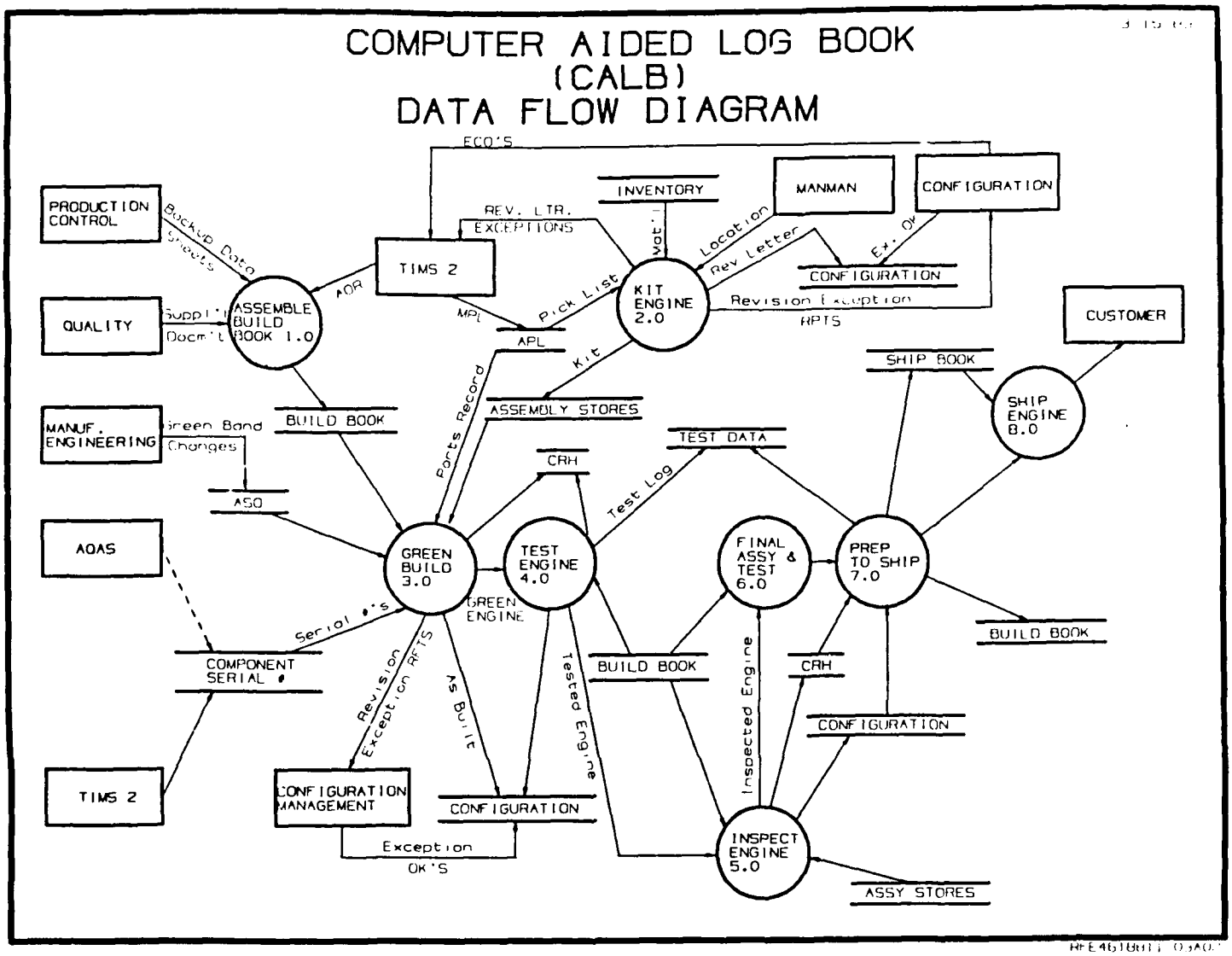

Figure 4-1. CALB Data Flow Diagram.

4.3 KITTING ENGINE FUNCTION

The Manufacturing Parts List (MPL) downloaded from TIMS2 is merged with location and inventory data from MANMAN to generate a material pick list. The CALB and Automated Storage and Retrieval System (AS/RS) interface is used to select required material. (Reference circle 2.0 on the Data Flow Diagram, Figure 4-1.) Significant features of the Kitting Engine Module are provided below.

- Component revision letter is checked and recorded at issue by the operator. Exceptions are noted and recorded electronically. Exception reports are also forwarded to Configuration Management.

- Terminal operator supplies the following information: initial engine serial number; engine quantity; and contract number.

- Work-in-process material is trucked to the assembly area in kit form.

- Issuing excess material to a work order causes severe fluctuations in a Material Requirements Planning (MRP) system. Therefore, all material is accounted for through inventory control personnel prior to the issuance of excess material.

- This process electronically records each serial number issued, and builds a skeleton configuration file for all configured parts (i.e., those parts whose revision letter is controlled).

- Configuration subsystem contains the following fields.

Field Name	Type	Field Length
Engine Part Number	A	15
Engine Serial Number	N	12
Engine Model Code	A	18
Engine Starts	N	2
Engine Build Number	N	2
Date	A	8
Component Part Number	A	15
Component Serial Number	A	12
Component Change Letter	A	2
Revision Letter Exception	A	1
Group Number	A	1

A = Alpha; N = Numeric

4.4 ENGINE GREEN BUILD FUNCTION

This process describes the complete assembly of an engine prior to initial test. During this process, serial numbers are recorded electronically via CRT into the CALB database. (Reference circle 3.0 on the Data Flow Diagram, Figure 4-1.) Significant features of this module are given below.

- Component serial numbers are entered when required. This facility is required for recording serial numbers for purchased or manufactured components whose data has not been recorded previously.

- To ensure that the components have not been swapped inadvertently between kit and build, the component change letter is validated against the APL one more time. Violations cause a warning message to the terminal operator, and an entry is recorded in the Configuration Exception field for that component. An exception report is also forwarded to the Configuration Management.

- An entry in the BOM indicates components which are serialized and need to be tracked through the serialization file.

- Component serial numbers are checked against a file of valid serial numbers of components available for engine build. If the serial number check fails then an appropriate terminal message is issued to the operator.

- The validation process described above sets a flag in the serial number file which indicates which serial numbers have been issued by part number.

- Component movement into and out of an engine assembly is recorded electronically. This data is recorded in the Component Replacement History (CRH) file.

- In the event that a component needs to be replaced, the following additional data is required:

    1. Engine serial number
    2. Component part number

3. Comments/remarks
4. Outgoing component serial number
5. Test time, if any, on outgoing serial number
6. Number of starts on out-going serial number
7. Build number on outgoing serial number
8. Incoming component serial number. Incoming components must satisfy the following edit criteria:
   - The component serial number must be valid.
   - The revision letter must be valid; if not, exceptions are noted and need to be approved.
   - If the component is currently assigned to an engine, the link is broken and a CRH record is established which identifies the break.
9. Test time, if any, on incoming serial number
10. Number of starts on incoming serial number
11. Build number on incoming serial number.

- Component movement direction of new or old components. Component movement direction (In/Out of the engine assembly) is recorded indicating activity related to old part out, new part in or one part being exchanged for another acceptable part.

- Records of the above transaction are kept in the Component Replacement History file. This file is linked to the configuration file, and contains the following additional fields data.

Field Name	Type	Field Length
Transaction Date	A	8
Component Movement Status	A	1
Run Time	N	8
Starts	N	2
Build Number	N	2
Remarks	A	180
Disposition	A	180

A = Alpha; N = Numeric

4.5 ASSEMBLE, TEST AND SHIP BOOK

After the engine has been assembled at the "Green Build" stage, it is then sent to "Engine Testing" operation. (Reference circle 4.0 on the Data Flow Diagram, Figure 4-1.) Engine testing operation is highly automated, and test data is printed out via test computer for further analysis. This test data becomes part of the engine test history; CALB system does not interface with test cells, or extract any test data.

Per quality engineering procedures, tested engines are further routed for the "Engine Inspection" operation. (Reference circle 5.0 on the Data Flow Diagram, Figure 4-1.) If required, engines are disassembled, replaced with new components, reassembled and retested. This cycle of engine testing and retesting continues until engines meet performance goals. CALB system keeps record of serial numbers of replaced parts, and those of new parts installed.

In addition, number of starts, run time on engines and components are also recorded automatically. (Reference circles 5.0 and 6.0 on Data Flow Diagram, Figure 4-1.) The completed engine, with acceptable performance characteristics, is then prepared for shipment. Ship book containing necessary engine serial records, performance data along with several manually prepared forms become part of the "engine ready to ship" document. (Reference circles 7.0 and 8.0 on Data Flow Diagram, Figure 4-1.) All engine data e.g., serial numbers, performance data, etc. collected in the CALB system become permanent history. This history is archived.

5.0 CALB SOFTWARE AND HARDWARE OVERVIEW

5.1 GENERAL DESCRIPTION

This chapter describes hardware and software configurations, and their locations as established under the CALB prototype system.

5.1.1 CALB Hardware Configuration Diagram

Figure 5-1, page 5-2 illustrates linkage between various computers located in Teledyne CAE - Toledo and Gainesville facilities. The Toledo based IBM 3033 computer houses the TIMS manufacturing system. This system contains a full bill of materials based upon engine serial number effectivity and it reflects the progression of engineering change letters, fabrication routings, and a Quality Control inspection standards system. Serial number on components available for engine assembly are entered on files resident on the TIMS database.

Toledo based IBM 3033 is linked to Gainesville based VAX 11/780 computer via communications network system as shown in Figure 5-2. Gainesville based VAX 11/780 computer system contains MANMAN system which is used to house TIMS2 database with a simplified bill of materials, fabrication routings, inventory, shop floor data and MRP. VAX 11/780 is further linked with Litton Automated Storage and Retrieval System (AS/RS) via PDP 11/34 micro computer as shown in Figure 5-1.

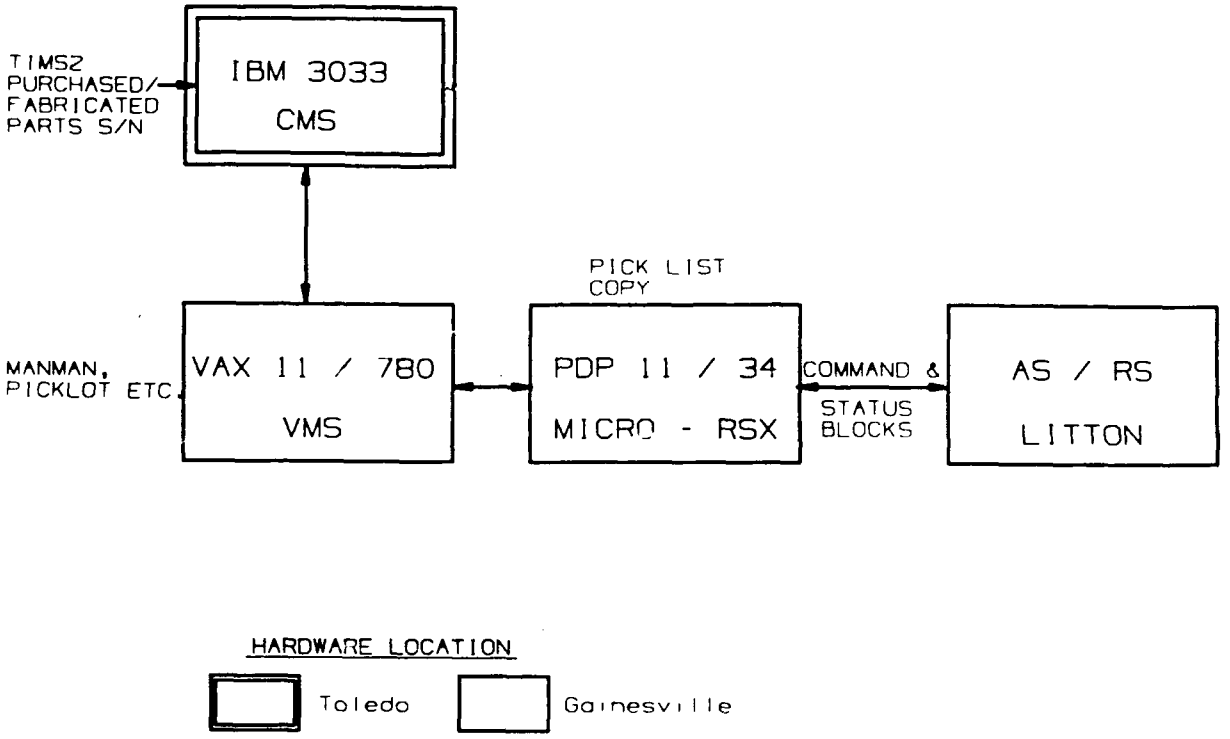

Figure 5-1. CALB Hardware Configuration Diagram.

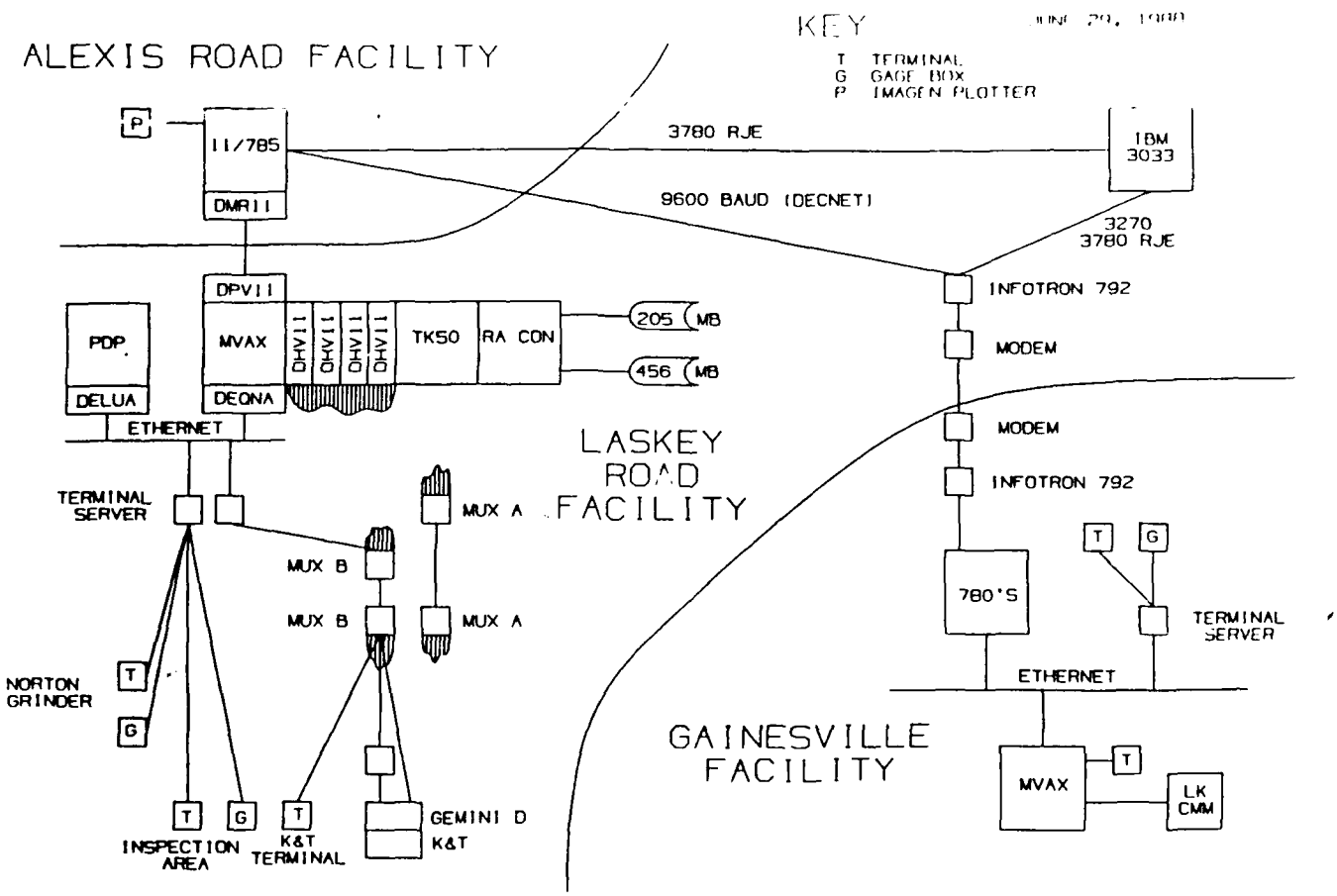

Figure 5-2. Communication Network System Between Teledyne CAE Toledo and Gainesville Facilities

5.1.2 CALB Software Requirements

In order to meet objectives of the CALB system, special software was developed in addition to existing software e.g., MANMAN and TIMS systems. Special software is described as follows.

5.1.2.1 Software for "Assemble Build Book" and "Green Build" Functions

Toledo based Information Systems group developed software needed for the "Assemble Build Book" and "Green Build" functions through the engine testing and shipping functions. Full description of the software related to these tasks have been provided in the User's Manual, Appendix B.

5.1.2.2 Software for "Kitting Engine" Function

Belcan Corporation developed software needed for kitting of engine components from the AS/RS system per engine components list generated by the TIMS2 system. The software resides on MANMAN/VAX systems and interfaces with Litton AS/RS system via a PDP-11 computer. The CALB kitting software processes the component list and is downloaded from the TIMS2 database with the MANMAN database. If the lists match entirely, engine kitting operation takes place. This task further consists of automatically fetching the components from the AS/RS, and then updating the MANMAN database accordingly. A full description of the software related to kitting functions has been described in the User's Manual, Appendix C.

6.0 PROTOTYPE DEMONSTRATION

6.1 GENERAL OVERVIEW

To meet objectives of the Statement of Work, prototype demonstration was prepared for presentation to the representatives from Wright-Patterson Air Force Base, Dayton, OH. The formal presentation will be conducted in late 1989 at the Teledyne CAE facility in Gainesville, GA. This chapter covers essentials of the planned demonstration and the findings made during in-house systems testing.

6.1.1 Database for CALB Prototype Demonstration

Actual data from Teledyne CAE engine, model 373, was selected for the CALB system demonstration. Manufacturing Parts List (MPL) for the engine #724951 (model 373) contains two-hundred thirteen (213) line items. This extensive part list was however, abbreviated to contain eight (8) parts only for use in the CALB system demonstration. Four of these parts require serial number control, others are non-serialized floor stock items. This abbreviated list formed a subassembly, part #724591-DEMO, and was found adequate to demonstrate essential elements of the CALB system.

6.2 BUILD PART FILE

The objective of this interface is to build a database for the CALB system. The Part File contains a variety of data relating to all kinds of parts that are recognized by Teledyne CAE. There are manufactured parts, purchased parts, and even research and development-only parts on the file. Software for the "Build Parts File" facility was developed by Teledyne CAE prior to the CALB system development. Since this file serves as an essential building block for the CALB system, some discussion and demonstration of this facility is needed.

To start input into the Parts File, main menu OIMENU1 is invoked. Menu screen for OIMENU1 appears as shown below.

```
OIMENU1          MANUFACTURING PART/ PRODUCT STRUCTURE SYSTEM
                                MASTER MENU

     0. EXIT SYSTEM
     1. EXIT MENU SYSTEM
     2. UPDATE MENU
     3. INQUIRY MENU
     4. UNIT-OF-MEASURE MENU

      PLEASE MAKE A SELECTION AND PRESS ENTER
```

Figure 6-1. Manufacturing Parts Master Menu.

Option 2 (OIMENU2) is used to update the Part Record. Menu screen for OIMENU2 appears as shown below.

```
OIMENU2          MANUFACTURING PART/ PRODUCT STRUCTURE SYSTEM
                              MAINTENANCE MENU

0. RETURN TO MASTER MENU
1. ADD A PART RECORD
2. CHANGE A PART RECORD
3. DELETE A PART RECORD

4. RELEASE AND CANCEL PRODUCT STRUCTURE RECORDS
5. MISCELLANEOUS PRODUCT STRUCTURE CORRECTIONS
6. CANCEL PRODUCT STRUCTURE RECORDS

PLEASE TYPE THE NUMBER OF THE SELECTION YOU WANT AND PRESS ENTER
```

Figure 6-2. Manufacturing Part Maintenance Menu.

As per the CALB Prototype System, to add a part record, option 1 is selected. Figure 6-3 illustrates option 1 screen with input data for P/N 723675 entered.

```
OINPART                          ADD A PART RECORD

PART-NUM:

REV-LTR:          CRIB:

PART-DESCRIPTION:                                          MB:

S/S:      PROC-CODE:

MODEL-CODE:                        CAT:      MATL-SPEC:

SIZE:

CTRL-FLG2:            REPAIR/REWORK (BLANK OR "BMPIRE"):   ASSY:
```

Figure 6-3. Add a Part Record Screen.

Various options available for the Part Record Maintenance are shown in Figure 6-2, page 6-3.

6.2.1 Build Bill of Material File

This interface was also developed by Teledyne CAE prior to CALB system development. The data is used as a standard during the evaluation of the relationship between particular engine serial numbers and the change letters of the components that go into them. A warning message is generated whenever a component revision number is not appropriate. The bulk of the module performs a separate set of functions and was developed previous to the CALB system. The menu screen pertaining to the BOM file is shown in Figure 6-4 below.

```
OICRELPS        RELEASE AND CANCEL PRODUCT STRUCTURE RECORDS
OLD-MFG-PART-NBR:
NEW-MFG-PART-NBR:
NEXT-ASSY-PART-NBR:
OLD-QTY:          NEW-QTY:          REF:      SER CTRL (USE "B" FOR BLANKING:
OLD-CHG:     NEW-CHC:     UM-MFG:           UM-COST:
MODEL-CODE:
ENGINE SERIAL NBR:
CANCEL ALSO?:
```

Figure 6-4. Bill of Material (BOM) Menu.

Figure 6-5 below illustrates Product Structure Explosion for the CALB system prototype data containing two (2) components.

```
OIIPS     PRODUCT STRUCTURE INQ MFG SINGLE LEVEL EXPLOSION
          MANF. PARTS - LATEST CONFIGURATION ONLY

PART-NUM: 723675

PART-DESCRIPTION            DRAWING NUM        REV-LTR
STATOR, AXIAL, 1 STG        723675             -M--
     PART-NUMBER            PART-DESCRIPTION                  QNA REF MB REV-LTR
     ------------------ ------------------------------ -------- --- -- -------
     UM-MFG   UM-COST
     -------- --------
     C723675                STATOR CSTG, AXIAL, 1 STG      1.0000     B  -E04
     EA       EA
     C723675-402            CSTG STATOR-1ST STG (QUALIFYIN 1.0000     B  -E06
     EA       EA
```

Figure 6-5. Product Structure Explosion for CALB Prototype Parts.

6.3 BUILD MODEL FILE

Part "model" section is a secondary or support module to maintain a list of the serialized components to be tracked at a given time for a particular engine model. This list is updated as often as the configuration of an engine changes. It performs the following specific functions:

- Provides a list of part number prompts for the user responsible for recording the serialized components being placed in a specific engine.

- Enforces a particular order of printing of serialized components on the "Engine Configuration" report.

The model section also contains general information concerning an engine that is used to expedite loading and printing of the serialized component data. This data includes a model "name", top-engine and base-engine part numbers, and an engine serial number prefix. This data is used for the following purposes:

- The model "name" and the top-engine part numbers are all printed on the "Engine Configuration" report.

- The top-engine part number is also used as a search argument on the TIMS2 Bill of Material (BOM) file at the time of editing component change letter.

- For most data entry purposes, any need to identify a full engine serial number is eliminated. Used in place of the full engine number is a one-position engine model code and a base engine number - which taken together may be input with relatively fewer key strokes. For example, the F107 engine prefix of "VE-E" is represented by the one position "C". In those few cases where a full engine serial number is required - such as for formal reporting purposes, the system automatically performs a switch based upon the model files, replacing the shorter model code and the base serial number with an extended number.

Figure 6-6 provides a display of Model Configuration for CALB prototype engine, model number "Y". Data for the prototype demonstration uses (4) components that require serial number control as shown below.

```
CFIMOD          DISPLAY A MODEL CONFIGURATION

MODEL NUMBER: y
MODEL NAME       MODEL PART NUMB MODEL PREFIX BASE PART NUMBE
DEMO             724951-DEMO     CA-E         724951-DEMO-1
      GRP TITLE              STANDARD PART
      ---- ---------------- ----------------
        10 SEAL,INTERNAL    309826
        20 BRG, BALL        309895
        30 STATOR,AXIAL     723675
        40 SHROUD ASSY      724566-101
```

Figure 6-6. Model Configuration for CALB Prototype Engine, Model Y.

6.4 BUILD PART SERIAL NUMBER AVAILABILITY FILE

This module holds a list of serialized component candidates for use in an engine. This list is used as the basis for an edit of serial number availability for engine assemblies. When a particular serial number has been committed to an engine, then the record of that commitment is also retained in the system. The main menu used for building a Serial Number Availability file is shown in Figure 6-7, page 6-8.

OIMENU3 MANUFACTURING PART/ PRODUCT STRUCTURE SYSTEM
INQUIRY MENU

0. RETURN TO MASTER MENU
1. PS COMPONENT SERIAL NUMBER INQUIRY
2. PS WHERE-USED INQUIRY
3. PRODUCT STRUCTURE INQ MFG SINGLE LEVEL EXPLOSION
4. PRINT ALL THE COMPONENTS FOR A PART - ON THE CONSOLE
5. PRINT ALL THE COMPONENTS FOR A PART - ON FILE OIIALL1 MITROL
6. PRINT AN ASSEMBLY BILL OF MATERIALS ON SPECIAL FORM - ONLINE
7. PRINT MULTIPLE ASSEMBLY BILLS OF MATERIALS ON SPECIAL FORM - BATCH
8. PRINT AN ASSEMBLY ROUTING ON SPECIAL FORM - ONLINE
9. PRINT MULTIPLE ASSEMBLY ROUTINGS ON SPECIAL FORM - BATCH

PLEASE TYPE THE NUMBER OF THE SELECTION YOU WANT AND PRESS ENTER

Figure 6-7. Menu Screen to Build Part Serial Numbers.

Part Serial Numbers are loaded into the data base using option #1 in the main menu screen. Option #1 menu screen appears in Figure 6-8, where additional data and number of units available are also entered.

CFNSER LOAD SERIAL NUMBERS TO THE SERIAL NUMBER AVAILABILITY FILE

PURCHASED ("P") OR MANUFACTURED ("M"):

PART NUMBER: SERIAL NUMBER: NBR OF UNITS:

Figure 6-8. Screen to Add Part Serial Numbers.

Figure 6-9 below displays Availability Status for Part #723675; nine (9) parts being available for engine building. This part number is one of the components used in the CALB prototype system demonstration. The status also displays serial numbers available for the engine assembly.

```
CFISER                  DISPLAY AVAILABILITY STATUS FOR A PART

PART NUMBER: 723675

SERIAL NUMBR IN-USE-NOW USING ENGINE
------------ ---------- -------------
301
302
303
304
305
306
307
308
309
```

Figure 6-9. Part Availability Status Display.

The last-using engine data can later be referenced when a component is removed from one engine and eventually applied to another engine. Thus, it serves as a cross reference to the old engine so that start and run-time statistics can be applied to the new.

6.5 BUILD ENGINE FILE

Figure 6-10, Engine Configuration Menu, is invoked to build and maintain production engine configuration during green build and test operation.

CFMENU4 PRODUCTION ENGINE CONFIGURATION SYSTEM MAINTENANCE MENU
FOR ASSEMBLY AND TEST

0. RETURN

1. ADD AN ENGINE
2. REVISE AN ENGINE
3. SHIP AN ENGINE AND CLEAR SERIAL NUMBERS
4. SCATTER AN ENGINE"S COMPONENTS
5. REVISE ENGINE STATS

PLEASE MAKE A SELECTION AND PRESS ENTER

Figure 6-10. Engine Configuration Maintenance Menu.

Selecting option #1 - ADD AN ENGINE - creates a new engine identity beginning with an engine record. Reference Figure 6-11 below for "Add an Engine Configuration" menu screen illustrating inputs for model number Y and the engine serial #1 - data for CALB prototype demonstration.

CFNCFG ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: y ENGINE SER #: 1

TRN-DATE: 02/22/89

BUILD NBR: 0 BUILD DESCRIPTION:

STARTS: 0

INCREMENTAL RUN HRS: 0 INCREMENTAL RUN MIN: 0

Figure 6-11. Add an Engine Configuration Menu.

The transaction also creates configuration records for each component identified on the model files as going into an engine of a particular model. A component replacement history (CRH) record is also created for any serialized component which has been used before in another engine and previously removed from it.

Engine build and run statistics can be input using options available on figure 6-10. In addition, the following major edits are available within this menu option.

- o A serialized component can only be used in one engine at a time.
- o A deviation in engineering change letter causes the system to generate a warning message on the console, and marks the serialized record as being deviant.
- o A serialized component not found to be "available" (i.e., not entered on the serial number availability file) produces a reject diagnostic, but can be overridden by an authorized person.
- o If a user overrides a part number with an invalid part number, the line is rejected.

Reference must be made to system user's guide, Appendix P, for further details on various options available, and the procedure on how to utilize system for the engine configuration. Figure 6-12 illustrates input data for engine configuration of the CALB prototype engine, serial #1, model Y. The printout

reflects all parts that build a complete prototype engine, with appropriate engine revision letters and the serial numbers.

```
CFNCFG              ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: y ENGINE SER #: 1
01 GRP PART-NUMBER     TITLE          | REV SERIAL-NUMBR
=> 010 309826          SEAL,INTERNAL
=> 020 309895          BRG, BALL
=> 030 723675          STATOR,AXIAL
=> 040 724566-101      SHROUD ASSY
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> .
```

Figure 6-12. Add Engine Configuration for CALB Prototype Engine.

6.6 ENGINE KITTING OPERATION

The kitting interface of CALB (referred to as CALB/KIT for convenience) has been developed by Belcan Corporation. The input to the kitting interface is an engine components list that is generated on the TIMS2 system in Toledo. (Refer to circle 2.0, Figure 4-1.) It consists of a list of components required to kit a set of engines, and includes for each component, the quantities required and an upper bound of acceptable revisions for each component. This list of components is then downloaded to a directory readily accessible by CALB/KIT. CALB/KIT processes this list and compares it against a MANMAN generated work order, as shown in Figure 6-13.

```
WORK ORDER NUMBER? CALB      *

==========================================================================
WORK ORDER NUMBER: CALB                                    DATE: 03/10/89
PART NUMBER: 724951                    GENERAL WIP ACCT: 1093
PART DESCRIPTION: 373 TURBOJET ENGINE ASSEMBLY   UOM: EA  SC: M   REV:
PROJECT ACTIVITY: 1093                          COST CATEGORY: 130600
==========================================================================
ORDER QUANTITY:                2.00   DATE ENTERED:              02/02/89
COMPLETED QUANTITY:            0.00   DATE CLOSED:               99/99/99
QUANTITY SCRAPPED:             0.00   LATEST DUE DATE:           05/01/89
RE-WORK:                         NO   ORIGINAL DUE DATE:        05/01/89
REVISION:                             SCHEDULED KIT DATE:        03/06/89
SALES ORDER NUMBER:        1093       MRP/MPS NEED DATE:         02/01/90
KIT LIST PRINTED:                NO   PLANNER CODE:                   03
STATUS:          RELEASED, UNKITTED   COMPONENTS ALLOCATED:          YES
LOT TRACKING:                    NO   NETTABLE:                     YES
==========================================================================
```

Figure 6-13. MANMAN Generated Work Order for Engine Kitting.

If the list matches the MANMAN work order completely, then CALB/KIT performs the engine kit. The engine kit consists of automatically retrieving the components from the Automated Storage and Retrieval System (AS/RS), and then updating the MANMAN database to mark the work order as kitted.

During the kitting process, deviations may occur. A deviation occurs when the component revision number in AS/RS inventory is higher than the highest accepted revision indicated on the downloaded bill of material. Each deviation is written to a deviation file that is then sent (via RJE) to the TIMS2 system for necessary action by the configuration manager.

Reference must be made to the APPENDIX C: USER'S MANUAL FOR "KITTING ENGINE FUNCTION" for a detailed discussion on the use of CALB/KIT interface. No further discussion on this interface is provided in this chapter.

6.7 BUILD GREEN ENGINE BUILD FILE

As the engine is being green built (assembled for the first time), assembly operator or quality personnel record all part numbers, and their serial number data via CALB system facilities shown in Figure 6-10. After the engine has been built, its configuration can be displayed, as shown in Figure 6-14, below. Column headings are explained in the user's manual.

CFICFG **DISPLAY AN ENGINE CONFIGURATION**

MODEL NUMBER: **ENGINE SER #:**

HOLD-ASSEMBLY: *TRN DATE: 02/22/89 BLD:* 1
BUILD DESCRIPTION: GREEN BUILD INSP INIT: QE INIT:

GRP	TITLE	PART NUMBER	SERIAL NBR	REV	D	TRN DATE	BLD	STS	RUN HRS	MIN
010	SEAL,INTERNA	309826	101	-A		02/22/89	0	1	2	25
020	BRG, BALL	309895	204	-A		02/22/89	0	1	2	25
030	STATOR,AXIAL	723675	303	-A		02/22/89	1	1	2	25
040	SHROUD ASSY	724566-101	403	-A		02/22/89	0	1	2	25

Figure 6-14. Display of Engine Configuration at Green Build.

6.8 REVISE ENGINE CONFIGURATION

The CALB system provides for recording revisions in engine configurations necessitated during engine testing and retesting cycles prior to engine shipping task. Options #2 and/or #5 of Master Engine Configuration Menu per Figure 6-10, page 6-10, are invoked for initiating and recording all revisions.

Screen for option #2: Revise Engine Configuration is shown in Figure 6-15 below.

```
CFUCFG          REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: y ENGINE SER #: 1
TRN-DATE: 02/22/89

INCREMENTAL BUILD: 1     BUILD DESCRIPTION: 2nd BUILD

INCREMENTAL STARTS: 0

INCREMENTAL RUN HRS: 0       INCREMENTAL RUN MIN: 0
```

Figure 6-15. Revise Engine Configuration Screen.

Figure 6-16 displays engine configuration after axial stator, part #723675, serial #303 has been replaced with serial #305.

```
CFNCFG              ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: y ENGINE SER #: 1
01 GRP PART-NUMBER     TITLE          | REV SERIAL-NUMBR
=> 010 309826          SEAL,INTERNAL    -a  101
=> 020 309895          BRG, BALL        -a  204
=> 030 723675          STATOR,AXIAL     -a  303
=> 040 724566-101      SHROUD ASSY      -a  403
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> .
```

Figure 6-16. Revised Engine Configuration Display.

Before transaction for any revision can be completed, the CALB system requests data related to replaced part, and reason for the revision and/or replacement. This data becomes part of the Component Replacement History (CRH) record. Figure 6-17 below shows input data entered, while part #723675, serial #303, was replaced with an identical part, serial #305.

```
CFUCFG          REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: y ENGINE SER #: 1
CORRECTION/CHANGE LOG ROUTINE: TO ESCAPE WITHOUT UPDATE, INPUT A "."

GRP: 030 PART-NUMBER: 723675          TITLE          |: STATOR,AXIAL    REV: -A
SERIAL-NUMBR: 305          F/C: a
:
REMARKS(1): burnt bearings
REMARKS(2):
```

Figure 6-17. Revised Engine Configuration for CRH File.

Figure 6-18 below displays complete engine configuration after second Engine Build, with replacement of new part, Axial Stator, part #723675, serial #305 has been completed. Transaction date, build history, run time data for new part, etc., are recorded automatically. (Compare input data for same part in Figure 6-14.)

```
CFICFG              DISPLAY AN ENGINE CONFIGURATION

MODEL NUMBER:    ENGINE SER #:

HOLD-ASSEMBLY:    TRN DATE: 02/22/89 BLD:    2
BUILD DESCRIPTION: 2ND BUILD              INSP INIT:       QE INIT:

GRP TITLE         PART NUMBER  SERIAL NBR REV D TRN DATE  BLD  STS RUN HRS  MIN
--- ------------ ------------ ---------- --- - -------- ---- ---- ------- ----
010 SEAL,INTERNA 309826       101        -A    02/22/89    1    1       2   25
020 BRG, BALL    309895       204        -A    02/22/89    1    1       2   25
030 STATOR,AXIAL 723675       305        -A    02/22/89    1    0       0    0
040 SHROUD ASSY  724566-101   403        -A    02/22/89    1    1       2   25
```

Figure 6-18. Revised Engine Configuration After Replacing P/N 723675, S/N 305.

6.9 ENGINE COMPONENT REPLACEMENT HISTORY (CRH) RECORD

As the engine configuration record is revised during engine testing and retesting, the CALB system provides opportunities to enter pertinent data on replaced components and new components. The data become part of the CRH Record which can be displayed as shown in Figure 6-19 below.

```
CFICFG1  DISPLAY AN ENGINE CONFIGURATION REPLACEMENT HISTORY

MODEL NUMBER: y ENGINE SER #: 1

HOLD-ASSEMBLY:    TRN DATE: 02/22/89 BUILD NBR:     2
BUILD DESCRIPTION: 2ND BUILD              INSP INIT:        QE INIT:

IN OR OUT: E GRP: 030 TRN DATE: 02/22/89

PART OUT: 723675          REV OUT: -A  SER NBR OUT: 303          BLD OUT:    1
F/C: A RUN HRS OUT:      2 RUN MIN OUT:   25 STARTS OUT:    1

REMARKS(1): BURNT BEARINGS
REMARKS(2):

 PART IN: 723675           REV IN: -A   SER NBR IN: 305
        RUN HRS IN:      0  RUN MIN IN:    0  STARTS IN:    0
```

Figure 6-19. Engine Configuration Replacement History Display.

6.10 SHIP ENGINE AND SIGN OFF RECORD

By invoking option 16 (program CFUCFG3, Document reference #M5-16 in Appendix B), engines tested and accepted are "shipped" with records as shown in Figure 6-20, page 6-18. Identifications of the inspector and quality engineer accepting final engine configuration and its performance are added at this stage. These identifications become part of the engine history for later reference.

```
CFUCFG3              CONFIGURATION REPORT SIGNOFFS BY ENGINE

MODEL NUMBER: y ENGINE SER #: 1

INSP INIT: JDW

QE INIT: DKB
```

Figure 6-20. Ship an Engine and Sign Off Menu.

Execution of the ship task automatically clears the Part Availability file as shown in Figure 6-21. Status of the part number 723675, serial #303 has been displayed as used in engine model Y, serial #1 (CALB prototype engine). S/N 303, thus, is not available for any engine assembly - its association with engine Y1 can be retrieved for future reference.

```
CFISER                DISPLAY AVAILABILITY STATUS FOR A PART

PART NUMBER: 723675

SERIAL NUMBR IN-USE-NOW USING ENGINE
------------ ---------- -------------
301
302
303                      Y1
304
306
307
308
309
```

Figure 6-21. Display Availability Status of Shipped Part.

7.0 FINAL DESIGN

7.1 BASIS FOR THE FINAL DESIGN

The Statement of Work requirements led to the preliminary system design which established the basis for the software and hardware requirements. The screening of the potential vendors was carried out by representatives from a variety of technical, legal and purchasing bodies inside Teledyne. That review was made in accordance with Corporate policies and procedures governing such activities. The potential vendors were graded for their ability to meet a spectrum of technical specifications that covered development, delivery and post-installation performance within specific guidelines. Through a process of vendor analysis, selection of suppliers came down to a combination that included an outside vendor, Belcan Corporation, and a portion of TCAE's own internal programming staff. The prototype that was subsequently developed utilized a mixture of hardware and software resources including both DEC and IBM computers and a software base consisting of a pair of manufacturing systems, namely the MANMAN package which is resident on the DEC hardware, and a manufacturing system resident on the IBM called TIMS2. New software built on top of this combination under CALB project has been tested and successfully demonstrated. The learning acquired through this evolutionary process has provided the basis for the final design of the CALB system to be implemented plant-wide in the Teledyne CAE - Gainesville facility.

7.2 CALB SOFTWARE REQUIREMENTS

The CALB system was developed to provide a variety of new functions for Teledyne's Final Assembly and Test department. These functions are described in the following subsections.

7.2.1 Assemble Build Book Function

The function of this module is to generate two major print-documents that are used in the Assembly and Test area. These documents are the Assembly Order report which provides a Bill of Materials (or BOM) listing for every component sub-assembly that begins in the Assembly and Test area, and the Assembly Order Routing report which provides a set of basically free-form text instructions for the manufacture of the same sub-assembly parts. The prototype to be developed is capable of producing separate copies of each document by pre-printed engine serial number. Their printing is invoked exclusively by a single, simplified "trigger" consisting of a top-level engine part number, a first-engine serial number, and a count of consecutive engines for which documents are to be produced at one time. This single trigger automatically prints all documents necessary, for each part that is to be assembled in the assembly and test area.

7.2.2 Kit Engine Function

The function of this module is to drive the Automated Storage and Retrieval System (or AS/RS), which facilitates inventory kitting activity. The collection

of all levels of components being brought together in the Assembly and Test area occur at the same time. A simplified triggering mechanism is once more incorporated into the prototype. That trigger is a top-level engine part number, a first-engine serial number, and a count of consecutive engines for which kitting is to take place at one time. The total combined requirement for each component is presented by the prototype to the AS/RS as a single quantity. The number of units of each component is then automatically deducted from the on-hand balance being maintained on the inventory module of the existing manufacturing system.

The prototype recognizes and excludes from the kit those small components that are kept in the assembly area as floor stock items. In addition, any deviations in component change letter standards that are encountered during the kitting process are identified by the system and communicated to a configuration manager.

7.2.3 Engine Log Book Function

The function of this module is to support the tracking of major engine contents, both past and present, in terms of their individual serial numbers. Also to be tracked, by engine, is a count of the builds and teardowns that occur prior to shipment. A separate count of each component's cumulative Test Cell run time must also be maintained. The major output of the prototype are printed reports that indicate an engine's final configuration in terms of major serialized components, and an associated component replacement history (CRH)

including total test time. A system of simplified data collection is incorporated into the system to collect serialization data as follows:

1. A floor-assembler/clerk normally does not have to indicate the part numbers for which he is to record serial numbers. Based upon his specification of a model number, CALB presents the assembler/clerk a list of previously-loaded parts that require the input of serialization data.

2. The assembler/clerk is able to indicate exceptions to the pre-prepared lists, such as use of alternate part numbers.

3. Previous test time for a recycled component is automatically recalled at the time of recorded incorporation into another engine. This previous experience is automatically made a part of the engine's component replacement history.

4. The system is able to support the recognition of serial number exchanges within an engine. The exchanges are then automatically factored into an engine's component replacement history.

5. The system is available to support the input of serial data at any time between initial "green build", final assembly and shipment.

6. The system prohibits the association of a serialized component with more than one engine at a time.

7. Change letter deviations that are encountered during the kitting process (and consequently prior to assembly) cause the "locking" of the receiving engine to further file maintenance. In particular, serial number logging is locked until after a configuration manager is able to review the deviations and give approval or denial of them.

8. Change letter deviations are identified and logged during the Assembly process and after kitting. These deviations are flagged and reported to the configuration manager but do not cause "relocking" of the engine's logbook records.

9. Component "availability" checking occurs as a by-product of the logging of serialized components to an engine. The edit produced in this case creates only a warning that can be over-ridden by the assembler/clerk.

10. A "master" user has the unlimited ability to correct miscellaneous data problems associated with the logbook function.

11. The CALB system provides secured access to each functional area of the system.

12. The system provides a means of making electronic sign off to indicate approval of final engine configurations.

7.3 CALB HARDWARE REQUIREMENTS

The requirements that follow reflect the divided nature of base support systems used by CALB. In the Teledyne CAE Gainesville plant, some manufacturing activities are being tracked on the DEC-based MANMAN manufacturing system, while others are being supported on Toledo's IBM-based TIMS manufacturing system. There is some overlap between the two systems:

1. ON MANMAN: A simplified bill of materials, fabrication routings, inventory, shop floor, and MRP.

2. ON TIMS: A full bill of material based upon engine serial number effectivity and reflecting the progression of engineering change letters, fabrication routings, and a Quality Control inspection standards system.

The majority of the hardware required for the implementation of the CALP system is already in place and consists of the following items. Justification and procurement of additional hardware and software is to be made in the Phase III Implementation study.

DEPARTMENT/FUNCTION	TYPE OF EQUIPMENT	QUANTITY
Assembly and Test (Serial Number "Logbook")	CRT Terminal/Keyboard *	2
Quality Assurance (Overall control of the serial number "Logbook"; production of serial number logging reports)	CRT Terminal/Keyboard *	1
	Xerox Laser Printer Model 4045	1 **
Configuration Management (TIMS Engineering BOM and Engine Locking/Unlocking procedure as a response to "Kit Engine")	CRT Terminal/Keyboard *	1
Manufacturing Engineering (TIMS Manufacturing BOM and Assembly Routings - in preparation of the "Assemble Build Book")	CRT Terminal/Keyboard *	2
	Xerox Laser Printer Model 4045	1 **
Production Control (Generation of periodic "Assemble Build Book" reports; "Engine Kit", maintenance of the availability file for "Logbook"; physical kitting of inventory)	CRT Terminal/Keyboard	2
	Xerox Laser Printer Model 4045	1 **
General Maintenance of the CALB system	DEC Computer	1
	IBM Computer	1
	Communications Hardware	1

* DEC terminals that are able to communicate with the IBM computer using existing communications facilities.

** There is only one Xerox Laser printer and one DEC systems printer that can be shared by all user parties. The outputs from the IBM computer will also be printed on this pair of printers.

Note: All of the above equipment is to be located in the TCAE Gainesville, Georgia facility.

7.4 SYSTEM ENHANCEMENT RECOMMENDATIONS

The CALB prototype was developed in substantial part by in-house TCAE programming staff, and has been debugged and reviewed by a combination of that staff and by representative end-users. Some parts of the code had been developed in-house years previous to the advent of CALB. Other aspects of the project are straight-forward in their development and have little room for modification or extenuation. As such, only minor modifications to the Phase II development are suggested, as follows:

1. Remove the component serial number availability check. At present, use of the component serial number is a general practice to assure that the component serial number is a valid serial number. However, the availability-checking function is somewhat redundant to the component serial-number uniqueness check, and as such, may not be economical to support in production. There is a considerable overhead to be incurred in providing timely, day to day maintenance of the "check file" which becomes basis of the edit function. Thus, it may be expedient to remove the check altogether.

   The "check file" has been preserved so that the "logbook" function can cross-reference engines that are a party to a component transfer. But this function is performed in a relatively simple manner without imposition of a previous-existence check at the time when a serialized part is being logged in CALB as a component to an engine.

2. Acquire a more powerful laser printer. The typically monthly printing of Assemble Build Book documents, one set per engine, taxes the capacity of the Xerox 4045 printer, and it mandates a tighter monitoring and service of the unit. A more powerful printer would mitigate these problems.

8.0 IMPLEMENTATION PLANS

8.1 GENERAL DESCRIPTION

This section describes the plan for the implementation of the CALB system at the Teledyne CAE Gainesville facility. Since much of the Phase II software has already been debugged and production-ready, and there exists a minimum of IBM/DEC hardware to support day to day use of that software, the anticipated development schedule is rather abbreviated as shown below.

- Perform final aspects of installation in the Production environment.
- Load the production databases with support data.
- Train personnel in new CALB functionality.
- Shakedown of the system.

The implementation schedule and the work breakdown structure for the implementation of the CALB system is presented in the Figure 8-1, and is discussed in more detail in the additional sections of the Implementation Plan as follows.

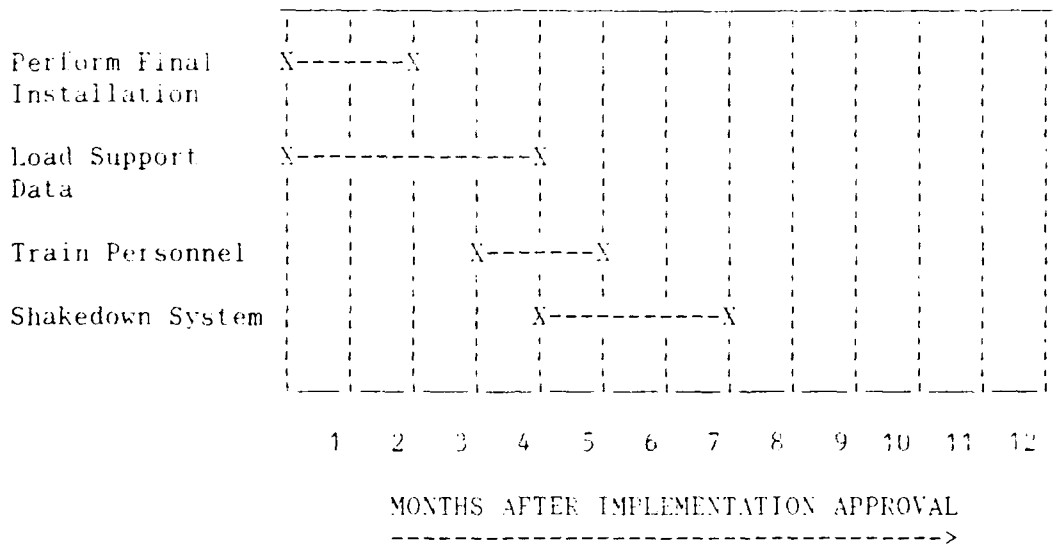

Figure 8-1. CALB Implementation Schedule.

8.2 PERFORM FINAL INSTALLATION

IBM aspects of the CALB system have already been installed on both the Gainesville and Toledo copies of TIMS2 by TCAE personnel. Additional files and fields have been defined to the TIMS2 databases and all program code has been loaded onto a production library. There is also adequate space on the TIMS2 database to contain new CALB inputs for full production use. However, the following programming tasks remain to make the system operational:

- Open up security by menu and program to individual Gainesville users and functional organizations.

- Resolve the issue of maintenance responsibility for the Availability File described in the Enhancements Section. Extra programming effort required to support the suggested modification is expected to be minimal.

8.3 LOAD PRODUCTION DATABASES AND SUPPORT DATA

All of the major functional modules within the CALB project, including "Assemble Build Book", "Kit Engines", and "Logbook", depend upon accurate manufacturing bills of material. This task will be devoted to verify accuracy of existing database, and loading up of additional data for other engines. In addition, in support of printing "Assemble Build Book" routers, the routing data will also be loaded into the Gainesville TIMS2 database.

8.4 PERSONNEL TRAINING REQUIREMENTS

Training will be required for supervisors, assembly personnel, and TCAE programmers. The initial training will be provided by the various units which have developed the separate CALB applications. Those aspects developed in-house will be presented by TCAE personnel, and those developed by an outside vendor will be provided by representatives of that other organization. Training will be completed before the system is rendered completely operational. Continuing educational requirements after installation will be conducted by the in-house users and programmers on an as-needed basis.

8.4.1 Supervisory Personnel Training

The training of supervisory personnel from all of the various user departments will emphasize the general operation and capabilities of the system. This training will provide a basis for the following:

- Operation of the system under normal conditions.

- A general exposure to CALB file maintenance programs; also, an extended review of system maintenance tasks that are likely to come under the direct control of supervisory personnel.

- Use of special reports in the continuing evaluation system performance, in the historical analysis of engine content, and in the management review of product durability.

8.4.2 Assembler/Engine-Kitting Operators Training Requirements

The training of operators responsible for the data entry for those tasks relating to engine kitting and the logging of component serial numbers being assembled into an engine will emphasize the specific details of system operation. This task will include the following objectives:

- Present an overview of the system in terms of its functions, capabilities, and transaction responsibilities.

- Familiarization with hardware.

- Familiarization with system menus and transaction panels in extensive detail.

8.4.3 System Programmer Training

The larger aspects of CALB software developed in-house are well understood by the programming personnel. However, those aspects developed by the outside vendor will require some measure of systems review, program familiarization, and validity checking on the part of TCAE programming staff. Once trained, that staff may be called upon to perform the following:

- o "Fine tune" the system as operational experience dictates.
- o Perform systems maintenance on an on-going basis thereafter.

8.4.4 Manpower Requirements During Training

The following TCAE personnel by functional area are to be trained in the operation of the CALB system.

- o Floor Assembler
- o Kitting Operators
- o Quality Inspector
- o Configuration supervisor and staff
- o Production Control supervisor and staff
- o Manufacturing Engineer
- o TCAE programmer.

8.4.5 Documentation Requirements for Training

The following documents are needed for accomplishing the training requirements.

- User's Manual for IBM aspects of CALB from TCAE programming staff. (Reference Appendix B.)

- User's Manual for DEC aspects of CALB from the software vendor, Beican Corporation. (Reference Appendix C.)

8.5 SHAKEDOWN OF THE SYSTEM

This final phase of implementation involves the gaining of a level of complete familiarity and comfort with the system. It is expected that the various users will have follow-up questions regarding particular details of the system's operation. Some additional fine-tuning of the programs will likely be required.

9.0 CALB BENEFITS ANALYSIS

Significant benefit potential exists for implementation of the CALB project. Implementation of such a system has been planned, needed hardware and software are already in place in TCAE - Gainesville facility. Preliminary benefits analysis indicates potential labor savings of 20%. Breakdown in hours/engine is summarized below.

1. Reduction in "Engine Kitting" related labor ~ 6.5 hrs per engine

2. Reduction in "Engine Configuration Report" generation related labor ~ 2 hr per engine

3. Reduction in "Component Replacement History Report" generation related labor ~ 1 hr per engine

4. Reduction in "Engine Build Traceability Labor" after engine has been shipped ~ 2 hr per engine

5. Reduction in "Assembly Order Routing" maintenance labor. Maintenance becomes necessary due to Engineering Change Orders. ~ 250 hrs per year

The above benefits and savings data are based upon the existing Teledyne CAE Gainesville environment and provided for general reference only. Detailed analysis must be made to identify benefits for any other system.

A P P E N D I X A

CALB SYSTEM SPECIFICATION FOR VENDOR QUOTATIONS

MAY 31 1988

Computerized Assembly Log Book

(CALB)

Statement of Work

MAY 31 1988

Contents

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1. PROJECT OBJECTIVES AND SCOPE

1.1. General Objectives

This statement of work identifies the general objectives and requirements for a computerized Assembly Log Book. Teledyne CAE is planning to use this system for providing closed-loop configuration control and automating the preparation of the assembly log book and the engine shipping book.

1.2. Requesting Organization

Teledyne CAE, Toledo Division, a division of Teledyne Industries, Inc. a California Corporation is located at 1330 Laskey Road, Toledo, Ohio. Teledyne CAE manufactures small gas turbine engines for manned and unmanned flight applications.

1.3. Technology Modernization Program

The computerized Assembly Log Book is a Phase II project funded under the U.S.A.F. Industrial Modernization Incentives Program "IMIP". The end results of Phase II are a prototype demonstration and final report. Upon successful completion of Phase II projects, Teledyne CAE is committed to full-scale implementation of feasible projects in Phase III of the program.

1.4. Computer Resources

Teledyne CAE's computer resources for this IMIP project will consist of: 1) An IBM 330 running the VM/CMS operating system; and a VAX 11/780 running the VMS operating system.

1.5. Overall Objectives

CALB will provide a means for integrating many systems; significantly reducing labor cost associated with preparing the assembly log book and engine shipping book. CALB will also improve the quality of these books. CALB will provide near real-time configuration exception reporting and control of the assembly process. CALB will eliminate the need of making multiple copies of assembly paperwork by providing the ability to display assembly paperwork at workstations.

1.6. Specific Objectives

A. To demonstrate an integrated computer system that includes: bill of material, inventory control, engineering change management, configuration control by serial number, and engine log books.

B. To demonstrate configuration exception reporting in near real-time.

C. To demonstrate computer generated portions of an assembly log book and engine shipping book in original print quality.

1. Electronic reproduction of Assembly Order Routings tied to Engine Serial Numbers.

2. Electronic reproduction of the Manufacturing Bill of Material.

D. To demonstrate serial number control and verification.

E. To demonstrate on-line storage and retrieval of current engine configuration and Component Replacement History.

2. SYSTEM DEVELOPMENT AND DOCUMENTATION

2.1. System Development

Systems development personnel shall:

- Develop software interfaces for data transfer between existing systems.
- Develop software required for each user interface.
- Develop software required for the Text Storage/Retrieval system.
- Develop software required for the output system.

2.2. System Documentation

Systems development personnel shall:

- Document each module according to TCAE standards.
- Document CALB system by providing TCAE personnel a user's guide.

2.3. System Testing

Systems development personnel shall:

- Perform complete testing and debugging of each individual module as they are developed.
- Perform complete system integration testing at the end of CALB development.

2.4. Prototype Implementation & Demonstration

Systems development personnel shall:

- Assist TCAE-G personnel in implementing the prototype system.
- Provide program maintenance support during the development of the demonstration.
- Provide documentation support for the presentation.

2.5 Phase III Implementation Details

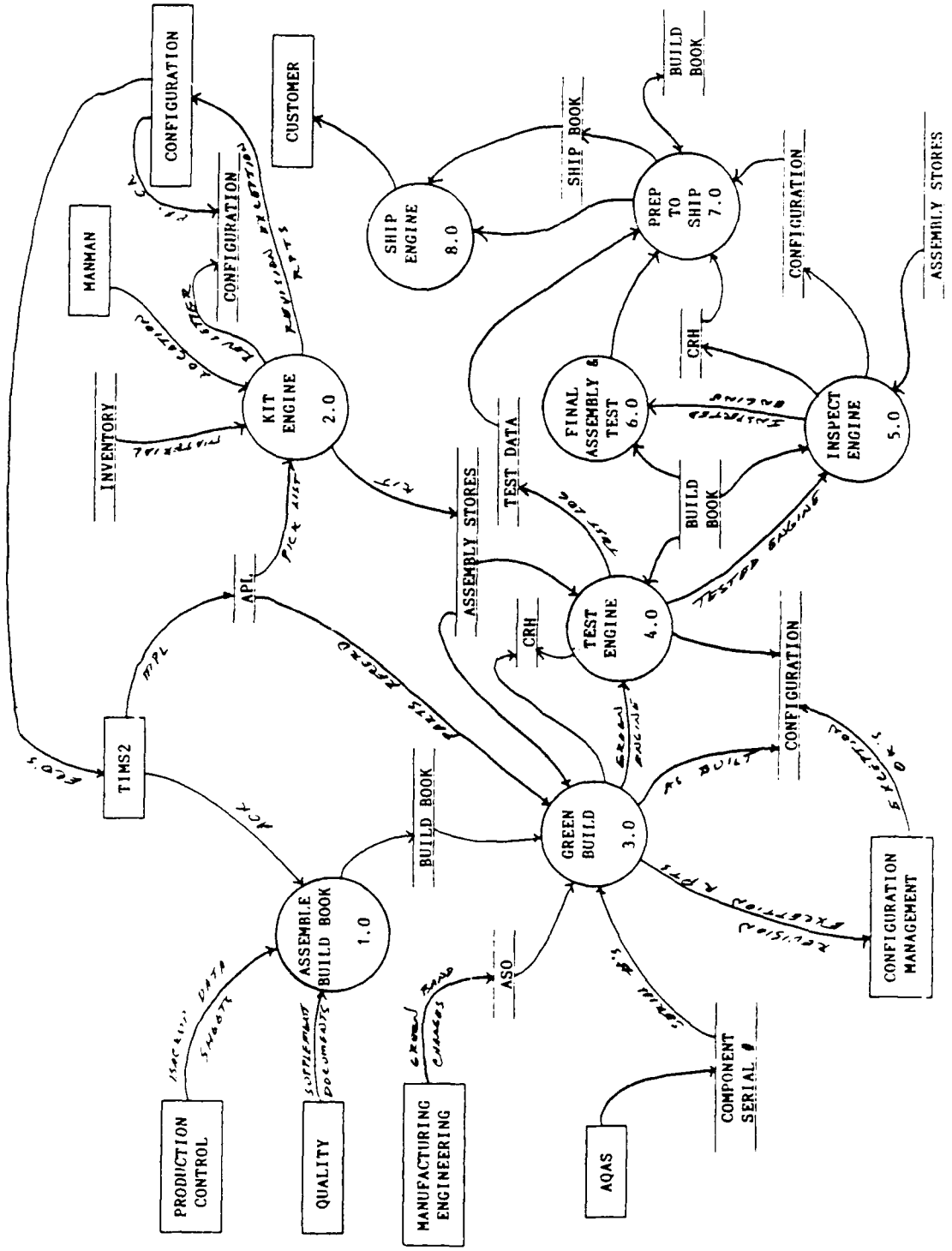
Systems development personnel shall:

- Provide a Final Report which includes final design for Phase III. Include needed hardware and software.

2.6. Conditions

- Software developed under this contract is the property of the Air Force.
- Technology shall be transferable.
- QUOTERS AND BIDDERS ARE EXPRESSLY ADVISED THAT THE UNITED STATES GOVERNMENT IS PARTICIPATING IN THIS PROGRAM AND THAT DESIGN AND DEVELOPMENT TECHNOLOGY AND DATA WILL BE SUBJECT TO ALL SUCH RIGHTS IN THAT DATA EMANATING HEREFROM AS ARE PECULIAR TO CONTRACTS OF THAT TYPE.

3. CALB DATA FLOW DIAGRAM



4. HARDWARE REQUIREMENTS

4.1. Computers

- The CALB project will require a mainframe computer processor. The currently installed IBM 3330 will be adequate for development and demonstration purposes.

- The CALB project will also require a computer processor in the mini-computer range. It has been determined that a current VAX 11/780 will be adequate for development and demonstration purposes. Furthermore, it is the most logical and economical choice as the processor since it is already installed, and handles various disjoint shop floor and administrative functions.

4.2. Printers

- The CALB project will require a laser printer for producing high quality output of the assembly log book and shipping book. The XEROX 4045 laser printer has been chosen based on its built-in font capabilities.

5. SOFTWARE REQUIREMENTS

5.1. Operating Systems

Based on the preliminary hardware analysis the chosen operating system for the CALB project will be:

VAX/VMS installed on the existing VAX 11/780 computer system.

VM/CMS installed on the existing IBM ~~3330~~ computer system.

5.2. Programming Languages

Based on the current system languages and in-house support, the following languages will be used:

VAX FORTRAN

MITROL

5.3. Database Management Systems

A Database Management System being the core of any package, must be structured and supported. Therefore the following database systems will be utilized:

The Digital Equipment Corporation database management system's VAX DBMS.

Mitrol Corporation's MITROL DBMS.

5.4. Query and Report Writers

DATATRIEVE

MITROL

MAY 3[illegible] 1983

5.5. Installed Packages

MANMAN MRP II package, DBMS Based, written in Fortran-77, using Datatrieve and TDMS.

MANMAN ENGINEER, DBMS Based, written in Fortran-77, using Datatrieve and TDMS.

TMS (Tool Management System) Package written in Fortran-77 using escape sequences for screen management and Datatrieve for reports.

Mitrol Corporation's MITROL DBMS, a fourth generation network database manager.

6. USER CONFIGURATION

CALB will allow users in the following departments access to the system through menu options specific to their department's functions

Assembly & Test
Configuration Management
Manufacturing Engineering
Production Control
Quality Control

CALB will allow maintenance of a Configuration Exception Reporting database and a Part/Drawing database to keep track of ECO changes. CALB will also maintain system control information in the database for each individual engine.

6.1. Assembly & Test

CALB Duties:

- Operator receives Assembly Shop Order and Engine kit
- Operator requests required tooling from TRACS
- Testing performed by test technicians
- Completes required process

CALB Users

- Assembly Technicians
- Test Technicians
- Assembly Group Leaders

CALB Integration:

- Will receive bar-coded Assembly Shop Order and kitted parts from Production Control.
- Will log in to the system and begin the assembly process. The operator will record revision letter, and where required, the serial number of a component part for error checking, validation, and recording.

6.2. Configuration Management

CALB Duties:

- Monitor Engine Configuration
- Monitor and Process ECO's

CALB Users:

- Configuration Manager

CALB Integration:

- Will process ECO's and make changes to the Assembly Parts List.
- Will monitor implementation of ECO's by Manufacturing Engineering.

6.3. Manufacturing Engineering

CALB Duties:

- Maintain Assembly Order Routings (AOR)

CALB Users:

- Process Engineers

CALB Integration:

- Will receive message via printed document from Configuration Management requesting incorporation of ECO changes into AOR's.
- Will update documents as required.

6.4. Production Control

CALB Duties:

- o Issues Assembly Shop Orders
- o Issues Assembly Order Routings
- o Kits Engines
- o Monitors Work-in-Process
- o Monitors and controls inventory

CALB Users:

- o Production Scheduler
- o Inventory Control Technician
- o Receiving Material Technician

CALB Integration:

- o Will generate an Assembly Shop Order from a serial number controlled bill of material. This document will contain the following information: Engine Model, Engine Serial Number, Lot number, Date Issued, and approvals from Production Control and Quality Control.

- o Will electronically issue the Assembly Order Routing to the floor. This issuance will create a new "vanilla" database for the particular engine to be built.

- o Will prepare engine kits and monitor work-in-process.

- o Will provide replacement parts as required.

6.5. Quality Control

CALB Duties:

- Verify Engine Configuration
- Inspect Assembly Operations
- Prepare Engine Shipping Book

CALB Users:

- Assembly Inspector
- Quality Engineer

CALB Integration:

- Will review engineering changes made by Manufacturing Engineering. The Quality Engineer will indicate approval of changes by making appropriate entries into the database. Quality Engineer will record all exceptions.

- Will compile entries into the system to create the Component Replacement History in the Engine Shipping Book.

- Will generate hard copy portions of the Engine Shipping Book for inspection by customer. Will also generate hard copy portions of the Assembly Log Book (Build Book) on request.

7. FUNCTIONAL SPECIFICATIONS

7.1. Assemble Build Book. The build book is used to maintain a historical record of the process of building and testing an engine through to completion. A Build Book is "assembled" for each engine scheduled to be built. The assembly process consists primarily of inserting blank documents into proper sections of the book. The documents are then completed at various stages of the build and test processes. (Reference bubble 1.0 on the data flow diagram.)

A. The following documents comprise the Build Book:

DOCUMENT	MAINTAINED BY
Assembly Order Routing (AOR)	TIMS2
Engine Backup Data Sheets	Prod. Control
Assembly Parts List	CALB
Non Conformance Log	Quality Assur.
Engine Assembly Work Sheet	Quality Assur.
Route Sheet & OK for Test	Quality Assur.
QC 1019 (Non Destructive Inspection Record)	Quality Assur.
QC 1020 (Disassembly Inspection Record)	Quality Assur.
QWI #54 (Envelope Acceptance Gage)	Quality Assur.
Flow Test Records	Quality Assur.
F107 Gearbox Assembly	Quality Assur.

B. Note that some of the documents identified above travel with material as it moves through the assembly and test process.

C. The AOR will be maintained in and drawn from TIMS2. When requesting an AOR print, the terminal operator will supply a starting engine serial number which will be printed on the router. Serial numbers will be incremented when copies for multiple engines are requested.

D. The APL will be generated electronically from the configuration established during Green Build. Note that this represents a change; under the "current" system, the APL is inserted prior to Green Build.

E. All other documents will continue to be prepared manually.

7.2. Kit Engine. The MPL downloaded from TIMS2 will be merged with location and inventory data from MANMAN to generate a material pick list. The MADSS AS/RS interface should be used to select required material. (Reference bubble 2.0 on the data flow diagram.)

A. Component revision letter will be checked and recorded at issue by the operator. Exceptions must be noted and recorded electronically. Exception reports must be forwarded to Configuration Management.

B. The terminal operator must supply: initial engine serial number; engine quantity; and contract number.

C. Material will be trucked to the assembly area in kit form.

D. Issuing excess material to a work order may cause severe fluctuations in an MRP based system. Therefore all material must be accounted for through inventory control personnel prior to the issue of excess material.

E. This process should electronically record each serial number issued, and build a skeleton configuration file for all configured parts (i.e. those parts whose revision letter is controlled).

F. Contained in the Configuration subsystem will be:

FIELD NAME	TYPE	LENGTH
Engine Part Number	A	15
Engine Serial Number	N	12
Engine Model Code	A	18
Engine Starts	N	2
Engine Build Number	N	2
Date	A	8
Component Part Number	A	15
Component Serial Number	A	12
Component Change Letter	A	2
Revision Letter Exception	A	1
Group Number	A	1
AQAS Serial Flag	A	1

7.3. **Green Build.** This process describes the complete assembly of an engine prior to initial test. During this process, serial numbers will be recorded electronically. (Reference bubble 3.0 on the data flow diagram.)

A. Component serial numbers will be entered when required.

B. To insure that components have not been swapped inadvertently between kit and build, the component change letter will be validated against the APL once again. Violations will cause a warning message to be issued to the terminal operator, and an entry to be recorded in the Configuration Exception field for that component. An exception report will be forwarded to Configuration Management.

C. An entry in the BOM will indicate which components are serialized and must be tracked through the serialization file.

D. Component serial numbers will be checked against a file of valid component serial numbers. This file will be maintained by data uploaded from AQAS, and by additional entries which will track serialized components not covered by the AQAS system. Failures are not allowed and should cause an appropriate terminal message to be issued to the operator.

E. The validation process described above will set a flag in the serial number file which will indicate which serial numbers have been issued (by part number).

F. Component movement into and out of an engine must be recorded electronically. This data will be recorded in the Component Replacement History (CRH) file.

G. In the event that a component must be replaced, the following data will be required:

1. Engine Serial Number.

2. Component Part Number.

3. Remarks.

4. Outgoing Component Serial Number.

5. Time on Outgoing Serial Number.

6. Starts on Outgoing Serial Number.

7. Build Number on Outgoing Serial Number.

8. Incoming Component Serial Number. Incoming components must satisfy the following edit criteria:

   a. The component serial number must be valid.

   b. The revision letter must be valid; if not, exceptions must be noted and approved. (See item B above.)

   c. If the component is currently linked to an engine, the link must be broken and a CRH record be established which identifies the break.

9. Time on Incoming Serial Number.

10. Starts on Incoming Serial Number.

11. Build Number on Incoming Serial Number.

H. Component Movement Direction (In/Out). The value for this field should be inferred.

I. Records of the above transaction will be kept in the Component Replacement History file. This file will be linked to the configuration file, and will contain the following additional items:

FIELD NAME	TYPE	LENGTH
Transaction Date	A	8
Component Movement Status	A	1
Run Time	A	8
Starts	N	2
Build Number	N	2
Remarks	A	180
Disposition	A	180

8. GENERAL PROCESSING RULES AND ASSUMPTIONS

A. The TIMS2 system will be used to warehouse the Bill of Material (BOM) library.

B. AORs will be stored, maintained, and produced from the TIMS2 system.

C. ASOs will be kept under Green Band control in the assembly area.

D. AQAS will track serial numbers to lots for serialized parts used in the fabrication process.

E. CALB will track the serial numbers of purchased parts issued directly to assembly.

F. CALB will insure that duplicate component serial numbers are not issued to the assembly process.

G. Component change letter will be checked at issue. Change letters which do not conform to those listed on the APL will be noted as exceptions. All exceptions will be forwarded to Configuration Management for resolution.

H. Component revision letters and serial numbers issued to an engine will be stored on line in TIMS2.

I. Change letter exceptions will lock the configuration file until approved by configuration management.

J. The current configuration for an engine will be stored in the configuration file. Changes will be logged in the Component Replacement History (CRH) file.

K. AQAS data will be uploaded to the IBM TIMS2 system in order to verify manufactured component serial numbers.

L. Serialized component parts not tracked by AQAS will be added to this file via a data entry panel.

9. SYSTEM INTERFACES

A. **Material Pick List.** A pull list will be generated by merging the MPL (downloaded from TIMS2) with inventory data from MANMAN. In order to utilize the MADSS inventory function, this picking transaction will reside on the VAX.

B. **Component Serial Number Validation.** A "Serial Number Validation" file will be established in order to verify component serial numbers. This file will reside in TIMS2. Data from AQAS will be uploaded in a timely basis in order to maintain this file. Data for serial numbers not tracked through AQAS will be loaded through a data entry panel.

C. **Component Revision Letter Validation.** Revision letters of components will be validated against the BOM stored in TIMS2.

D. **Configuration.** A "Configuration" file will be established to track all components issued to an engine. This file will reside in TIMS2. This file will be used to generate the Assembly Parts Record sheets for inclusion into the Build Book.

E. **Component Replacement History.** This history file will be established in order to track all component changes to an engine during the build and test processes. This file will reside in TIMS2 and be tied to the Configuration file mentioned above.

10. DOCUMENTATION REQUIREMENTS

10.1. INTRODUCTION

One of the basic premises of the IMIP program is that technology shall be transferable. The most important factor for making computer software transferable is thorough and uniform documentation. Therefore, all software developed as a result of this project effort will conform to the following guidelines.

10.2. PROGRAM DOCUMENTATION

All software will be documented using standard documentation methodologies. This standard includes but is not limited to the following:

- Complete explanation of each modules's purpose
- Complete variable definitions at beginning of each module.
- Description of inputs and outputs for each module
- Modular code
- Self-identifying naming conventions
- Indentation to pictorially indicate program loops
- Self-documenting code
- Informative comments throughout code
- Global data dictionary

10.3. SYSTEM DOCUMENTATION

Each sub-system within CALB and the CALB monitor shall have adequate system documentation and a user's guide.

The system documentation will include:

- System flowchart
- Explanation of system functionality
- Explanation of system inputs and outputs
- Brief description of each module
- Report layouts
- List of data files

The user's guide should be well written and include step by step instructions for using the system. Also, the user's guide should have a section that lists possible errors that can occur and an explanation of how to recover from those errors. The user's guide should have a section that describes required system inputs and also describes each report that can be generated from that system.

11. SYSTEM TESTING

11.1. Location and Participants

Final testing will be conducted on-site at Teledyne CAE, Gainesville Division. Representatives from both TCAE and the sub contractor will be in attendance. Participants will consist of Teledyne employees who will be using the system on a regular basis and the Teledyne project leader.

11.2. Items Tested

The CALB Monitor and all user interfaces discussed in Appendix A will be tested thoroughly. In addition, the Text Storage/Retrieval system and the Output system will also be tested.

11.3. Test Schedule

System testing will begin as each module is completed and will be conducted by the contract programmer and must be approved by the Teledyne project leader. Failure to pass testing will require a rewrite and re-test. The final acceptance test will last approximately one week, during which time each item will be re-tested and its acceptance initialized by the Teledyne Project Leader.

Overall acceptance of the entire system will be contingent on the contractor providing adequate documentation as described in Section 10.

12. SOFTWARE RIGHTS CLAUSE

[¶ 35,532]

52.227-7013 Rights in Technical Data and Computer Software.

[Caution: see changes effective 10/18/85 at ¶ 94,226—CCH.]

As prescribed at 27.412(a)(1), insert the following clause:

RIGHTS IN TECHNICAL DATA AND COMPUTER SOFTWARE (MAY 1981)

(a) *Definitions.* "Commercial Computer Software", as used in this clause, means computer software which is used regularly for other than Government purposes and is sold, licensed or leased in significant quantities to the general public at established market or catalog prices.

"Computer", as used in this clause, means a data processing device capable of accepting data,

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performing prescribed operations on the data, and supplying the results of these operations; for example, a device that operates on discrete data by performing arithmetic and logic processes on the data, or a device that operates on analog data by performing physical processes on the data.

"Computer Data Base", as used in this clause, means a collection of data in a form capable of being processed and operated on by a computer.

"Computer Program", as used in this clause, means a series of instructions or statements in a form acceptable to a computer, designed to cause the computer to execute an operation or operations. Computer programs include operating systems, assemblers, compilers, interpreters, data management systems, utility programs, sort-merge programs, and ADPE maintenance/diagnostic programs, as well as applications programs such as payroll, inventory control, and engineering analysis programs. Computer programs may be either machine-dependent or machine-independent, and may be general-purpose in nature or designed to satisfy the requirements of a particular user.

"Computer Software", as used in this clause, means computer programs and computer data bases.

"Computer Software Documentation", as used in this clause, means technical data, including computer listings and printouts, in human-readable form which (1) documents the design or details of computer software, (2) explains the capabilities of the software, or (3) provides operating instructions for using the software to obtain desired results from a computer.

"Limited Rights", as used in this clause, means rights to use, duplicate, or disclose technical data, in whole or in part, by or for the Government, with the express limitation that such technical data shall not, without the written permission of the party furnishing such technical data be (1) released or disclosed in whole or in part outside the Government, (2) used in whole or in part by the Government for manufacture, or in the case of computer software documentation, for preparing the same or similar computer software, or (3) used by a party other than the Government, except for:

(1) Emergency repair or overhaul work only, by or for the Government, where the item or process concerned is not otherwise reasonably available to enable timely performance of the work, *provided* that the release or disclosure thereof outside the Government shall be made subject to a prohibition against future use, release or disclosure; or

(2) Release to a foreign government, as the interest of the United States may require, only for information or evaluation within such government or for emergency repair or overhaul work by or for such government under the conditions of (1) above.

"Restricted Rights", as used in this clause, means rights that apply only to computer software, and include, as a minimum, the right to—

(1) Use computer software with the computer for which or with which it was acquired, including use at any Government installation to which the computer may be transferred by the Government;

(2) Use computer software with a backup computer if the computer for which or with which it was acquired is inoperative;

(3) Copy computer programs for safekeeping (archive) or backup purposes; and

(4) Modify computer software, or combine it with other software, subject to the provision that those portions of the derivative software incorporating restricted rights software are subject to the same restricted rights.

In addition, restricted rights include any other specific rights not inconsistent with the minimum rights in (1)-(4) above that are listed or described in this contract or described in a license or agreement made a part of this contract.

"Technical Data", as used in this clause, means recorded information, regardless of form or characteristic, of a scientific or technical nature. It may, for example, document research, experimental, developmental or engineering work, or be usable or used to define a design or process or to procure, produce, support, maintain, or operate materiel. The data may be graphic or pictorial delineations in media such as drawings or photographs, text in specifications or related performance or design type documents or computer printouts. Examples of technical data include research and engineering data, engineering drawings and associated lists, specifications, standards, process sheets, manuals, technical reports, catalog item identifications and related information, and computer software documentation. Technical data does not include computer software or financial, administrative, cost and pricing, and management data or other information incidental to contract administration.

"Unlimited Rights", as used in this clause, means rights to use, duplicate, or disclose technical data, in whole or in part, in any manner and for any purpose whatsoever, and to have or permit others to do so.

(b) *Government Rights.*

(1) *Unlimited Rights.* The Government shall have unlimited rights in:

(i) technical data and computer software resulting directly from performance of experimental, developmental or research work which was specified as an element of performance in this or any other Government contract or subcontract;

(ii) computer software required to be originated or developed under a Government contract, or generated as a necessary part of performing a contract;

(iii) computer data bases, prepared under a Government contract, consisting of information supplied by the Government, information in

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which the Government has unlimited rights, or information which is in the public domain;

(iv) technical data necessary to enable manufacture of end-items, components, and modifications, or to enable the performance of processes, when the end-items, components, modifications or processes have been or are being, developed under this or any other Government contract or subcontract in which experimental, developmental or research work is, or was specified as an element of contract performance, except technical data pertaining to items, components, processes, or computer software developed at private expense (but see subdivision (b)(2)(ii) below);

(v) technical data or computer software prepared or required to be delivered under this or any other Government contract or subcontract and constituting corrections or changes to Government-furnished data or computer software;

(vi) technical data pertaining to end-items, components or processes, prepared or required to be delivered under this or any other Government contract or subcontract, for the purpose of identifying sources, size, configuration, mating and attachment characteristics, functional characteristics and performance requirements ("form, fit and function" data, e.g., specification control drawings, catalog sheets, envelope drawings, etc.);

(vii) manuals or instructional materials prepared or required to be delivered under this contract or any subcontract hereunder for installation, operation, maintenance or training purposes;

(viii) technical data or computer software which is in the public domain, or has been or is normally released or disclosed by the Contractor or subcontractor without restriction on further disclosure; and

(ix) technical data or computer software listed or described in an agreement incorporated into the schedule of this contract which the parties have predetermined, on the basis of subparagraphs (i) through (viii) above, and agreed will be furnished with unlimited rights.

(2) *Limited Rights.* The Government shall have limited rights in:

(i) technical data, listed or described in an agreement incorporated into the Schedule of this contract, which the parties have agreed will be furnished with limited rights; and

(ii) unpublished technical data pertaining to items, components or processes developed at private expense, and unpublished computer software documentation related to computer software that is acquired with restricted rights, other than such data as may be included in the data referred to in subdivisions (b)(1)(i), (v), (vi), (vii), and (viii) above. The word *unpublished*, as applied to technical data and computer software documentation, means that which has not been released to the public nor been furnished to others without restriction on further use or disclosure. For the purpose of this definition, delivery of limited rights technical data to or for the Government under a contract does not, in itself, constitute release to the public.

Limited rights shall be effective provided that only the portion or portions of each piece of data to which limited rights are to be asserted pursuant to subdivisions (2)(i) and (ii) above are identified (for example, by circling, underscoring, or a note), and that the piece of data is marked with the legend below in which is inserted:

A. the number of the prime contract under which the technical data is to be delivered,

B. the name of the Contractor and any subcontractor by whom the technical data was generated, and

C. an explanation of the method used to identify limited rights data.

LIMITED RIGHTS LEGEND

Contract No _____

Contractor _____

Explanation of Limited Rights Data Identification Method Used

— — — —

— — — —

Those portions of this technical data indicated as limited rights data shall not, without the written permission of the above Contractors, be either (A) used, released or disclosed in whole or in part outside the Government, (B) used in whole or in part by the Government for manufacture or, in the case of computer software documentation, for preparing the same or similar computer software, or (C) used by a party other than the Government, except for: (1) emergency repair or overhaul work only, by or for the Government, where the item or process concerned is not otherwise reasonably available to enable timely performance of the work, *provided* that the release or disclosure hereof outside the Government shall be made subject to a prohibition against further use, release or disclosure; or (2) release to a foreign government, as the interest of the United States may require, only for information or evaluation within such government or for emergency repair or overhaul work by or for such government under the conditions of (1) above. This legend, together with the indications of the portions of this data which are subject to such limitations shall be included on any reproduction hereof which includes any part of the portions subject to such limitations.

(3) *Restricted Rights.*

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(i) The Government shall have restricted rights in computer software, listed or described in a license or agreement made a part of this contract, which the parties have agreed will be furnished with restricted rights, *provided*, however, notwithstanding any contrary provision in any such license or agreement, the Government shall have the rights included in the definition of "restricted rights" in paragraph (a) above. Such restricted rights are of no effect unless the computer software is marked by the Contractor with the following legend:

RESTRICTED RIGHTS LEGEND
Use, duplication or disclosure is subject to restrictions stated in Contract No. ____ with ____ (Name of Contract) ____

and the related computer software documentation includes a prominent statement of the restrictions applicable to the computer software. The Contractor may not place any legend on computer software indicating restrictions on the Government's rights in such software unless the restrictions are set forth in a license or agreement made a part of this contract prior to the delivery date of the software. Failure of the Contractor to apply a restricted rights legend to such computer software shall relieve the Government of liability with respect to such unmarked software.

(ii) Notwithstanding subdivision (i) above, commercial computer software and related documentation developed at private expense and not in public domain may, if the Contractor so elects, be marked with the following Legend:

RESTRICTED RIGHTS LEGEND
Use, duplication, or disclosure by the Government is subject to restrictions as set forth in subdivision (b)(3)(ii) of the Rights in Technical Data and Computer Software clause at 52.227-7013.

(Name of Contractor and Address)

When acquired by the Government, commercial computer software and related documentation so legended shall be subject to the following:

(A) Title to the ownership of the software and documentation shall remain with the Contractor.

(B) User of the software and documentation shall be limited to the facility for which it is acquired.

(C) The Government shall not provide or otherwise make available the software or documentation, or any portion thereof, in any form, to any third party without the prior written approval of the Contractor. Third parties do not include prime contractors, subcontractors and agents of the Government who have the Government's permission to use the licensed software and documentation at the facility, and who have agreed to use the licensed software and documentation only in accordance with these restrictions. This provision does not limit the right of the Government to use software, documentation, or information therein, which the Government may already have or obtains without restrictions.

(D) The Government shall have the right to use the computer software and documentation with the computer for which it is acquired at any other facility to which that computer may be transferred; to use the computer software and documentation with a backup computer when the primary computer is inoperative; to copy computer programs for safekeeping (archives) or backup purposes, and to modify the software and documentation or combine it with other software, *provided*, that the unmodified portions shall remain subject to these restrictions.

(E) If the Contractor, within sixty (60) days after a written request, fails to substantiate by clear and convincing evidence that computer software and documentation marked with the above Restricted Rights Legend are commercial items and were developed at private expense, or if the Contractor fails to refute evidence which is asserted by the Government as a basis that the software is in the public domain, the Government may cancel or ignore any restrictive markings on such computer software and documentation and may use them with unlimited rights. Such written requests shall be addressed to the contractor as identified in the Restricted Rights Legend.

(4) No legend shall be marked on, nor shall any limitation or restriction on rights of use be asserted as to, any data or computer software which the Contractor has previously delivered to the Government without restriction. The limited or restricted rights provided for by this paragraph shall not impair the rights of the Government to use similar or identical data or computer software acquired from other sources.

(c) *Copyright.*

(1) In addition to the rights granted under the provisions of paragraph (b) above, the Contractor hereby grants to the Government a nonexclusive, paid-up license throughout the world, of the scope set forth below, under any copyright owned by the Contractor, in any work of authorship prepared for or acquired by the Government under this contract, to reproduce the work in copies or phonorecords, to distribute copies or phonorecords to the public, to perform or display the work publicly, and to prepare derivative works thereof, and to have others do so for Government purposes.

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With respect to technical data and computer software in which the Government has unlimited rights, the license shall be of the same scope as the rights set forth in the definition of "unlimited rights" in paragraph (a) above. With respect to technical data in which the Government has limited rights, the scope of the license is limited to the rights set forth in the definitions of "limited rights" in paragraph (a) above. With respect to computer software which the parties have agreed in accordance with subparagraph (b)(3) above will be furnished with restricted rights, the scope of the license is limited to such rights.

(2) Unless written approval of the Contracting Officer is obtained, the Contractor shall not include in technical data or computer software prepared for or acquired by the Government under this contract any works of authorship in which copyright is not owned by the Contractor without acquiring for the Government any rights necessary to perfect a copyright license of the scope specified in subparagraph (c)(1).

(3) As between the Contractor and the Government, the Contractor shall be considered the "person for whom the work was prepared" for the purpose of determining authorship under Section 201(b) of Title 17, United States Code.

(4) Technical data delivered under this contract which carries a copyright notice shall also include the following statement which shall be placed therein by the Contractor, or should the Contractor fail, by the Government:

This material may be reproduced by or for the U.S. Government pursuant to the copyright license under the clause at 52.227-7013 (date).

(d) *Removal of Unauthorized Markings.* Notwithstanding any provision of this contract concerning inspection and acceptance, the Government may correct, cancel, or ignore any marking not authorized by the terms of this contract on any technical data or computer software furnished hereunder if:

(1) the Contractor fails to respond within sixty (60) days to a written inquiry by the Government concerning the propriety of the markings, or

(2) the Contractor's response fails to substantiate, within sixty (60) days after written notice, the propriety of limited rights markings by clear and convincing evidence, or of restricted rights markings by identification of the restrictions set forth in the contract.

In either case, the Government shall give written notice to the Contractor of the action taken.

(e) *Relation to Patents.* Nothing contained in this clause shall imply a license to the Government under any patent or be construed as affecting the scope of any license or other right otherwise granted to the Government under any patent.

(f) *Limitation on Charges for Data and Computer Software.* The Contractor recognizes that the Government or a foreign government with funds derived through the Military Assistance Program or otherwise through the United States Government may contract for property or services with respect to which the vendor may be liable to the Contractor for charges for the use of technical data or computer software on account of such a contract. The Contractor further recognizes that it is the policy of the government not to pay in connection with its contracts, or to allow to be paid in connection with contracts made with funds derived through the Military Assistance Program or otherwise through the United States Government, charges for data or computer software which the Government has a right to use and disclose to others, which is in the public domain, or which the Government has been given without restrictions upon its use and disclosure to others. This policy does not apply to reasonable reproductions, handling, mailing, and similar administrative costs incident to the furnishing of such data or computer software. In recognition of this policy, the Contractor agrees to participate in and make appropriate arrangements for the exclusion of such charges from such contracts, or for the refund of amounts received by the Contractor with respect to any such charges not so excluded.

(g) *Acquisition of Data and Computer Software from Subcontractors.*

(1) Whenever any technical data or computer software is to be obtained from a subcontractor under this contract, the Contractor shall use this same clause in the subcontract, without alteration, and no other clause shall be used to enlarge or diminish the Government's or the Contractor's rights in that subcontractor data or computer software which is required for the Government.

(2) Technical data required to be delivered by a subcontractor shall normally be delivered to the next-higher tier contractor. However, when there is a requirement in the prime contract for data which may be submitted with limited rights pursuant to subparagraph (b)(2) above, a subcontractor may fulfill such requirement by submitting such data directly to the Government rather than through the prime Contractor.

(3) The Contractor and higher-tier subcontractors will not use their power to award subcontracts as economic leverage to acquire rights in technical data or computer software from their subcontractors for themselves.

(End of clause)

***ALTERNATE I* (May 1981)** As prescribed at 27.412(a)(2), add the following paragraph to the basic clause:

Notice of Certain Limited Rights.

(h)(1) Unless the Schedule provides otherwise, and subject to (2) below, the Contractor will promptly notify the Contracting Officer in writing of the intended use by the Contractor or a

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subcontractor in performance of this contract of any item, component or process for which technical data would fall within subparagraph (b)(2) above.

(2) Such notification is not required with respect to:

(i) standard commercial items which are manufactured by more than one source of supply; or

(ii) items, components, or processes for which such notice was given pursuant to predetermination of rights in technical data in connection with this contract.

(3) Contracting Officer approval is not necessary under this clause for the Contractor to use the item, component or process in the performance of the contract. (APR 1972)

ALTERNATE II **(May 1981)** As prescribed at 27.412(a)(3), add the following paragraph to the basic clause:

( ) Publication for sale. If, prior to publication for sale by the Government and within the period designated in the contract or task order, but in no event later than 24 months after delivery of such data, the Contractor publishes for sale any data (1) designated in the contract as being subject to this paragraph and (2) delivered under this contract, and promptly notifies the Contracting Officer of these publications, the Government shall not publish such data for sale or authorize others to do so. This limitation on the Government's right to publish for sale any such data so published by the Contractor shall continue as long as the data is protected as a published work under the copyright law of the United States and is reasonably available to the public for purchase. Any such publication shall include a notice identifying this contract and recognizing the license rights of the government under subparagraph (c)(1) of this clause. As to all such data not so published by the Contractor, this paragraph shall be of no force or effect.

[DAC 84-1, 3/1/84; DAC 84-7, 8/15/84]

[¶ 35,532.04]

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52.227-7018 Restrictive Markings on Technical Data.

As prescibed at 27.412(f), insert the following clause:

RESTRICTIVE MARKINGS ON TECHNICAL DATA (MAR 1975)

(a) The Contractor shall have, maintain, and follow throughout the performance of this contract, procedures sufficient to assure that restrictive markings are used on technical data required to be delivered hereunder only when authorized by the terms of the "Rights in Technical Data and Computer Software" clause of this contract. Such procedures shall be in writing. The Contractor shall also maintain a quality assurance system to assure compliance with this clause.

(b) As part of the procedures, the Contractor shall maintain (1) records to show how the procedures of paragraph (a) above were applied in determining that the markings are authorized, as well as (2) such records as are reasonably necessary to show pursuant to subparagraph (d)(2) of the "Rights in Technical Data and Computer Software" clause that restrictive markings used in any piece of technical data delivered under this contract are authorized.

(c) The Contractor shall, within sixty (60) days after award of this contract, identify in writing to the Contracting Officer by name or title the person(s) having the final responsibility within Contractor's organization for determining whether restrictive markings are to be placed on technical data to be delivered under this contract. The Contractor hereby authorizes direct contact between the Government and such person(s) in resolving questions involving restrictive markings.

(d) The Contracting Officer may evaluate or verify the Contractor's procedures to determine their effectiveness. Upon request, a copy of such written procedures shall be furnished. The failure of the Contracting Officer to evaluate or verify such procedures shall not relieve the Contractor of the responsibility for complying with paragraphs (a) and (b) above.

(e)(1) If the Contractor fails to make a good faith effort to institute the procedures of paragraphs (a) and (b) above, any limited rights markings on technical data delivered under this contract may be cancelled or ignored by the Contracting Officer. The Contracting Officer shall give written notice to the Contractor of the action taken, including identification of the data on which markings have been cancelled or ignored, and thereafter may use such data with unlimited rights.

(2) The Contracting Officer may give written notification to the Contractor of any failure to maintain or follow the established procedures, or of any material deficiency in the procedures, and state a period of time not less than thirty (30) days within which the Contractor shall complete corrective action. If corrective action is not completed within the specified time, restrictive markings on any technical data being prepared for delivery or delivered under this contract during that period shall be presumed to be unauthorized by the terms thereof and the Contracting Officer may cancel or ignore such markings if the Contractor is unable to substantiate the markings in accordance with the procedures of paragraph (d) of the clause at 52.227-7013, "Rights in Technical Data and Computer Software".

(f) Notwithstanding any provisions of this contract concerning inspection and acceptance, the acceptance by the Government of technical data with restrictive legends shall not be construed as a waiver of any rights accruing to the Government.

(g) This clause, including this paragraph (g), shall be included in each subcontract under which technical data is required to be delivered. When so inserted, "Contractor" shall be changed to "Subcontractor".

(End of clause)

[DAC 84-1, 3/1/84.]

[¶ 35,532.09]

¶ 35,532.08 DoD 52.227-7018

[¶ 35,532.17]

52.227-7027 Deferred Ordering of Technical Data or Computer Software.

As prescribed at 27.412(o), insert the following clause:

DEFERRED ORDERING OF TECHNICAL DATA OR COMPUTER SOFTWARE (NOV 1974)

In addition to technical data or computer software specified elsewhere in this contract to be delivered hereunder, the Government may, at any time during the performance of this contract or within a period of three (3) years after acceptance of all items (other than technical data or computer software) to be delivered under this contract or the termination of this contract, order any technical data or computer software (as defined in the "Rights in Technical Data and Computer Software" clause of this contract) generated in the performance of this contract or any subcontract hereunder. When such technical data or computer software is ordered, the Contractor shall be compensated for converting the data or computer software into the prescribed form, for reproduction and delivery. The obligation to deliver such technical data of a subcontractor and pertaining to an item obtained from him shall expire three (3) years after the date the contractor accepts the last delivery of that item from that subcontractor under this contract. The Government's rights to use said data or computer software shall be pursuant to the "Rights in Technical Data and Computer Software" clause of this contract.

(End of clause)

[DAC 84-1 3/1/84]

A P P E N D I X B

COMPUTER-AIDED LOG BOOK SYSTEM USER'S GUIDE
"GREEN BUILD" THROUGH FINAL SHIPMENT

(TOLEDO INFORMATION SYSTEMS GROUP)

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1. OVERVIEW:

The Computer-Aided-Log-Book or CALB system supports the tracking of the kitting/assembly/teardown/reassembly process of new and overhauled engines. This document outlines aspects of that system which will exist inside the Teledyne TIMS manufacturing system and were developed specifically as a result of government IMIP funding. Aspects of CALB developed outside the TIMS database, as well as pre-existing modules inside TIMS that are in one way or another being used by new CALB programs, are not documented in these pages. Those modules which are documented here perform the following basic functions:

A. Stores record of USER-SELECTED component serial numbers in association with the engines in which they are currently resident. Also maintains an engine history of the serialized components that have been previously removed and replaced. The most important printed outputs of the system are an "Engine Configuration" report and a "Replacement History" report.

B. Edits the configuration process to assure that no serialized component is recorded as existing in more than one engine at the same time. This process will occur at the time of data entry.

C. Produces a "soft" edit of the status of the serialized components in terms of "availability" at the time of assembly and thereafter.

D. WHEN SERIALIZED COMPONENTS ARE BEING RECORDED AS HAVING BEEN INTRODUCED (OR ASSEMBLED) INTO AN ENGINE, it performs a "soft" editing procedure to insure that the components have Engineering Change Letters that are each NO GREATER THAN the Bill of Material Standard identified at the time of data entry. Deviations are flagged for review by a configuration specialist. The "Where-Used" "relation" on the MANUFACTURING Bill of Materials inside the existing TIMS manufacturing system will be used for editing purposes. This edit is a limited recapitulation of the more rigorous edit performed earlier during kitting (described in item E. immediately below).

E. Based upon a similiar kind of edit to that described in D. performed AT THE TIME OF KITTING AND BEFORE ASSEMBLY (the edit is performed outside of TIMS), it provides a means internal to TIMS of TEMPORARILY denying most later data entry against the engine. This "locking" mechanism forces the primary users of the system to seek review and approval of the deviations with a configuration specialist. The latter individual also has the ability to override the "locked" engines one at a time.

F. Electively, can perform a variety of analyses on final engine configurations by serialized-component and by subsets of a serialized component population (ie, by particular range of serial numbers and by particular component change letters).

2. FUNCTIONAL MODULES WITHIN THE TIMS CALB APPLICATION:

A. Part "model" section: This is a secondary or support module for primary module E, described below. It maintains a list of the serialized components to be tracked AT A GIVEN TIME for a particular engine model. This list needs to be updated only as often as the configuration of an engine changes. It performs the following specific functions:

- o Provides a list of part number prompts for the user responsible for recording the serialized components being placed in a specific engine.
- o Enforces a particular order of printing of serialized components on the "Engine Configuration" report.

The model section also contains a series of pieces of GENERAL information concerning an engine that is used to expedite the loading and printing of serialized component data. This data includes a model "name", top-engine- and base-engine- "part" numbers, and an engine serial number prefix. This data is used for the following purposes:

- o The model "name", top-engine- and base-engine- part numbers are all printed on the "Engine Configuration" report.
- o The "top-engine part number is also used as a search argument on the complex TIMS Bill of Material (BOM) file at the time of editing component change letter.
- o For most data entry purposes, eliminates the need to identify a full engine serial number. Used in place of the full engine number is a one-position engine model code and a base engine number - which taken together may be input with relatively fewer key strokes. The model code is already used elsewhere in TIMS, and will serve in CALB as a near universal prompt instead of the engine serial number prefix. For example, the offical F107 engine prefix of "WR-E" will be represented by the one postion number "C". In those few cases where a full engine serial number is required - such as for formal reporting purposes - the system will automatically perform a switch based upon the model files, replacing the shorter model code and base serial number with an extended number.

B. Bill of Material Section: Data in this module is REFERENCED in CALB section E. (the kitting and assembly of serialized components). The data is used as a standard during the evaluation of the relationship between particular engine serial numbers and the Change Letters of the components that go into them. A warning message is generated in E. whenever a component is deemed to be premature for an engine. Note that the bulk of the module performs a separate set of functions and was developed several years previous to CALB and outside the scope of IMIP funding.

C. Component Serial Number Availability section: This new module will hold a list of serialized component candidates for use in an engine. This list is used as the basis for a "soft" edit of a serial number's availability in module E. When a particular serial number has been committed to an engine, the record of that commitment is also retained in the module.

The last-using engine data can be later referenced when a component is removed from one engine and eventually applied to another using module E. It serves as a cross reference to the old engine so that start and run-time statistics can be copied to the new.

There are two means of loading the availability file. The first is a self-contained set of loading procedures inside the TIMS CALB system. These procedures can be used to load the serial numbe data in advance of performing the logbooking function described in module E.

The second means of loading serialized data is useful only as a mechanism for miscellaneous data corrections. Because the main edit against serial number availability is a "soft" one in module E, the principal maintenance transactions in E. can also "create" availability records IF A USER CHOOSES TO REAFFIRM THE EXISTENCE OF THE COMPONENT AFTER HAVING INITIALLY RECEIVED A REJECTION MESSAGE. It is clear that widespread use of this override feature (ie, by not consistently utilizing the primary serial number loading mechanism) will compromise the integrity of the data as well as slow data entry in E.

D. Kitting Deviations section: Component change letters are to be recorded at the time of assembly kitting on a program module being written outside of TIMS. This data will be recorded by the operator of the Gainesville ASRS device. The data will be recorded for even those components that are not serialized. ONCE PICKING IS COMPLETE, the Change Letter "deviations" will then be transferred over to the TIMS system where they will be stored in association with serialized engine component configuration data (although on a separate file). Where there are deviations in an engine, that engine record will then become "locked" to module E. processing (described immediately below) until a configuration specialist reviews and gives approval to the deviations.

E. Serial Number Loading section: This is the core module of the entire Logbook application. Its functions have been touched upon in the discussion of the other Logbook sections above, although a more systematic review will now be undertaken here:

- o In general terms, the module manages the storage and printing of "Engine Configuration" and "Component Replacement History" data. This data is stored separately on a pair of files, one essentially for each report. There is also two means of managing the files. The first and more important is a series of large transaction "complexes" having the ability to maintain both files at the same time - to the extent that is required - derivative from a single user input. These large transactions functionally emulate an IBM CMS file editor in many respects. The user is able to look at a list of serialized engine components at one time. He may then simply overtype what has been added or changed, and both files are appropriately updated together.

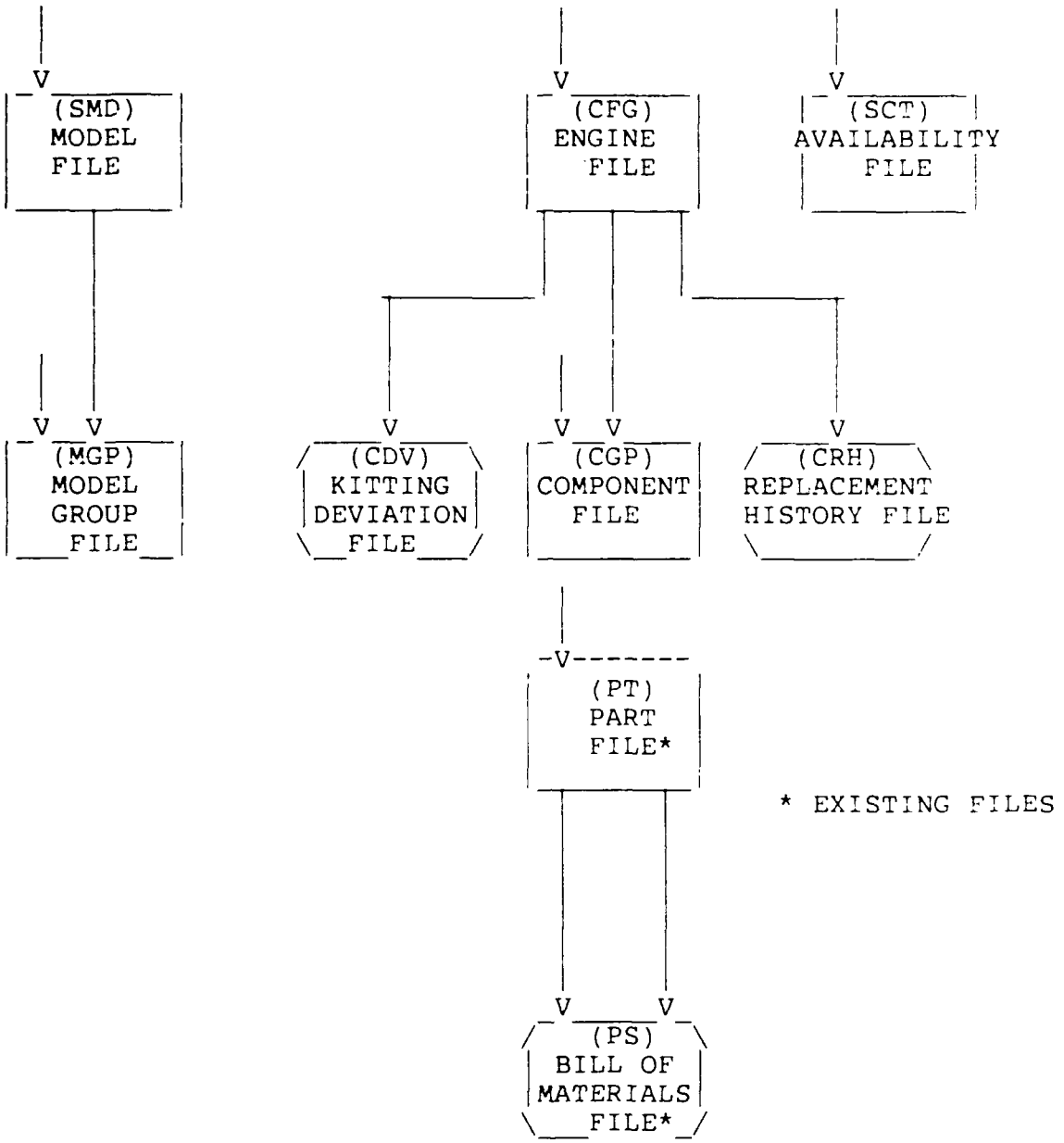
  On the "ADD" transaction of this type, a list of standard parts is first copied off the Module A. support files already described. The list is then presented on screen with prompts for component serial numbers and changes letters. Even those components that are not immediately serialized will be saved with the engine. Such parts will be held on file in anticipation of future inputting sessions using the "UPDATE" transaction.

  A separate set of transactions has been developed to manipulate each of the files separately in the case of miscellaneous or exceptional conditions. It is expected that this second set of transactions will be only sparingly used, and accordingly will be reserved exclusively for a single "master user".

- o The "ADD" and "UPDATE" transaction "complexes" are extremely powerful. In addition to the recording of serialized components applied to an

engine and removed from it, the two transactions have the ability to to ADD serialized components NOT IN THE PART MODEL FILES and REMOVE any serialized component previously associated with the engine. The pair of transactions also has the ability to alter the "printing" or "sorting" order of the serialized components as they fall on the "Engine Configuration" report. The part number groups (numbers which control the print order of the components) can also be altered. It is to be expected that some of these features will be used only very sparingly. However, all are necessary to be able to respond to the variety of exceptional data situations and changes of reporting strategy that may occasionally crop up in the course of maintenance.

3. FILE STRUCTURE ON TIMS:



CALB SECTION	MAJOR FILES
Part Model	SMD, MGP
Bill of Materials	PT, PS
Component Serial Number	SCT
Kitting Deviations	CDV
Serial Number Loading	CFG, CGP, CRH

The various files contain the following data (in general terms):

- o SMD: Contains a few items of general detail regarding a particular engine model.
- o MGP: Contains one part that will figure on a list of components going into an engine. Used in Module E. (Serial Number Loading) to obtain a list of part prompts for the user who is loading component serial numbers.

- o CFG: The engine serial number file. Contains general information relating to a specfic engine serial number for a specific model.

- o CGP: The engine part "group" file. Contains data relating to a specific part and serial number for the part. Also contain performance data that is specific to the serialized component. Where no serial number has yet been added to the engine for the "group", the record will contain just a part number. This will facilitate the "recall" of the components when they are EVENTUALLY placed in the engine. This file is one of the two major stores of data for Module E.

- o CRH: The component replacement history file: Stores a variety of data relating to the following events recorded by Module E:

  - Replacement of one serialized component with another

  - Removal of a serialized component from an engine

  - Initial addition of a serialized component to an engine WHERE THE COMPONENT HAS BEEN USED PREVIOUSLY IN ANOTHER OR EVEN THE SAME ENGINE.

- o CDV: Contains a summary of all the components that have "deviant" Change Letters AS OF THE TIME OF ENGINE KITTING. Used by the configuration specialist exclusively to review kitting deviations.

- o SCT: The serial number availability file. Stores the availability status and latest-using engine of each serialized component used in or to be used in an engine that has been assembled but not shipped.

- o PART: The pre-CALB TIMS part file. Contains a variety of data relating to all the kinds of parts that are recognized by TCAE. There are manufactured parts, purchased parts, and even R & D-only parts on the file.

- o BOM: The pre-CALB TIMS Bill of Material file. Records the "goes-into" relationships between all of the records on the Part file. Used in CALB to perform Change Letter validations and editing.

4. DATA ENTRY INTO THE TIMS DATABASES:

A. While in IBM's CMS environment, enter TIMS1 if Toledo or TIMS2 if Gainesville:

B. A banner like the following will be displayed:

TIMS2 TELEDYNE INDUSTRIAL MANAGEMENT SYSTEM

```
   REQUEST NAME
**************************************
                          *  Y/N
**************************************
 INQUIRY.............   N

 DEFERRED EXECUTION...   N

 TRANSMIT BATCH DATA..   Y

 DATABASE NAME.......   TIMS2
**************************************
```

C. To gain access to the on-line environment where all IBM CALB file maintenance, console inquiries, and printed reports can be accessed, enter a "Y" on the INQUIRY line. Depending on the particular user, one of the two following events will occur:

- o Some users will be passed directly into their initial transaction menu.
- o Other users, having privileges in other TIMS systems in addition to CALB, may be transferred into an aspect of the TIMS environment that does not absolutely require use of menus to invoke transactions. That subsection of the environment is introduced by display on the screen of a second banner relating to the MITROL language which is the program basis of TIMS. The cursor is set at the bottom of this banner as follows:

  ENTER REQUEST: _

  Users in this class must separately invoke a particular CALB menu by keying a menu name into the console positions BEGINNING AT THE CURSOR PROMPT. This class of user also has the additional option of invoking all of their maintenance transactions and ON-LINE console inquiries and reports WITHOUT FIRST HAVING TO INVOKE A MENU. Note: batch or overnight reports MUST be invoked WITHIN the menu system since report search arguments and other allied data processing factors are buried in the menus themselves.

D. Security is maintained by an existing system internal to TIMS that ties particular menus and transactions to the password-protected virtual machines that exist in IBM's VM operating environment. A TIMS database administrator controls all access to this security system and performs all modifications to it. The user and hence the application programmer must submit all requests for security changes (and programming changes) through that other individual.

5. SYSTEMATIC LIST OF TRANSACTIONS, INQUIRIES AND REPORTS FOR NEW CALB IMIP PROJECT-FUNDED CODING IN THE TIMS DATABASES:

A. MENUS:

o Menu ownership by responsible user area:

USER	MENUS
CONFIGURATION MANAGEMENT	CFMENU2*
PRODUCTION CONTROL	CFMENU3*
ASSEMBLY AND TEST	CFMENU8*, CFMENU4, and CFMENU5
QUALITY ASSURANCE	CFMENU7*, CFMENU1, CFMENU5, and CFMENU6

* TOP LEVEL OR MASTER MENUS

o To select an option on any of the menus, simply key in a choice by its transaction number on the menu and hit the enter key: The transaction will then be initiated.

CFMENU1 PRODUCTION ENGINE CONFIGURATION SYSTEM MAINTENANCE MENU FOR QUALITY ASSURANCE

0. RETURN

1. ADD AN ENGINE
2. REVISE AN ENGINE
3. MISC. REVS TO AN ENG
4. TRANSFER AN ENG COMP
5. SHIP AN ENGINE AND CLEAR SERIAL NBRS
6. REVISE ENGINE STATS
7. SCATTER AN ENGINE"S COMPONENTS
8. DELETE AN ENGINE
9. ADD A MODEL
10. REVISE A MODEL
11. REMOVE A MODEL
12. REVISE SERIAL AVAILABILITY
13. ADD CONFIG HISTORY
14. REVISE CONFIG HISTORY
15. REMOVE CONFIG HISTORY
16. config rpt signoffs by engine

PLEASE MAKE A SELECTION AND PRESS ENTER

INPUT

CFMENU2 PRODUCTION ENGINE CONFIGURATION SYSTEM GENERAL MENU
FOR CONFIGURATION CONTROL

0. RETURN

1. ADD A KIT DEVIATION
2. REVISE A KIT DEVIATION
3. APPROVE/PLACE-ON-HOLD AN ENGINE
4. REMOVE A KIT DEVIATION

5. KIT DEVIATION INQUIRY BY ENGINE
6. ENGINE CONFIGURATION INQUIRY

7. CHANGE LETTER DEVIATION REPORT FOR UNSHIPPED ENGINES - BATCH
8. AUDIT THE W-U RELATION FOR SER PARTS BY MODEL - ON-LINE

PLEASE MAKE A SELECTION AND PRESS ENTER

INPUT

CFMENU3 PRODUCTION ENGINE CONFIGURATION SYSTEM ON-LINE MENU
FOR PRODUCTION CONTROL

0. RETURN

1. ADD SERIAL NBRS
2. REVISE A SER NBR
3. REMOVE A SER NBR

4. SERIAL NUMBER INQUIRY

5. ASSEMBLY BOM EXTRACTION FOR KITTING
6. AUDIT THE W-U RELATION FOR SER PARTS BY MODEL - ON-LINE

7. ASSEMBLY ORDER - ON LINE
8. ASSEMBLY ORDER - BATCH
9. ASSEMBLY ORDER ROUTING - ON LINE
10. ASSEMBLY ORDER ROUTING - BATCH

PLEASE MAKE A SELECTION AND PRESS ENTER

INPUT

CFMENU4 PRODUCTION ENGINE CONFIGURATION SYSTEM MAINTENANCE MENU
FOR ASSEMBLY AND TEST

0. RETURN

1. ADD AN ENGINE
2. REVISE AN ENGINE
3. SHIP AN ENGINE AND CLEAR SERIAL NUMBERS
4. SCATTER AN ENGINE"S COMPONENTS
5. REVISE ENGINE STATS

PLEASE MAKE A SELECTION AND PRESS ENTER

INPUT

CFMENU5 PRODUCTION ENGINE CONFIGURATION SYSTEM INQUIRY MENU

0. RETURN

1. ENGINE CONFIGURATION
2. CONFIG HISTORY
3. KIT DEVIATIONS
4. COMP PART TO ENGINE

5. MODEL CONFIGURATION

6. SERIAL NUMBER

PLEASE MAKE A SELECTION AND PRESS ENTER

INPUT

CFMENU6 PRODUCTION CONFIGURATION SYSTEM REPORT MENU

0. RETURN TO MAIN MENU
1. ENGINE CONFIGURATION REPORT - ONLINE
2. COMPONENT REPLACEMENT HISTORY REPORT - ONLINE
3. ENGINE CONFIGURATION IN A RANGE OF SERIAL NUMBERS - ONLINE
4. ENGINES HAVING A COMPONENT PART - BATCH
5. ENGINES HAVING A COMPONENT PART AND REVISION LETTER - BATCH
6. CHANGE LETTER DEVIATION REPORT FOR UNSHIPPED ENGINES BATCH
7. AUDIT THE W-U RELATION FOR SER PARTS BY MODEL - ON-LINE

PLEASE MAKE A SELECTION AND PRESS ENTER

INPUT

CFMENU7 PRODUCTION ENGINE CONFIGURATION SYSTEM MASTER MENU
FOR QUALITY ASSURANCE

0. RETURN

1. MAINTENANCE MENU
2. INQUIRY MENU
3. REPORT MENU

PLEASE MAKE A SELECTION AND PRESS ENTER

INPUT

CFMENU8 PRODUCTION ENGINE CONFIGURATION SYSTEM MASTER MENU
FOR ASSEMBLY AND TEST

0. RETURN

1. MAINTENANCE MENU
2. INQUIRY MENU

PLEASE MAKE A SELECTION AND PRESS ENTER

INPUT

B. TRANSACTION TO MENU CROSS REFERENCE: The following sections discuss each transaction individually. What follows first is a cross-reference guide between the numbered items on each menu and the programs they invoke. Using the Document Reference number as a cross-reference, a user can easily locate the discussion of a particular program of interest.

CFMENU1 (MODULE A. AND E. TRANSACTIONS)

TRANSACTION NAME	PROGRAM	DOCUMENT REF NBR
1. ADD AN ENGINE	CFNCFG	M5-1
2. REVISE AN ENGINE	CFUCFG	M5-2
3. MIS. REVS TO AN ENGINE	CFUCFG1	M5-3
4. TRANSFER AN ENGINE COMPONENT	CFUCFGT	M5-4
5. SHIP AN ENGINE AND CLEAR SERIAL NUMBERS	CFDSER1	M5-5
6. REVISE ENGINE STATISTICS	CFUCFG2	M5-6
7. SCATTER AN ENGINE"S COMPONENTS	CFDCFG1	M5-7
8. DELETE AN ENGINE	CFDCFG	M5-8
9. ADD A MODEL	CFNMOD	M5-9
10. REVISE A MODEL	CFUMOD	M5-10
11. REMOVE A MODEL	CFDMOD	M5-11
12. REVISE SERIAL AVAILABILITY	CFUSER1	M5-12
13. ADD CONFIGURATION HISTORY	CFNCRH	M5-13
14. REVISE CONFIGURATION HISTORY	CFUCRH	M5-14
15. REMOVE CONFIGURATION HISTORY	CFDCRH	M5-15
16. CONFIGURATION REPORT SIGNOFFS BY ENGINE	CFDCFG3	M5-23

CFMENU2 (MODULE B. AND D. TRANSACTIONS)

TRANSACTION NAME	PROGRAM	DOCUMENT REF NBR
1. ADD A KIT DEVIATION	CFNDEV	M5-16
2. REVISE A KIT DEVIATION	CFUDEV	M5-17
3. APPROVE/PLACE-ON-HOLD AN ENGINE	CFUDEV1	M5-18
4. REMOVE A KIT DEVIATION	CFDDEV	M5-19
5. KIT DEVIATION INQUIRY BY ENGINE	CFICFG2	I5-3
6. ENGINE CONFIGURATION INQUIRY	CFICFG	I5-1
7. CHANGE LETTER DEVIATION REPORT...	CFPBOM	R5-6
8. AUDIT THE W-U RELATION FOR SER PARTS...	CFPCFG5	R5-7

CFMENU3 (MODULE C. TRANSACTIONS)

TRANSACTION NAME	PROGRAM	DOCUMENT REF NBR
1. ADD SERIAL NUMBERS	CFNSER	M5-20
2. REVISE A SERIAL NUMBER	CFUSER	M5-21
3. REMOVE A SERIAL NUMBER	CFDSER	M5-22
4. SERIAL NUMBER INQUIRY	CFISER	I5-6
5. ASSEMBLY BOM EXTRACTION FOR KITTING	OIPAKIT1	R5-8
6. AUDIT THE W-U RELATION FOR SER PARTS...	CFIBOM	R5-7
NOTE: OTHER TRANSACTIONS RELATE TO EXISTING PRE-CALB TRNANSACTIONS THAT WILL NOT BE COVERED IN THIS DOCUMENT		

CFMENU4 (MODULE E. TRANSACTIONS)

TRANSACTION NAME	PROGRAM	DOCUMENT REF_NBR
1. ADD AN ENGINE	CFNCFG	M5-1
2. REVISE AN ENGINE	CFUCFG	M5-2
3. SHIP AN ENGINE AND CLEAR SERIAL NUMBERS	CFDSER1	M5-5
4. SCATTER AN ENGINE"S COMPONENTS	CFDCFG1	M5-7
5. REVISE ENGINE STATISTICS	CFUCFG2	M5-6

CFMENU5 (GENERALIZED INQUIRY MENU)

TRANSACTION NAME	PROGRAM	DOCUMENT REF_NBR
1. ENGINE CONFIGURATION	CFICFG	I5-1
2. CONFIGURATION HISTORY	CFICFG1	I5-2
3. KIT DEVIATIONS	CFICFG2	I5-3
4. COMPONENT PART TO ENGINE	CFICFG3	I5-4
5. MODEL CONFIGURATION	CFIMOD	I5-5
6. SERIAL NUMBER	CFISER	I5-6

CFMENU6 (GENERALIZED REPORT MENU)

TRANSACTION NAME	PROGRAM	DOCUMENT REF_NBR
1. ENGINE CONFIGURATION REPORT - ON-LINE	CFPCFG	R5-1
2. CONFIGURATION HISTORY REPORT - ON-LINE	CFPCFG1	R5-2
3. ENGINE CONFIGURATION IN A RANGE OF...	CFPCFG2	R5-3
4. ENGINES HAVING A COMPONENT PART - BATCH	CFPCFG3	R5-4
5. ENGINES HAVING A COMPONENT PART AND A...	CFPCFG4	R5-5
6. CHANGE LETTER DEVIATION REPORT FOR...	CFPCFG5	R5-6
7. AUDIT THE W-U RELATION FOR SER PARTS...	CFPBOM	R5-7

CFMENU7 (MODULE A. AND E. MENU)

TRANSACTION NAME	PROGRAM	DOCUMENT REF_NBR
1. MAINTENANCE MENU	CFMENU1	ABOVE
2. INQUIRY MENU	CFMENU5	ABOVE
3. REPORT MENU	CFMENU6	ABOVE

CFMENU8 (MODULE E. MENU, PRIMARILY)

TRANSACTION NAME	PROGRAM	DOCUMENT REF_NBR
1. MAINTENANCE MENU	CFMENU4	ABOVE
2. INQUIRY MENU	CFMENU5	ABOVE

C. MAINTENANCE TRANSACTIONS (ALL ON-LINE):

M5-1: ADD AN ENGINE: A transaction "complex" that is used to create a new engine identity beginning with an engine record (CFG). A configuration (CGP) record is also created for each component identified on the model files as going into an engine of a particular model. A component replacement history (CRH) record is also created for any serialized component which has been used before in another engine AND PREVIOUSLY REMOVED FROM IT.

The parts taken off the model files (SMD and MGP) are presented to the user as a list of DEFAULT components requiring serialization. The user can input all, some or none of the serial numbers when he uses this transaction. Even those components that do not receive initial serialization are saved on file (CGP) and will be presented back to the user later when he is ready to "modify" the engine with the M5-2 "REVISE" TRANSACTION.

The user has a variety of additional options which he can invoke. He can add more groups (or parts) to the engine, he can remove any of the groups, he can change part numbers on the default list in order to (for example) indicate that an alternate part is being used in preference to the default, and he can even modify the order that the parts will be listed in the future on the "REVISE" transaction and on the Engine Configuration report.

Where a "hold" has been placed on an engine by Configuration management as a result of a deviation in kitting (in terms of engineering change letters), this transaction will not function. The user of this transaction must in that case await an "unlocking" of the engine by Configuration management.

Engine build and run statistics can also be input on this transaction and reflected down to each component just serialized.

The following are major edits in the transaction:

- o A serialized component can only be used in one engine at a time
- o A deviation in engineering change letter (ie, a change letter larger than the change letter of record on the TIMS BOM FOR THAT ENGINE SERIAL NUMBER AND MODEL) will cause the program to generate a warning message on the console and mark the serialized (CGP) record as being deviant.
- o A serialized component not found to be "available" (ie, not on the serial number availability file, the SCT) will produce a reject diagnostic, but CAN then be overriden in such a fashion that an availability record is generated "on the fly".
- o If a user overrides a part number default with an INVALID part number, the line will be rejected
- o If the user attempts to alter the sort order of the part list in such a way that he duplicates a previously loaded "group number" (the number that governs the order of listing and printing), then that line too will be rejected

The following is a summary of the dialog for this transaction:

- o Prompt for model code and engine serial number base. See display M5-1A below.

- Prompt for build and test run statistics which will be applied TO ALL PARTS THAT HAVE BEEN SERIALIZED in succeeding steps of the program. See display M5-1B below.

- Prompt for controls that govern the examination of the list of parts copied off the model file. The first prompt governs the examination of the list. An option of "U" indicates to the program that examination of the list WILL CONTINUE WITHOUT THE LOADING OF ANY DATA TO FILE. An "S" conversely indicates that the manipulation of the data is complete and that the list in its existing form should be applied completely to the database. The second prompt governs the section of the list to examine. This control is necessary because the list of part prompts may stretch for several "pages". The group "number" then governs the first line in the list that is to be examined in a given "update" ("U") iteration. A "1" represents the first line item on the list, a "2" represents the second line item and so on. Using this feature, a user may jump immediately into the middle of a list of parts or go backwards and review previous input as he desires. An overrideable default value of "1" is placed into the field on the first iteration of this step ahead of display of a section of the list (the next dialog step), and succeeding iterations default to the last line examined IN THE PREVIOUS ITERATION of the list step plus one line. Using these defaults, a user can "walk" through an entire multi-page list without having to make ANY elective changes in the listing order. See displays M5-1C and M5-1E below.

- Update prompts for a section of the parts list. This section allows the entry of change letter ("REV") and serial number and other optional data. To enter these items for a group, the user can tab over to the appropriate field and key in the data. The following may also be performed: To change part numbers for a group, overstrike the part number in the list to be changed. To remove a group, blank out the part number. To alter the sort order of the list, change group ("GRP") numbers as are necessary. To add a group number, go to the end of the list where there are additional entries having a default group number of "999". In these "999" lines, as many extra groups as are needed can be added (subject to a maximum of 125 groups). The group numbers input will control the print order on the Engine Configuration Report. A unique title may also be changed, or incorporated at the time of a line item "add". Note that this title is used only as an item of memorandu . in data entry. The part file description is used on the Engine Configuration report.

  No physical changes are made to the database or edits performed, until a user indicates "S"("STOP") on the M5-1C/M5-1E job step. See display M5-1D for an example of part list prompts.

- The next dialog step may not be seen in the input of some engines. This step will occur only when an editing problem arises at the time of application of the list to database. The list is applied one item at a time, and an "interruption" will only occur when an editing problem is encountered. Typical screen prompts in this case are illustrated in displays M5-1F and M5-1G below. These displays are also prompts for data correction. Many of the errors that may be encountered have been previously described. The user may correct an error of the type shown in M5-1F by simply hitting the enter key (thus overriding). Any other error message showing in M5-1F or M5-1G must be physically corrected in order to load the group. To "escape" without load of the group, type a period followed by

blanks in the group number field.

Other messages may occasionally pop on screen and temporarily halt processing of the list load. In any such case AND IN any other case where processing is temporarily suspended and there is a program status of "MORE..." displayed in the bottom right corner of the screen, simply hit the enter key to forward processing of the transaction along. A "MORE..." status message may in particular precede a display of the type shown in M5-1F and M5-1G, but the user response should be the same - namely to force the transaction along by the striking of the enter key. However, once the "MORE..." status is replaced by "INPUT", the striking of the enter key will NO LONGER be sufficient to force a resumption of processing of the transaction (except for the case of the "serial number not found" error).

CFNCFG ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: ENGINE SER #:

M5-1A

INPUT

CFNCFG ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203

TRN-DATE: 10/26/88

BUILD NBR: 0 BLD DESC:

SCR-STARTS: 0

INCREMENTAL RUN HRS: 0 INCREMENTAL RUN MIN: 0

M5-1B

INPUT

```
CFNCFG              ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203
UPDATE(U), OR STOP(S): U 1ST GROUP: 1
```

M5-1C

INPUT

```
CFNCFG              ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203
01 GRP PART-NUMBER     TITLE          | REV SERIAL-NUMBR
=> 010 34993           BEARING ASS #1   -f  ab125
=> 020 23395           SUPPORT          ct  3002
=> 030 34492           STATOR HSG
=> 040 XXXXX           BEARING 2
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> .
```

M5-1D

INPUT

```
CFNCFG              ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203
UPDATE(U), OR STOP(S): s 1ST GROUP: 14
```

M5-1E

INPUT

```
CFNCFG              ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203

SN NOT FOUND AMONG THE AVAILABLE; CAN OVERRIDE AT THIS TIME

CORRECTION ROUTINE: TO ESCAPE WITHOUT UPDATE, INPUT A "."

GRP: 020 PART-NUMBER: 23395          TITLE    |: SUPPORT          REV: CT
SERIAL-NUMBR: 3002
```

M5-1F

INPUT

CFNCFG ADD A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450204

CORRECTION ROUTINE: TO ESCAPE WITHOUT UPDATE, INPUT A "."

GRP: 040 PART-NUMBER: XXXXX TITLE |: BEARING 2

PART-NUM XXXXX WAS NOT FOUND
LINE IGNORED

M5-1G INPUT

M5-2: REVISE AN ENGINE: A transaction "complex" that is used to make all kinds of modifications to an EXISTING engine identity. Some fields general to an engine (CFG record) may be modified as well as all the fields on each component (CGP record). A component replacement history record (CRH) is also CREATED for any serialized component which has been used before in another engine AND PREVIOUSLY REMOVED FROM IT. Also, a CRH is created where a serialized component is exchanged with another, and where a serialized component is removed from an engine without immediate replacement.

The list of parts shown to the user represents the list previously copied off the model file using the "ADD" transaction M5-1 discussed previously, plus any modifications made to it in previous uses of this "REVISE". Once again, any components left without a serial number at the end of a given iteration of the "REVISE" will be nonetheless retained for future iterations of the "REVISE".

The user has a variety of additional options which he can invoke. He can add more groups (or parts) to the engine, he can remove any of the groups, he can change part numbers in order to (for example) indicate that an alternate part is being used in preference to the default, he can remove serial identities and even serialized PARTS, and he can modify the order that the parts will be listed out in the future on the "REVISE" transaction and on the Engine Configuration report.

Where a "hold" has been placed on an engine by Configuration management as a result of a deviation in kitting (in terms of engineering change letters), this transaction will not function. The user of this transaction must in that case await an "unlocking" of the engine by Configuration management.

Engine build and run statistics can also be input on this transaction and reflected down to each CURRENTLY SERIALIZED component (ie, after the latest load of components has been completed).

The following are major edits in the transaction:

- o Use of the same serialized component in multiple engines at the same time is not allowed.

- o A deviation in engineering change letter (ie, a change letter larger than the change letter of record on the TIMS BOM FOR THAT ENGINE SERIAL NUMBER AND MODEL) will cause the program to generate a warning message on the console and mark the serialized (CGP) record as being deviant.

- o A serialized component not found to be "available" (ie, not on the serial number availability file, the SCT) will produce a reject diagnostic, but CAN then be overriden in such a fashion that an availability record is generated "on the fly".

- o If a user overrides a part number default with an INVALID part number, the line will be rejected

- o If the user attempts to alter the sort order of the part list in such a way that he duplicates a previously loaded "group number" (the number that governs the order of listing and printing), then that line too will be rejected

The following is a summary of the computer dialog in this transaction:

- Prompt for model code and engine serial number base. See display M5-2A below.

- Prompt for build and test run statistics which will be applied TO ALL PARTS THAT WILL HAVE BEEN SERIALIZED at the end of succeeding steps of the program. See display M5-2B below.

- Prompt for controls that govern the examination of the list of parts copied off the model file. The first prompt governs the examination of the list. An option of "U" indicates to the program that examination of the list WILL CONTINUE WITHOUT THE LOADING OF ANY DATA TO FILE. "S" conversely indicates that the manipulation of the data is complete and that the list in its now existing form should be applied completely to the database. The second prompt governs the section of the list to examine. This control is necessary because the list of part prompts may stretch for several "pages". The group "number" then governs the first line in the list that is to be examined in a given "update" ("U") iteration. A "1" represents the first line item on the list, a "2" represents the second line item and so on. Using this feature, a user may jump immediately into the middle of a list of parts or go backwards and review previous input as he desires. A overrideable default value of "1" is placed into the field on the first iteration of this step ahead of display of a section of the list (the next dialog step), and succeeding iterations default to the last line examined IN THE PREVIOUS ITERATION of the list step plus one line. Using the defaults a user can thus "walk" through an entire multi-page list without having to make ANY elective changes in the listing order. See displays M5-2C and M5-2E below.

- Update prompts for a section of the parts list. This section allows the entry of change letter ("REV") and serial number and other miscellaneous data. To enter these items for a group, the user should tab over to the appropriate field and key in the data. In addition, to change a part number for a group, a user can overstrike a part number in the list. To remove a group, the part number should be blanked out. To alter the sort order of the list, the group ("GRP") numbers can be changed as is appropriate. And to add a group number, go to the end of the list where there are additional entries having a default group number of "999". In the "999" lines, as many extra groups as are required can be added (subject to a maximum of 125 groups). A unique title may also be changed, or incorporated at the time of a line item "add". Note that this title is used only as an item of memorandum in data entry. The part file description is used on the "Engine Configuration" report.

  Note that no physical changes are made to the database or edits performed, until a user indicates "S"("STOP") on the preceeding job step. See display M5-2D below for an example of part list prompts. Also note that only true changes to the list are applied to the database in order to expedite speed of processing.

- The next dialog step may n been seen in the input of some engines. This step occurs only when a change is introduced such that additional data is required or there is a data editing problem. The list of items is examined and changes are applied one at a time. An interruption will produce screen prompts such as are illustrated in displays M5-2F, M5-2G, and

M2-H below. These displays are also prompts for additional data inputs (M2-2F) or data corrections (M5-2G and M5-2H). The M5-2F is strictly a prompt for remarks concerning a serial number swap or removal without replacement. Note: a hybrid display combination of M5-2F and M5-2G may also appear if an error condition occurs in an attempted swap.

Typical error conditions have been previously described. The user may correct an error of the types shown in M5-2G by simply hitting the enter key (thus overriding). Any other error message showing in M5-2G or M5-2H must be physically corrected in order to load the group. To "escape" - which would in affect cause restoration of the group to its original state prior to the abortive modification, type a period followed by blanks in the group number field.

There are also other messages that may occasionally pop on screen and temporarily halt processing of the list load. In any such case AND IN any other case where processing is temporarily suspended and there is a program status of "MORE..." displayed in the bottom right corner of the screen, simply hit the enter key to force a continuation of processing. A "MORE..." status message may in particular precede a display of the type shown in M5-2F, M5-1G, and M5-2H, but the user response should be the same - namely to force the transaction along by the striking of the enter key. However, once the "MORE..." status has been transformed to "INPUT", the striking of the enter key will NOT be sufficient to force a resumption of processing of the transaction (save for a "serial number not found" condition).

CFUCFG REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: ENGINE SER #:

CFUCFG REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203
TRN-DATE: 10/26/88

INCREMENTAL BUILD: 0 BLD DESC:

INCREMENTAL STARTS: 0

INCREMENTAL RUN HRS: 0 INCREMENTAL RUN MIN: 0

M5-2B

INPUT

CFUCFG REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203
UPDATE(U), OR STOP(S): U 1ST GROUP: 1

M5-2C

INPUT

```
CFUCFG          REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203
01 GRP PART-NUMBER     TITLE          | REV SERIAL-NUMBR
=> 010 34993           BEARING ASS #1   -F  AB125
=> 020 23395           SUPPORT          -f  ct3003
=> 030 34492           STATOR HSG       -e  yyyyy
=> 040 xxxxx           BEARING 2
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> .
```

M5-2D

INPUT

```
CFUCFG          REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203
UPDATE(U), OR STOP(S): s 1ST GROUP: 14
```

M5-2E

INPUT

```
CFUCFG          REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203


CORRECTION/CHANGE LOG ROUTINE: TO ESCAPE WITHOUT UPDATE, INPUT A "."

GRP: 020 PART-NUMBER: 23395       TITLE       |: SUPPORT          REV: -F
SERIAL-NUMBR: CT3003       F/C: a
:
REMARKS(1): correcting a serial number
REMARKS(2):
```

M5-2F

INPUT

```
CFUCFG          REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203

SN NOT FOUND AMONG THE AVAILABLE; CAN OVERRIDE AT THIS TIME

CORRECTION/CHANGE LOG ROUTINE: TO ESCAPE WITHOUT UPDATE, INPUT A "."

GRP: 030 PART-NUMBER: 34492          TITLE    |: STATOR HSG       REV: -E
SERIAL-NUMBR: YYYYY        F/C:
: DON"T FILL OUT ANY OF THE FOLLOWING; 1ST SERIAL ASSIGNMENT FOR GROUP
REMARKS(1):
REMARKS(2):
```

M5-2G

INPUT

CFUCFG REVISE A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203

PART CORRECTION ROUTINE: TO ESCAPE WITHOUT UPDATE, INPUT A "."

GRP: 040 PART-NUMBER: XXXXX TITLE |: BEARING 2

PART-NUM XXXXX WAS NOT FOUND
LINE IGNORED

M5-2H

INPUT

M5-3: MIS. REVS TO AN ENGINE: A simple transaction that allows selected corrections to build and test data for an engine and its components. The transaction is intended as a backup to the M5-1, M5-2, and M5-6 to handle exceptional data conditions ONLY. Unlike the two "complexes" and the M5-6, this transaction adjusts fields one at a time. The others are sweeping, which is to say that data input on a single panel is applied TO EACH currently serialized component. This transaction applies field changes to only a single component at a time - which the user must first specify by indication of a group number. This transaction also permits the update of a certain number of fields general to the entire engine (that are NOT specific to any one component).
The dialog is relatively simple, prompting first for generalized engine changes, then later for specific component groups (see displays M5-3A through M5-3D below):

CFUCFG1 MISCELLANEOUS REVISIONS TO AN ENGINE AND ITS GROUPS

MODEL NUMBER: ENGINE SER #:

M5-3A INPUT

CFUCFG1 MISCELLANEOUS REVISIONS TO AN ENGINE AND ITS GROUPS

MODEL NUMBER: c ENGINE SER #: 450203
BUILD NBR: 0 TRN DATE: 10/26/88 STARTS: 0

M5-3B INPUT

CFUCFG1 MISCELLANEOUS REVISIONS TO AN ENGINE AND ITS GROUPS

MODEL NUMBER: c ENGINE SER #: 450203

GRP:

M5-3C INPUT

CFUCFG1 MISCELLANEOUS REVISIONS TO AN ENGINE AND ITS GROUPS

MODEL NUMBER: c ENGINE SER #: 450203

GRP: 010

PART NUMBER: 34993 SERIAL NUMBR: AB125 REV: -F

REV DEV: TRN DATE: 10/26/88 BUILD NBR: 0

STARTS: 0 RUN HRS: 0 RUN MIN: 0

M5-4: TRANSFER AN ENGINE COMPONENT: A simple, one panel transaction that will "steal" a component out of one engine and apply it to another. Component replacement history records will also be generated for both engines by the transaction. The transaction provides a faster means of stealing when swift data maintenance is imperative. The same effect can be achieved by use of the M5-2, first applied to the surrendering engine and then to the engine of component receipt. The M5-2 should probably be used to achieve the effect of M5-4 most of the time. See panel M5-4A:

CFUCFGT TRANSFER A COMPONENT FROM ONE ENGINE TO ANOTHER

MODEL NUMBER: ENGINE SER #:

GRP: PART-NUMBER: SERIAL NUMBR: F/C:
TRN DATE:

REMARKS(1):
REMARKS(2):

M5-4A INPUT

M5-5: SHIP AN ENGINE AND CLEAR SERIAL NUMBERS: A simple transaction which performs a variety of maintenance cleanup activities at the time of engine shipment. Firstly, a flag is set on the engine record (CFG) to suppress the printing of change letter deviations on the R5-6 report. Secondly, the availability file (the SCT) is cleared of serialized components now recorded as being in the engine. The record of latest configuration (CGP) and the engine's component replacement history (CRH) are preserved in perpetuity, however. See display M5-5A.

CFDSER1 SHIP AN ENGINE AND CLEAR THE SERIAL NUMBER AVAILABLE FILE

MODEL NUMBER: ENGINE SER #:

M5-5A INPUT

M5-6: REVISE ENGINE STATISTICS: A simple transaction to apply incremental test and build data to an engine. All currently serialized groups receive the incremental updates. Those not currently serialized do not. This transaction duplicates a small portion of transaction M5-2. See display M5-6A.

CFUCFG2 REVISE ENGINE STATISTICS - AUTOMATED

MODEL NUMBER: ENGINE SER #:

INCREMENTAL BUILD: BLD DESC:

INCREMENTAL STARTS: INCREMENTAL RUN HRS: INCREMENTAL RUN MIN:

M5-6A INPUT

M5-7: SCATTER AN ENGINE"S COMPONENTS: This transaction allows a user to return all currently serialized components in an engine to the availability file (SCT). The serialized components previously marked as being in the engine are deleted from file as is all record of kitting deviations, if any. The component replacement history (CRH) for the engine, however, is retained, since this data must serve as reference to other engines which may later receive the seasoned components now being scattered. This is because the component replacement history is the single source of reference for accumulated component test and build data.

The seasoned components are returned to a status of available - meaning that they are assumed to be immediately reuseable. Those which must be scrapped will have to be later deleted using transaction M5-22 described below, REMOVE A SERIAL NUMBER. In addition, those serialized components which require some kind of repair prior to being made available for recycling will have to be later statused as "ON HOLD" using M5-12, REVISE SERIAL NUMBER AVAILABILITY.

When the serialization process begins anew at a later date, transaction M5-1, ADD AN ENGINE, rather than transaction M5-2, REVISE AN ENGINE, must be used in order to obtain a list of default components as prompts on an input screen.

The dialog for this transaction has three steps. The user initially receives prompts to identify the engine (M5-7A), a list of components now on the engine is then shown (M5-7B), and there is finally a prompt for confirmation of intention to scatter (M5-7C).

CFDCFG1 SCATTER AN ENGINE"S COMPONENTS

MODEL NUMBER: c ENGINE SER #: 450203 TRN DATE:

M5-7A INPUT

CFDCFG1 SCATTER AN ENGINE"S COMPONENTS

MODEL NUMBER: c ENGINE SER #: 450203 TRN DATE:

HOLD-ASSEMBLY: TRN DATE: 10/26/88 BLD: 0

GRP	TITLE	PART NUMBER	SERIAL NBR	REV	D	TRN DATE	BLD	STS	RUN HRS	MIN
010	BEARING ASS	34993	AB125	-F		10/26/88	0	0	0	0
020	SUPPORT	23395	CT3003	-F		10/26/88	0	0	0	0
030	STATOR HSG	34492	QA123A203B	-E		10/26/88	0	0	0	0
040	BEARING 2	19301				10/26/88	0	0	0	0

M5-7B MORE...

CFDCFG1 SCATTER AN ENGINE"S COMPONENTS

MODEL NUMBER: c ENGINE SER #: 450203 TRN DATE:

HOLD-ASSEMBLY: TRN DATE: 10/26/88 BLD: 0

DO YOU WISH TO SCATTER:

M5-7C INPUT

M5-8: DELETE AN ENGINE: This transaction is useful only in those rare situations where the complete identity of an engine must be deleted. Literally all records for the engine are removed by this transaction, including current configuration (CGP), configuration history (CRH), and kitting deviation history (CDV). What is not touched by this transaction is the availability file (SCT). Those components currently serialized are NOT restatused as "available" as in the case with transaction M5-7 where serialized components are being scattered. To reflect a renewal of availability for any components previously recorded as being serialized on an engine being deleted, the user will have to use transaction M5-12, REVISE SERIAL NUMBER AVAILABILITY, described below. The "last use" field should also be blanked in this case by M5-12.
The dialog for this transaction has three steps. The user is initially prompted for the identity of an engine (M5-8A), he is then shown a list of components now on the engine (M5-8B), and he is finally prompted for confirmation of his intent to delete (M5-8C).

CFDCFG COMPLETELY REMOVE AN ENGINE CONFIGURATION

MODEL NUMBER: ENGINE SER #:

M5-8A INPUT

CFDCFG COMPLETELY REMOVE AN ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203

HOLD-ASSEMBLY: TRN DATE: 10/26/88 BLD: 0

GRP	TITLE	PART NUMBER	SERIAL NBR	REV	D	TRN DATE	BLD	STS	RUN HRS	MIN
010	BEARING ASS	34993	AB125	-F		10/26/88	0	0	0	0
020	SUPPORT	23395	CT3003	-F		10/26/88	0	0	0	0
030	STATOR HSG	34492	QA123A203B	-E		10/26/88	0	0	0	0
040	BEARING 2	19301				10/26/88	0	0	0	0

M5-8B MORE...

CFDCFG COMPLETELY REMOVE AN ENGINE CONFIGURATION

MODEL NUMBER: c ENGINE SER #: 450203

HOLD-ASSEMBLY: TRN DATE: 10/26/88 BLD: 0

DO YOU WISH TO DELETE:

M5-8C INPUT

M5-9: ADD A MODEL: This transaction is used primarily to assemble a list of component part prompts for an engine. The prompts are stored on a pair of files (the SMD and MGP) and are copied by transaction M5-1 when a user wishes to load a new engine. A user thus does NOT have to key in component part numbers when he is using M5-1. He instead is presented with a previously developed list from which he then only has to indicate component serial numbers and change letters. The list presented in any given case will depend upon the model number specified (for example, the Tomahawk F107 has a model code of "C").

This transaction also stores some miscellaneous items of information concerning generalities of a model. This information includes a component-list sequence number called a "group" number (discussed also in M5-1 and M5-2) and a standard model serial-number prefix BY MODEL. This latter piece of information can be accessed based upon input of a simple one-position model number. A user thus does not have to input an entire extended engine serial number every time he wishes to perform maintenance (as for example in M5-1) or obtain a print on an engine. Some other odd pieces of data that are constant FOR AN ENGINE MODEL and which are printed out on R5-1, the Engine Configuration Report, are also stored on the model files.

The dialog for this transaction begins with a prompt for a model number (for example, "C") shown in M5-9A below. If there not yet any components for this model (or if there is no previous record for the model at all), prompt M5-9B will appear. A user may now key in those general items of information regarding a new model. Striking enter again will present the user with panel M5-9C which controls the entry of the list of components in much the same fashion as a user can REVIEW a new list of components in M5-1. Entry of a "U" into M5-9C will present the user with an open list of line prompts for component part numbers and their corresponding group numbers (that controls the list's sorting order) and brief part descriptions (display M5-9D). Whenever a user fills a screen with list items and hits enter once again, he is returned to panel M5-9C. He can then load more items to the list after striking enter yet again (with a "U" remaining in the M5-9C prompt), or by entering an "S" in the prompt (see display M5-9E), actual loading of list items to file will begin. Those items that have no errors will be loaded one at a time without further console messages. Any that do have an error will interrupt the loading process and cause display of a panel such as is illustrated in M5-9F. A user may then make corrections to the list item. Sometimes, a user may have to strike enter an additional time after M5-9F is displayed in order to begin corrections. This will be required whenever a display status of "MORE..." rather than "INPUT" is displayed in the bottom right corner of panel 5M-9F. An error will occur where an invalid part number has been entered or there has been a duplication of a group number FOR THAT SPECIFIC MODEL.

CFNMOD ADD A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER:

M5-9A INPUT

CFNMOD ADD A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: d

MODEL NAME:

MODEL PART NUMBER:

MODEL PREFIX:

BASE PART NUMBER:

M5-9B INPUT

```
CFNMOD          ADD A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: d
UPDATE(U), OR STOP(S): U
```

M5-9C INPUT

```
CFNMOD          ADD A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: d
01 GRP PART-NUMBER     TITLE          |
=> 010 34993           brg, assy #1
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> 999
=> .
```

M5-9D INPUT

```
CFNMOD          ADD A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: d
UPDATE(U), OR STOP(S): s




                              M5-9E                          INPUT
```

```
CFNMOD          ADD A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: d

PROBLEM ARISING IN  GRP: 010

PART-NUMBER: XXXXX          TITLE          |: BRG, ASSY # 1




PART-NUM XXXXX          WAS NOT FOUND
LINE IGNORED

                              M5-9E                          MORE...
```

M5-10: REVISE A MODEL: This transaction is the companion "change" transation to M5-9. The pair is used primarily to modify a list of component part prompts for an engine. The prompts are stored on a pair of files (the SMD and MGP) and are copied by transaction M5-1 when a user wishes to load a new engine. A user thus does NOT have to key the component prompts when he is using M5-1. He instead is presented with a previously coded list of part numbers for which he then has only to indicate the component serial numbers and change letters. M5-1 is thus able to present distinct and different lists of part numbers for separate engine models. The specification of a model number (for example, the Tomahawk F107 has a model code of "C") determines the list that the M5-1 will copy from the SMD/MGP.

This transaction can also modifiy all the miscellaneous items of information concerning generalities of a model that M5-9 has previously loaded. This information includes a component-list sequence number called a "group" number (discussed also in M5-1 and M5-2) and a standard model serial-number prefix BY MODEL. This latter piece of information can be accessed based upon input of a simple one-position model number. A user is thus freed from from having to input a complete engine serial number each time he wishes to perform maintenance (as for example in M5-1) or obtain a print an an engine. A series of other pieces of data that are constant FOR AN ENGINE MODEL and which have to be printed out on R5-1, the Engine Configuration Report, are stored on the model files.

The dialog for this transaction begins with a prompt for a model number (for example, "C") shown in M5-10A below. If there have been loaded any previous components for this model, prompt M5-10B will appear. A user may now correct any general items of information regarding a new model. Striking enter again will present the user with panel M5-10C which controls the revision of the list of components in much the same fashion as a user can REVIEW an existing list of components in M5-2.

Entry of a "U" into M5-9C will present the user with the existing list of component items with their attendent group numbers and part descriptions (see display M5-10D). The user can then make any of the following corrections:

- o Change a part number or its short description by simple overtyping
- o Change the sort order of the list by altering some of the group numbers
- o Remove a component by blanking out its part number
- o Add additional component elements to the list by keying in new lines at the bottom of THE CONSOLE PRESENTATION of the list. The relative position of the new items on the list AFTER THE LOADING OF THE CHANGES TO FILE will be determined by the group numbers chosen. A component may be interposed in the middle or even at the beginning of the list by indicating an unused group number between existing group numbers (It is useful to increment group numbers by - for example - "010" when using M5-9 to initially load the model).

Whenever a user has made all the changes that are required to a given part of the list on screen now, he then should hit enter once again. He is then returned to panel M5-10C. He can then go on to a further section of the list by striking enter WITHOUT changing the "U" on the first prompt of M5-10C. He can equally jump over sections of the list by indicating a "relative" group number other than what is displayed as default. With this transaction, he may thus bounce back and forth in the list until he is satisfied that he has made all of the modifications that are required. He can even jump immediately into the middle of the list by overriding the default group number of "1" on his initial entry into the M5-10C panel for a model. Once he is satisfied with his changes, he should then key in a response of "S" (see M5-10E). At this point modifications to the files begin. No changes are applied previous to input of an "S". Then, only those list items that are changed will produce file modifications. The changes will be applied one item at a time. There will not be further console displays except for those items that have some kind of error. Those with errors will cause interruption to the modification process and will initiate a display of a panel such as is illustrated in M5-10F. A user may at this time make corrections to that list item. Sometimes, a user may have to strike enter an extra time after M5-10F is displayed in order to begin corrections. This will be required whenever a display status of "MORE..." rather than "INPUT" is displayed in the bottom right corner of panel 5M-10F. An error will be encountered where there is an invalid part number or a duplication of a group number FOR A SPECIFIC MODEL.

CFUMOD REVISE A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: j

CFUMOD REVISE A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: j

MODEL NAME: J401

MODEL PART NUMBER: 719401

MODEL PREFIX: T-E

BASE PART NUMBER:

M5-10B INPUT

CFUMOD REVISE A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: j
UPDATE(U), OR STOP(S): U 1ST GROUP: 1

M5-10C INPUT

```
CFUMOD          REVISE A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: j
01 GRP PART-NUMBER      TITLE
=> 010 718412           SHAFT
=> 020 718022           SHAFT W/O/R
=> 040 718371           AXIAL ROTOR
=> 050 718412           TURBINE RTR
=> 060 719415           ILT HG ASSY
=> 070 719089           STAT HG ASSY
=> 080 721462           TURB ASSY
=> 090 721096-101       DUCT ASSY
=> 100 718489           COMP SHROUD
=> 110 721851           DIFF ASSY
=> 120 721472           COMP SH ASSY
=> 130 719565-101       INLET ASSY
=> 140 723849-101       SEAL ASSY
=> .
```

M5-10D INPUT

```
CFUMOD          REVISE A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: j
UPDATE(U), OR STOP(S): s 1ST GROUP: 14
```

M5-10E INPUT

CFUMOD REVISE A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NUMBER: d

PROBLEM ARISING IN GRP: 010

PART-NUMBER: XXXXX TITLE |: BRG, ASSY # 1

PART-NUM XXXXX WAS NOT FOUND
LINE IGNORED

M5-10F MORE...

M5-11: REMOVE A MODEL: This transaction may be used to remove all data relating to an engine model. It has a two step dialog. Step one consists of a prompt for model number (display M5-11A). Step two (display M5-11B) shows all of the general items of information regarding the model. It also prompts for a confirmation of the deletes.

CFDMOD REMOVE A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NBR:

M5-11A INPUT

CFDMOD REMOVE A MODEL FOR A PRODUCTION ENGINE CONFIGURATION

MODEL NBR: d

MODEL PART NUMBER: XXXXXX

MODEL PREFIX: WR-E

BASE PART NUMBER: YYYYY

DO YOU WISH TO DELETE:

M5-11B INPUT

M5-12: REVISE SERIAL NUMBER AVAILABILITY: This transaction should be used only in exceptional situations to make corrections on availability status and last-using-engine for particular component serial numbers (on the SCT file). Those particular fields perform the following functions inside the system as a whole: The In-Use-Now field controls availability status. When committed to a particular engine NOW as the result of previous input on the M5-1 or M5-2, the field contains a status of "S" denoting "in use" or "sold". When blank, the component is considered "available for immediate use". A third status of "H" or "hold" is also recognized by the overall system. This status indicates that a component is not in an engine presently, and is also not immediately available for use either. Its use is discussed below. The other prompts, a combination of model number and engine serial number, are also principally being maintained by the M5-1 and M5-2 and indicate the last use of a component in an engine. Where the component is STILL in an engine, the fields indicate that particular engine number. Where the component has been removed from one engine and is not yet scrapped nor placed in another engine, the fields will still indicate which engine has used the component last. This information is vital when LATER reestablishing a use for the component in ANOTHER OR EVEN THE SAME ENGINE. It is used as cross-reference then to the PREVIOUSLY USING ENGINE in order to pick up historical test- and build- statistics. Where the pair of fields is not filled, the meaning to the system as a whole is that the component nas never been previously used.

This transaction has several uses. It can be used as a correction to the M5-1, M5-2, and M5-7 in exceptional circumstances. The transaction will however be primarily employed in two other circumstances: Firstly, this transaction ONLY is capable of introducing a hold status ("H") on a "seasoned" component while it is being repaired. Once repaired, this transaction exclusively can remove the "hold" status. The second main use of this transaction will arise in the aftermath of use of transaction M5-8, DELETE AN ENGINE, for those components which were previously serialized and which by M5-8 have now been deleted.

The dialog is a simple two step procedure. Step M5-12A prompts for a part number and serial number combination while the succeeding step M5-12B allows for the status revision using the mechanism of a user-keyed overlay of existing record values.

CFUSER1 REVISE THE AVAILABILITY STATUS FOR A SERIAL NUMBER

PART NUMBER: SERIAL NBR:

M5-12A INPUT

CFUSER1 REVISE THE AVAILABILITY STATUS FOR A SERIAL NUMBER

PART NUMBER: 34993 SERIAL NBR: ab120

IN-USE-NOW: MODEL NUMBER: C ENGINE SER #: 450202

M5-12B INPUT

M5-13: ADD CONFIGURATION HISTORY: This transaction allow a user to make miscellaneous additions to the configuration history of an engine (the CRH file). It should be used ONLY in the rare occasions when the normal battery of maintenance transactions are somehow inadequate. In most cases, M5-1, M5-2, M5-4, and M5-7 should provide an adequate AUTOMATED update of this file. The dialog is a simple one panel create (see display M5-13A).

NOTE: It is useful to recall the function of this history file. M5-1 et al will only generate a history record for a component where a serial number is being exchanged, deleted, or a SEASONED component is being added.

```
CFNCRH                        ADD A CONFIGURATION HISTORY RECORD

MODEL NUMBER:   ENGINE SER #:                ACT:   GRP:      TRN DATE:

PART OUT:                  REV OUT:     SER NBR OUT:                BLD OUT:
F/C:   RUN HRS OUT:          RUN MIN OUT:      STARTS OUT:

REMARKS(1):
REMARKS(2):

 PAPT IN:                    REV IN:      SER NBR IN:
        RUN HRS IN:           RUN MIN IN:       STARTS IN:
```

M5-13A INPUT

M5-14: REVISE CONFIGURATION HISTORY: This transaction allow a user to make miscellaneous revisions to the configuration history of an engine (the CRH file). It should be used ONLY in the rare occasions when the normal battery of maintenance transactions are somehow inadequate. In most cases, M5-1, M5-2, M5-4, and M5-7 should provide an adequate AUTOMATED update of this file.

The dialog has two panel types. M5-14A prompts for an engine and transaction date. Using the date indicated, M5-14B will show the user each transaction history record generated on a given date for an engine, one at a time. All information that may be changed on the record is displayed for user correction through overlay. Striking of the enter key will advance a user one record to the next entry made on that date. Changes that are made to an entry are immediately passed to file.

NOTE: It is useful to recall the function of this history file. M5-1 et al will only generate a history record for a component where a serial number is being exchanged, deleted, or a SEASONED component is being added.

CFUCRH REVISE CONFIGURATION HISTORY RECORDS

MODEL NUMBER: ENGINE SER #: TRN DATE:

M5-14A INPUT

CFUCRH REVISE CONFIGURATION HISTORY RECORDS

MODEL NUMBER: c ENGINE SER #: 450202 TRN DATE: 10/19/88

IN OR OUT: E GRP: 040

PART OUT: 19301 REV OUT: -M SER NBR OUT: 604 BLD OUT: 0
F/C: A RUN HRS OUT: 1 RUN MIN OUT: 45 STARTS OUT: 1

REMARKS(1): CHANGING A SERIAL NUMBER
REMARKS(2):

PART IN: 19301 REV IN: -M SER NBR IN: 605
RUN HRS IN: 0 RUN MIN IN: 0 STARTS IN: 0

M5-14B INPUT

M5-15: REMOVE CONFIGURATION HISTORY: This transaction allow a user to make miscellaneous deletions on the configuration history of an engine (on the CRH file). It should be used ONLY in the rare occasions when the normal battery of maintenance transactions are somehow inadequate. In most cases, M5-1, M5-2, M5-4, and M5-7 should provide an adequate AUTOMATED update of the file.

The dialog has two panel types. M5-15A prompts for an engine and transaction date. Using the date indicated, M5-15B will show the user each transaction history record generated on a given date for an engine, one at a time. The history record is displayed on screen, and the user is prompted to indicate whether or not he wishes to delete it. A "Y" will indicate that a delete is desired in the prompt field. Striking the enter key will forward a user to the next entry made on that date. Those history items not receiving a "Y" will NOT be deleted.

NOTE: It is useful to recall the function of this history file. M5-1 et al will only generate a history record for a component where a serial number is being exchanged, deleted, or a SEASONED component is being added.

CFDCRH REMOVE CONFIGURATION HISTORY RECORDS

MODEL NUMBER: ENGINE SER #: TRN DATE:

M5-15A INPUT

```
CFDCRH                    REMOVE CONFIGURATION HISTORY RECORDS

MODEL NUMBER: c ENGINE SER #: 450202        TRN DATE: 10/19/88

IN OR OUT: E GRP: 040
PART OUT: 19301          REV OUT: -M  SER NBR OUT: 604          BLD OUT: 0
F/C: A RUN HRS OUT: 1       RUN MIN OUT: 45   STARTS OUT: 1

REMARKS(1): CHANGING A SERIAL NUMBER
REMARKS(2):

 PART IN: 19301             REV IN: -M   SER NBR IN: 605
        RUN HRS IN: 0        RUN MIN IN: 0     STARTS IN: 0
DO YOU WISH TO DELETE:
```

M5-16: ADD A KIT DEVIATION: This transaction allows a user to make miscellaneous additions to the kitting deviation file (CDV) for an engine. It should be used ONLY in the rare occasions when the normal transfer of kitting deviations out of MANMAN has proved to be inadequate. This transfer occurs automatically at the end of the kitting process, and should provide an adequate updating mechanism to the file in all but exceptional cases. The dialog is a simple one panel create (see display M5-16A).

NOTE: It is useful to recall the function of this file. It holds a list of kitting deviations to be used exclusively as an aid for review of engine "lock status" by the configuration specialist. When any one deviation is put to file for an engine, that engine is automatically locked to further updating until and unless transaction M5-18 described below is used to perform an "unlock".

CFNDEV ADD A KIT DEVIATION

MODEL NUMBER: ENGINE SER #:

PART NUMBER:

ACT REV:

STD REV:

M5-16A INPUT

M5-17: REVISE A KIT DEVIATION: This transaction allows a user to make miscellaneous revisions to the kitting deviation file (CDV) for an engine. It should be used ONLY in the rare occasions when the normal transfer of kitting deviations out of MANMAN has proved to be inadequate. This transfer occurs automatically at the end of the kitting process, and should provide an adequate update of the file in all but exceptional cases. The dialog has only two simple panels. M5-17A prompts the user for selection of a particular engine and component part number. M5-17B then displays existing change letter values (standard and actual) for the deviation. The user can make corrections by a simple overtyping of the data. In a few cases, more than one kitting deviation record can be produced if there is more than one deviant occurrence of the same component part number for an engine.

NOTE: It is useful to recall the function of this file. It holds a list of kitting deviations to be used exclusively as an aid for the review of engine "lock" status by the configuration specialist. When any one deviation is put to file for an engine, that engine is locked to further updates until and unless transaction M5-18 described below is used to perform an "unlock".

CFUDEV REVISE A KIT DEVIATION

MODEL NUMBER: ENGINE SER #:

PART:

M5-17A INPUT

CFUDEV REVISE A KIT DEVIATION

MODEL NUMBER: c ENGINE SER #: 450202

PART: 34993

ACT REV: -G

STD REV: -F

M5-17B INPUT

M5-18: APPROVE/PLACE-ON-HOLD A KITTING DEVIATION: This transaction allows the configuration specialist to review and "unlock" any engine found to have component change letter deviations. It can also be used in exceptional cases to "relock" an engine if there are any problems with the automated "locking" mechanism built on top of MANMAN, or if an engine needs to be relocked after the initial kitting process for any exceptional reason.

There are three steps in this transaction. M5-18A prompts for a particular engine number. M5-18B then displays all the kitting deviations, if any, currently on the engine. Finally, M5-18C prompts the user for locking/unlocking of the engine. A "lock" may be produced on an engine by the input of an "H" (indicating "hold") and an "unlock" may be produced by the input of a blank (" ").

CFUDEV1 APPROVE/PLACE-ON-HOLD KIT DEVIATIONS FOR AN ENGINE

MODEL NUMBER: ENGINE SER #:

M5-18A INPUT

CFUDEV1 APPROVE/PLACE-ON-HOLD KIT DEVIATIONS FOR AN ENGINE

MODEL NUMBER: c ENGINE SER #: 450202

PART NUMBER:	AC	ST
34993	-G	-F

M5-18B MORE...

CFUDEV1 APPROVE/PLACE-ON-HOLD KIT DEVIATIONS FOR AN ENGINE

MODEL NUMBER: c ENGINE SER #: 450202

HOLD-ASSEMBLY: H

M5-18C INPUT

M5-19: REMOVE A KIT DEVIATION: This transaction allows a user to make miscellaneous revisions to the kitting deviation file (CDV) for an engine. It should be used ONLY in the rare occasions when the normal transfer of kitting deviations out of MANMAN has proved to be inadequate. This transfer occurs automatically at the end of the kitting process, and should provide an adequate update of the file in all but exceptional cases. The dialog has only two simple panels. M5-19A prompts the user for selection of a particular engine and component part number. M5-19B then displays existing change letter values (standard and actual) for the deviation. The user can then confirm the deletion by indicating a "Y" in the prompt field. In a few cases, more than one kitting deviation record can be produced if there is more than one deviant occurrence of the same component part number for an engine. A prompt for deletion of each occurrence in that case will be displayed independently.

NOTE: It is useful to recall the function of this file. It holds a list of kitting deviations to be used exclusively as an aid for review of engine "lock" status by the configuration specialist. When any one deviation is put to file for an engine, that engine is locked to further updating until and unless transaction M5-18 described above is used to perform an "unlock".

CFDDEV REMOVE A KIT DEVIATION

MODEL NUMBER: ENGINE SER #:

PART NUMBER:

M5-19A INPUT

CFDDEV REMOVE A KIT DEVIATION

MODEL NUMBER: c ENGINE SER #: 450202

PART NUMBER: 34993

ACT REV: -G

STD REV: -F

DO YOU WISH TO DELETE:

M5-20: ADD SERIAL NUMBERS: This transaction is used to add one or more serial numbers to the component availability file (the SCT). To use, simply fill in the one piece panel, M5-20A. All fields save the last must be filled. To create a string of up to 50 consecutively-numbered serialied components for a given part being tracked in the assembly process, simply indicate the lowest-numbered serial number and the number of consecutive occurrences (or "Number of Units"). As many availability records will be loaded to file as have been indicated. If any serial numbers in the series being loaded at one time are found to previously exist, then the entire transaction will be rejected for that component. A request for load of more than 50 serial numbers at one time will be similiarly be rejected.

CFNSER LOAD SERIAL NUMBERS TO THE SERIAL NUMBER AVAILABILITY FILE

PURCHASED ("P") OR MANUFACTURED ("M"):

PART NUMBER: SERIAL NUMBER: NBR OF UNITS:

M5-20A INPUT

M5-21: REVISE A SERIAL NUMBER: This simple one-panel transaction shown in M5-21A allows for the replacement of one serial number with another on the SCT file - as long as the number being replaced is shown to have never previously been used in an engine. It is useful only for exceptional data situations.

CFUSER REVISE A SERIAL NUMBER

PART NBR: OLD SER: NEW SER:

M5-21A INPUT

M5-22: REMOVE A SERIAL NUMBER: This simple one-panel transaction shown in M5-22A allows for the deletion of a series of availability records from off the SCT file - as long as no one record in the consecutive series is indicated to have ever been used in an engine. It may remove up to 50 records at one time. It is useful only for exceptional data situations.

CFDSER MISCELLANEOUS REMOVAL OF ERRONEOUS SERIAL NUMBERS

PURCHASED ("P") OR MANUFACTURED ("M"):

PART NUMBER: SERIAL NUMBER: NBR OF UNITS:

M5-22A INPUT

M5-23: CONFIGURATION REPORT SIGNOFFS BY ENGINE: This simple two-panel transaction, shown in M5-23A and M5-23B, allows the final "electronic signoff" of an engine (on the CFG file) before it is shipped. The first panel prompts for an engine number and the second panel allows addition/modification of the two required user signoffs.

CFUCFG3 CONFIGURATION REPORT SIGNOFFS BY ENGINE

MODEL NUMBER: ENGINE SER #:

INPUT

CFUCFG3 CONFIGURATION REPORT SIGNOFFS BY ENGINE

MODEL NUMBER: 1 ENGINE SER #: 620250

INSP INIT: xxx

QE INIT: yyy

INPUT

D. CONSOLE INQUIRIES (ALL ON-LINE):

I5-1: ENGINE CONFIGURATION INQUIRY: This transaction can be used to display the latest version of an engine configuration on file. There are two panel types. I5-1A prompts for a particular engine serial number. Then I5-1B will display a portion of a component list. Simply hit enter repeatedly to page-through the list.

```
CFICFG              DISPLAY AN ENGINE CONFIGURATION

MODEL NUMBER:    ENGINE SER #:
```

I5-1A INPUT

```
CFICFG              DISPLAY AN ENGINE CONFIGURATION

MODEL NUMBER:    ENGINE SER #:

HOLD-ASSEMBLY:    TRN DATE: 10/21/88 BLD:     0 BLD DESC:
INSP INIT:        QE INIT:

GRP TITLE        PART NUMBER SERIAL NBR REV D TRN DATE BLD STS RUN HRS MIN
--- ------------ ----------- ---------- --- - -------- --- --- ------- ---
010 BEARING ASS  23372       VZ124      -J    10/19/88   0   0       0   0
020 SUPPORT      23395       CT3002     -F    10/19/88   0   0       0   0
030 STATOR HSG   34492       QA123A200B -E    10/19/88   0   0       0   0
040 BEARING 2    19301       605        -M    10/19/88   0   0       0   0
```

I5-2A INPUT

I5-2: ENGINE CONFIGURATION HISTORY INQUIRY: This transaction can be used to scan through a configuration history for an engine. There are two panel types. I5-2A prompts for a particular engine serial number. Then I5-2B will display one component replacement history record for the engine. Hit enter repeatedly to page-through the list of history entries.

```
CFICFG1  DISPLAY AN ENGINE CONFIGURATION REPLACEMENT HISTORY

MODEL NUMBER:    ENGINE SER #:
```

I5-2A INPUT

```
CFICFG1  DISPLAY AN ENGINE CONFIGURATION REPLACEMENT HISTORY

MODEL NUMBER: c ENGINE SER #: 450202

HOLD-ASSEMBLY:    TRN DATE: 10/21/88 BUILD NBR:     0 BLD DESC:
INSP INIT:        QE INIT:

IN OR OUT: E GRP: 040 TRN DATE: 10/19/88

PART OUT: 19301         REV OUT: -M  SER NBR OUT: 604          BLD OUT:    0
F/C: A RUN HRS OUT:       1 RUN MIN OUT:   45 STARTS OUT:      1

REMARKS(1): CHANGING A SERIAL NUMBER
REMARKS(2):

PART IN: 19301             REV IN: -M   SER NBR IN: 605
        RUN HRS IN:       0  RUN MIN IN:    0  STARTS IN:     0
```

I5-2B MORE...

I5-3: ENGINE KIT DEVIATION INQUIRY: This transaction can be used to see any change letter kitting deviations for an engine. Also shown is whether or not the engine is currently "locked." There are two panel types. I5-3A prompts for a particular engine serial number. Then I5-3B will display the kitting deviations as well as a few pieces of general purpose information. If any one engine should ever have more than a page of kitting deviations, simply strike enter to page forward.

CFICFG2 DISPLAY AN ENGINE"S CONFIGURATION DEVIATIONS

MODEL NUMBER: ENGINE SER #:

I5-3A INPUT

CFICFG2 DISPLAY AN ENGINE"S CONFIGURATION DEVIATIONS

MODEL NUMBER: c ENGINE SER #: 450202

HOLD-ASSEMBLY: H TRN DATE: 10/21/88 BUILD NBR: 0 BLD DESC:
INSP INIT: QE INIT:

PART NUMBER	ACT REV	STD REV
34993	-G	-F

I5-3B INPUT

I5-4: COMPONENT PART TO ENGINE INQUIRY: This transaction can be used to locate the engines in which a range of component serial numbers has been previously loaded. There are two panel types. I5-4A prompts for a particular component part number and range of component serial numbers. I5-4B will then display a list of particular numbers. Hit enter to page through this list.

```
CFICFG3          ENGINE COMPONENT PART TO ENGINE INQUIRY
                  MAX INQUIRY RANGE = 50 SERIAL NUMBERS

                              PART NBR:
COMP. SERIAL NBR LOW:                    COMP. SERIAL NBR HI:
```

I5-4A INPUT

```
CFICFG3          ENGINE COMPONENT PART TO ENGINE INQUIRY
                  MAX INQUIRY RANGE = 50 SERIAL NUMBERS

                              PART NBR: 23395
COMP. SERIAL NBR LOW:                    COMP. SERIAL NBR HI: 9999999

SERIAL NUMBR ENGINE SER NBR
____________ _______________
CT3002       C450202
CT3003       C450203
```

I5-4B INPUT

I5-5: MODEL CONFIGURATION INQUIRY: This transaction can be used to display the latest list of components to be tracked for a given engine model. The displays are extracted from the model files. There are two panel types. I5-5A prompts for a particular engine model number. I5-5B will then display a portion of a component list. Simply hit enter repeatedly to page-through the list.

```
CFIMOD          DISPLAY A MODEL CONFIGURATION

MODEL NUMBER:
```

I5-5A INPUT

```
CFIMOD          DISPLAY A MODEL CONFIGURATION

MODEL NUMBER: j
MODEL NAME        MODEL PART NUMB MODEL PREFIX BASE PART NUMBE
J401              719401          T-E
      GRP TITLE              STANDARD PART
      ---- ----------------- --------------
        10 SHAFT             718412
        20 SHAFT W/O/R       718022
        40 AXIAL ROTOR       718371
        50 TURBINE RTR       718412
        60 ILT HG ASSY       719415
        70 STAT HG ASSY      719089
        80 TURB ASSY         721462
        90 DUCT ASSY         721096-101
       100 COMP SHROUD       718489
       110 DIFF ASSY         721851
       120 COMP SH ASSY      721472
```

I5-5B MORE...

I5-6: SERIAL NUMBER INQUIRY: This transaction can be used to display the serial number availability status for a given component part. The displays are extracted from the availability file. There are two panel types. I5-6A prompts for a particular component part number. I5-6B will then display a portion of the availability list for the specified component part. Hit enter repeatedly to page-through the list. Current availability status and last-using engine are also displayed on the list. The list should be reasonably short since availability data is purged after a using engine is marked as "shipped" by M5-5.

CFISER DISPLAY AVAILABILITY STATUS FOR A PART

PART NUMBER:

I5-6A INPUT

CFISER DISPLAY AVAILABILITY STATUS FOR A PART

PART NUMBER:

SERIAL NUMBR	IN-USE-NOW	USING ENGINE
CT3000		
CT3001		C450201
CT3002	S	C450202
CT3003	S	C450203
CT3004		
3003		C450203

I5-6B INPUT

E. PRINTED REPORTS AND FILE EXTRACTIONS (MIXED ON-LINE AND BATCH):

R5-1: ENGINE CONFIGURATION REPORT - ON LINE: This report will generate a special form for a series of up to 50 consecutive engines relating to a particular model. The format of the report is illustrated in display R5-1A. The means of requesting print of the report are shown in displays R5-1B and R5-1C. The R5-1B prompt is displayed first. It affords a user a choice of print destinations. R5-1C follows with a prompt for model number and range of serial numbers. This prompt for a "range" is intended primarily as a means of printing consecutive shipments OF THE SAME ENGINE on back-to-back sheets. These are typically distinguished, one from another, with unique suffixes.

CFPCFG ENGINE CONFIGURATION PAGE 001
TOMAHAWK

TOP ENGINE ASSEMBLY PN. 1029110-112 S/N WR-E450202

BASIC ENGINE ASSEMBLY PN. 27035

ITM NBR	NOMENCLATURE	PART NUMBER	CHANG LTR	SERIAL NUMBER
010	BEARING, BALL ALT-02	23372	-J	VZ124
020	SUPPORT, #1 BRG	23395	-F	CT3002
030	CASE ASSEMBLY, CPRSR, 1STG	34492	-E	QA123A20
040	BEARING, ROLLER-ALT-01	19301	-M	605

R5-1A INSPECTOR"S STAMP Q.E. STAMP

CFPCFG PRINT AN ENGINE CONFIGURATION

1. XEROX-1: SYSTEMS PRINTER
2. XEROX-5: GAINESVILLE

SELECT A PRINTER OPTION AND PRESS ENTER:

R5-1B INPUT

CFPCFG PRINT AN ENGINE CONFIGURATION

MODEL-CODE SERIAL-NBR-LO SERIAL-NBR-HI

:

R5-1C INPUT

R5-2: ENGINE CONFIGURATION HISTORY REPORT - ON LINE: This report will generate a special form for a series of up to 50 consecutive engines relating to a particular model. The format of the report is illustrated in display R5-2A. The means of requesting print of the report are shown in displays R5-2B and R5-2C. The R5-2B prompt is displayed first. It affords a user a choice of print destinations. R5-2C follows with a prompt for model number and range of serial numbers. This prompt for a "range" is intended primarily as a means of printing consecutive shipments OF THE SAME ENGINE on back-to-back sheets. These are typically distinguished, one from another, with unique suffixes.

CFPCFG1 COMPONENT REPLACEMENT HISTORY FORM QA-103 PAGE 001

MODEL-NUMBER	ENGINE-SER-NBR	HOLD-ASSEMBLY	TRN-DATE	BUILD-NBR
C	WP-E450202	H	10/21/88	0

A	PART-NUMBER	CL	PART-NAME	SERIAL-NBR	BD	F	HOUR:MIN	ST	TRN-DATE	REMARKS
R	23372	-J	BEARING, BALL A	VZ123	0	A	1:45	1	10/19/88	
I	23372	-J		VZ124			0:00	0		
R	34993	-F	BEARING, BALL A	AB120	0	A	1:45	1	10/19/88	
I	23372	-J		VZ123			0:00	0		
R	34993	-F	BEARING, BALL A	AB122	0	A	0:00	0	10/19/88	
I	34993	-F		AB120			1:45	1		
R	19301	-M	BEARING, ROLLER	604	0	A	1:45	1	10/19/88	CHANGING A SERIAL NUMBER
I	19301	-M		605			0:00	0		
R	19301		BEARING, ROLLER		0	A	0:00	0	10/19/88	
I	19301	-M		604			1:45	1		

END OF COMPONENT REPLACEMENT HISTORY

CFPCFG1 PRINT A COMPONENT REPLACEMENT HISTORY FOR AN ENGINE

1. XEROX-1: SYSTEMS PRINTER
2. XEROX-2: INFORMATION SYSTEMS
3. XEROX-3: PRODUCTION CONTROL
4. XEROX-5: GAINESVILLE

SELECT A PRINTER OPTION AND PRESS ENTER:

R5-2B INPUT

CFPCFG1 PRINT A COMPONENT REPLACEMENT HISTORY FOR AN ENGINE

MODEL-CODE LO-SERIAL-NBR HI-SERIAL-NBR

:

R5-2C INPUT

R5-3: ENGINE COMPONENT PART TO ENGINE REPORT - ON LINE: This report is a direct print-analogy to console inquiry, I5-4. The format of the report is illustrated in display R5-3A. The means of requesting print of the report are shown in displays R5-3B and R5-3C. The R5-3B prompt is displayed first. It affords a user a choice of print destinations. R5-3C follows with a prompt for model number and range of serial numbers.

CFPCFG2 ENGINE CONFIGURATION IN A RANGE OF SERIAL NUMBERS PAGE 001

PART-NUMBER	LOW-SER-NBR	HI-SER-NBR
23372	VZ120	9999999

COMP-SER-NBR	ENGINE-SER-NBR
VZ124	C450202

R5-3A

CFPCFG2 ENGINE COMPONENT PART TO ENGINE REPORT

1. XEROX-1: SYSTEMS PRINTER
2. XEROX-2: INFORMATION SYSTEMS
3. XEROX-3: PRODUCTION CONTROL
4. XEROX-5: GAINESVILLE

SELECT A PRINTER OPTION AND PRESS ENTER:

R5-3B INPUT

CFPCFG2 ENGINE COMPONENT PART TO ENGINE REPORT
MAX INQUIRY RANGE = 50 SERIAL NUMBERS

PART NUMBER	COMPONENT SERIAL NUMBERS LOW	HIGH

:

R5-3C INPUT

R5-4: ENGINES HAVING A COMPONENT PART REPORT - BATCH: This report is a first cousin of report R5-3. This version automatically prints out an complete list of all serial numbers currently credited as existing in engines logged on system FOR A USER SPECIFIED COMPONENT PART. The format of the report is illustrated in display R5-4A. The means of requesting print of the report are shown in displays R5-4B and R5-4C. The R5-4B prompt is displayed first. It prompts for a selected component part number to print. R5-4C shows a followup prompt for number of print copies. A separate prompt for print destination which precedes the R5-4B prompt is NOT illustrated here.

TELEDYNE INDUSTRIAL MANAGEMENT SYSTEM

DATABASE: TIMS1 REPORT: CFPCFG3 -1 T E L E D Y N E, C A E RUN-DATE: 11/18/88
PAGE NO....: 1 ENGINES HAVING A COMPONENT PART OF 23372 RUN-TIME: 15:14:01
TIMS NO.: 60923 * RUN-MODE: INTERACTIVE

ENGINE SER NBR	SERIAL NUMBR	REV	BUILD NBR	TRN DATE	STARTS	RUN HRS	RUN
450202	VZ124	-J	0	10/19/88	0	0	0

CFMENU3 PRODUCTION CONFIGURATION SYSTEM REPORT MENU
ENGINES HAVING A SPECIFIC COMPONENT

PART NUMBER:

R5-4B INPUT

CFMENU3 PRODUCTION CONFIGURATION SYSTEM REPORT MENU
ENGINES HAVING A SPECIFIC COMPONENT

PART NUMBER: .
ENTER THE NUMBER OF COPIES YOU WISH TO HAVE FOR THIS REPORT:

R5-4C INPUT

R5-5: ENGINES HAVING A COMPONENT PART AND CHANGE LETTER REPORT - BATCH: This report is a first cousin of reports R5-3 and R5-4. This version automatically prints out an list of all the serial numbers currently credited as existing in engines logged on system FOR A USER SPECIFIED COMPONENT PART AND CHANGE LETTER. The format of the report is illustrated in display R5-5A. The means of requesting print of the report are shown in displays R5-5B and R5-5C. The R5-5B prompt is displayed first. It prompts for a component part number and change letter to be printed. R5-5C shows a followup prompt for number of print copies. A separate prompt for print destination which precedes the R5-5B prompt is NOT illustrated here.

TELEDYNE INDUSTRIAL MANAGEMENT SYSTEM

DATABASE: TIMS1 REPORT: CFPCFG4 -1 T E L E D Y N E, C A E RUN-DATE: 11/18/88
PAGE.NO....: 1 ENGINES HAVING A COMPONENT PART OF 23372 AND A REV NBR OF -J RUN-TIME: 15:14:01
TIMS.NO.: 60923 *---------- * RUN-MODE: INTERACTIVE

ENGINE SER NBR	SERIAL NUMBR	REV	BUILD NBR	TRN DATE	STARTS	RUN HRS	RUN
450202	VZ124	-J	0	10/19/88	0	0	0

CFMENU3 PRODUCTION CONFIGURATION SYSTEM REPORT MENU
ENGINES HAVING A SPECIFIC COMPONENT and change letter

PART: REV NUMBER:

R5-5B INPUT

CFMENU3 PRODUCTION CONFIGURATION SYSTEM REPORT MENU
ENGINES HAVING A SPECIFIC COMPONENT and change letter

PART: . REV NUMBER:
ENTER THE NUMBER OF COPIES YOU WISH TO HAVE FOR THIS REPORT:

R5-5C INPUT

R5-6: CHANGE LETTER DEVIATION REPORT FOR UNSHIPPED ENGINES - BATCH: This report is a full dump of change letter deviations encountered during the logbooking process (not the kitting process) for UNSHIPPED engines. The format of the report is illustrated in display R5-6A. There are no special prompts for search parameters in this report. Canned prompts for printer destinations and number of copies are not illustrated here.

TELEDYNE INDUSTRIAL MANAGEMENT SYSTEM

DATABASE: TIMS1 REPORT: CFPCFG5 -1 T E L E D Y N E, C A E RUN-DATE: 1./18/88
PAGE.NO....: 1 CHANGE LETTER DEVIATION REPORT FOR UNSHIPPED ENGINES RUN-TIME: 15:14:01
TIMS.NO.: 60923 * RUN-MODE: INTERACTIVE

MODEL NBR	ENGINE SERIAL NBR	GRP	PART NUMBER	SERIAL NUMBR
C	450203	020	23395	CT3003

R5-7: AUDIT THE WHERE-USED RELATION FOR SERIALIZED PARTS BEING USED IN CONFIGURATION LOGS - ON LINE: This report provides an overview of the change Letter auditing procedure utilized during the logbooking process. It provides a list of engine-serial-number/change-letter effectivities for each component currently being tracked in the logbooking procedure FOR A USER-SPECIFIED MODEL. The format of the report is illustrated in display R5-7A. Display R5-7B shows an initial user prompt for choice of destination printers. R5-7C in turn displays the followup user prompt for a model code. This parameter is used to find the component part numbers that will drive the print. The components are copied off the list of parts that are held on the model files supporting maintenance transaction M5-1.

TELEDYNE INDUSTRIAL MANAGEMENT SYSTEM

DATABASE: TIMS1 REPORT: CFPBOM -1 T E L E D Y N E, C A E RUN-DATE: 11/18/88
PAGE.NO....: 1 AUDIT THE "WHERE-USED" RELATION FOR SERIALIZED PARTS BEING USED IN CONFIGURATION LOGS RUN-TIME: 15:14:01
TIMS.NO.: 60923 *---------- RUN-MODE: INTERACTIVE

PART-NUM 34993 PART-DESCRIPTION BEARING, BALL ALT-01

ASSEMBLY PART-NUM	ASSEMBLY PART-DESCRIPTION	CHG	EF-SRNUM-IN	EF-SRNUM-OUT	SEQ
GTP-07	AXIAL COMPRESSOR STRUCTURES GROUP	-B	AAAAAAAAAAA0	WR-E450061	006000
GTP-07	AXIAL COMPRESSOR STRUCTURES GROUP	-C	WR-E450062	WR-E450078	006000
39614	BEARING, BALL (ICD)	-C	WR-E450079	WR-E450094	001000
39614	BEARING, BALL (ICD)	-D	WR-E450095	WR-E450102	001000
39614	BEARING, BALL (ICD)	-E	WR-E450103	WR-E450190	001000
39614	BEARING, BALL (ICD)	-F	WR-E450191	999999999999	001000

PART-NUM 23395 PART-DESCRIPTION SUPPORT, #1 BRG

ASSEMBLY PART-NUM	ASSEMBLY PART-DESCRIPTION	CHG	EF-SRNUM-IN	EF-SRNUM-OUT	SEQ
GTP-07	AXIAL COMPRESSOR STRUCTURES GROUP	-D	AAAAAAAAAAA0	WR-E450061	005000
GTP-07	AXIAL COMPRESSOR STRUCTURES GROUP	-F	WR-E450062	999999999999	005000

CFPBOM AUDIT THE WHERE-USED RELATION FOR SERIALIZED PARTS BEING USED IN CONFIGURATION LOGS

1. XEROX-1: SYSTEMS PRINTER
2. XEROX-2: INFORMATION SYSTEMS
3. XEROX-3: PRODUCTION CONTROL
4. XEROX-5: GAINESVILLE

SELECT A PRINTER OPTION AND PRESS ENTER:

R5-7B INPUT

CFPBOM AUDIT THE WHERE-USED RELATION FOR SERIALIZED PARTS BEING USED IN CONFIGURATION LOGS

MODEL-CODE

:

R5-7C INPUT

R5-8: ASSEMBLY BOM EXTRACTION FOR KITTING - ON LINE: This file extract is used by Production Control to transfer a bill of materials out of the TIMS environment down to DEC/MANMAN for monthly assembly kitting. Its outputs cannot be viewed directly. Its inputs are shown in display R5-8A. The mechanism of extraction is through a combination of model number, engine part number and initial engine serial number. Contract number is an item of descriptive information in this program. "Engines Picked" controls the computation of the number of units of each component to be picked in the next month. Multiple models may be produced in a single session of this program by inputting additional extract requests after the first.

OIPAKIT1 ASSEMBLY BOM EXTRACTION FOR KITTING

MOD NBR	ENGINE NUMBER	SERIAL NUMBER	CONTRACT NUMBER	ENGINES PICKED
:				

R5-8A INPUT

A P P E N D I X

USER'S GUIDE: "FITTING ENGINE" FUNCTIONS (PELICAN COMPILATION)

INTRODUCTION

This document is a user's manual for the kitting interface of CALB. It contains a description of all the forms and procedures that the user needs to execute in order to kit an engine for assembly.

The input to the kitting interface of CALB (referred to as CALB/KIT for convenience) is an engine components list that is generated on the TIMS system in Toledo. It consists of a list of components required to kit a set of engines, and includes, for each component, the quantities required and an upper bound of acceptable revisions for each component. This list of components is then downloaded to a directory readily accessible by CALB/KIT. CALB/KIT will process this list and compare it against a MANMAN generated work order. If the list matches the MANMAN work order completely, then CALB/KIT will perform the engine kit. The engine kit consists of automatically fetching the components from the AS/RS, and then updating the MANMAN data base to mark the work order as kitted.

During the kitting process, deviations may occur. A deviation occurs when the revision number associated with a component in inventory is higher than the highest acceptable revision indicated on the downloaded bill of material. Each deviation is written to a deviations file that is then sent (via RJE) to the TIMS system where it is used in electronically producing the build book.

CALB KIT ENGINE INTERFACE

The input to this interface will be a bill of components for an engine kit set. This bill will be prepared by the TIMS2 system and will be downloaded to a directory on the VAX. The bill will contain one record for each component of an engine. The information on this bill consists of two parts-engine information which is repeated on each record, and component information which varies from one record to the next.

The main CALB menu will offer the following choices:

```
     CALB-KIT ENGINE INTERFACE

  100 COPY DOWNLOADED FILES
  200 KIT AN ENGINE.
  300 CONTINUE ENGINE KIT.
  400 ISSUE A SINGLE COMPONENT TO AN ENGINE.
  500 UNKIT AN ENGINE.
  999 EXIT

  SELECT ONE:
```

MENU OPTION 100 - COPY DOWNLOADED FILES

A bill of materials downloaded from the IBM will end up in a fixed predetermined directory on the VAX. This interface will copy the data from a bill of material to a file which is named by concatenating as shown below.

a. The engine number.
b. The starting serial number.
c. The extension 'DAT'.

This file will then be used by the "KIT ENGINE" interface. The downloaded bill will be deleted from its original directory.

MENU OPTION 200 - KIT AN ENGINE

The user is initially presented with the following form:

CALB-KIT AN ENGINE

WORK ORDER NUMBER: CALB

ENGINE MODEL NUMBER: 724951

STARTING SERIAL NUMBER: CA-E620250 NUMBER OF ENGINES:

TAB-NEXT FIELD BS-PREVIOUS FIELD
PF1-EXIT RET-END OF FORM

The user can end this form with a RETURN or by hitting PF1. If he hits PF1, a message appears as follows.

CANCELLING WORK ORDER KIT

will be displayed at the bottom of the form and the user goes back to the main menu.

In normal usage, the user will enter the work order number, the engine number, and the starting serial number. The system will make checks as follows.

1. There is a matching work order (with a work order number of CALB in this instance) whose status is RELEASED, UNKITTED. If no such work order exists, a message is displayed as follows.

NO SUCH WORK ORDER

The screen is cleared and the user is asked to reenter.

2. There is a downloaded bill of material matching the entered engine number and start serial number. In this case, it will look for a file called 724951_CA-E620250.DAT. If this file is not found, the system will display a message as follows.

NO BILL FOR ENGINE 724951 SERIAL NUMBER CA-E620250

The screen is cleared and the user is asked to reenter.

If all the checks are successful, the screen is redisplayed as follows.

CALB-KIT AN ENGINE

WORK ORDER NUMBER: CALB

ENGINE MODEL NUMBER: 724951

STARTING SERIAL NUMBER: CA-E620250 NUMBER OF ENGINES: 2

TAB-NEXT FIELD BS-PREVIOUS FIELD
PF1-EXIT RET-END OF FORM

This screen includes the information on the number of engines (2 in this case). The user can examine this form and make a final decision on whether to kit (by hitting RETURN) or cancel (by hitting PF1).

If the user does hit RETURN, the KIT ENGINE INTERFACE then starts to execute. First, it compares the components in the downloaded bill of material with the components in work order. The following message is then displayed:

NOW COMPARING DOWNLOADED BILL WITH WORK ORDER

If differences exist between the two bills of material, the following message appears:

DIFFERENCES EXIST BETWEEN THE BILLS.DO YOU WANT A HARD COPY (Y OR N)?

A hard copy of the differences will be provided if the user elects, and the user will go back to the kit engine form.

If no differences are found, then the following message appears.

NO DIFFERENCES FOUND.

And the system starts building the pick list.

At this point, the message is displayed as follows:

NOW BUILDING PICK LIST.

If there are shortages for any of the components the following message is displayed:

SHORTAGES EXIST FOR ENGINE 724931 ENGINE CA-E620250. HIT ANY KEY.

And the system waits for the operator to strike a key.

After the operator has struck a key, he is shown a list of all the subassemblies that were found to be short. This list will appear as follows:

COMPONENT	REQ	INVENTORY	ENG SERIAL	NUM ENGINES
774311	12	8	CA-E620252	3
785111	15	9	CA-E620252	3
MS-102170	16	4	CA-E620251	3

DO YOU STILL WANT TO KIT (Y/N/M)?

The engine serial number is the first engine for which a shortage exists. The number of engines is the number that were found short. When assemblies are being picked for a range of engine serial numbers, CALB will assign the assemblies found to the earliest engine serial numbers. If any shortages exist, they will be assumed to occur in the last engine serial numbers. Thus for example, if one component is required per engine, and kitting is being done for (10) engines, and (8) subassemblies are in inventory, then the last (2) engines will be short, and the (8) subassemblies will be assigned to the first eight engines.

The shortage list is shown with only three items, but it could consist of several screens. The user needs to reply to the prompt "Do you still want to kit ?". The user enters a "Y" when he has decided that he wants to kit in spite of shortages, an "N" when he has decided not to kit. The user will enter an "M" if he is not sure whether or not to kit and wants to see more of the list of shortages.

If no shortages are found, or if the user wants to hit in spite of shortages, the system will start the pick. A message appears as follows.

STARTING TO PICK.PLEASE BE PATIENT.....

After a suitable delay, the first pan is brought to workstation 5.

At this point, the screen appears as follows:

PICK SCREEN

PICKING PART: MS101-2 PAN: 010 LOT: 12345673

REVISION: J QTY: 2

NEXT ACTION: P

P-PICK S-SKIP X-EXIT
TAB-NEXT FIELD BS-PREVIOUS FIELD
RET-END OF FORM

The system will display default values for all of the fields. The default for the REVISION will be the revision associated with the lot. The default displayed in the Quantity field will be the quantity in the lot. The default in the NEXT ACTION field will be "P" for pick.

The operator can enter new values in the REVISION, QTY, and NEXT ACTION fields. The actual revision on the part (as determined by visual inspection) should be entered in place of REVISION. The actual quantity that the operator wants to pick (which should be less than or equal to the quantity in the lot) should be entered in the QTY field. Typing a "P" in the NEXT ACTION field will cause the system to record the pick of an item. Typing an "S" will cause the system to SKIP the part, and typing an "X" will cause the system to exit immediately. The last entry displayed will not be picked if an "X" is typed.

Once the operator has completed the PICK SCREEN and typed RETURN, the system response will depend on whether or not a new pan needs to be fetched. If the user has not picked all of the components from the current pan, the PICK SCREEN will be redisplayed for a new component/lot number.

If the user has completed picking from this pan, a message appears as follows.

PRESS PICK COMPLETE TO RETURN 010 AND FETCH PAN 042

The first pan number is the last pan fetched, and the second pan number is the next pan to be retrieved. Once the user has hit the PICK COMPLETE button, the entire pick cycle is repeated for the next pan.

Once all the parts are picked, the following message is displayed:

ALL PARTS PICKED. HIT ANY KEY TO CONTINUE.

The system will wait for the operator to strike a key and then display the following message:

NOW UPDATING MANMAN DATA BASE.

After the MANMAN data base has been updated, the system will return to the main CALE menu.

MENU OPTION 300 - CONTINUE ENGINE KIT

This operation is essentially identical to KIT ENGINE. The operator is first presented with the screen

CALB-CONTINUE ENGINE KIT

WORK ORDER NUMBER: CALB

ENGINE MODEL NUMBER: 724951

STARTING SERIAL NUMBER: CA-E620250

TAB-NEXT FIELD BS-PREVIOUS FIELD
PF1-EXIT RET-END OF FORM

The user can end this form with a RETURN or by hitting PF1. If he hits PF1, a message appears as follows and the user goes back to the main menu.

CANCELLING WORK ORDER KIT

In normal usage, the user will enter the work order number, the engine number, and the starting serial number. The system will make checks as follows.

1. There is a matching work order (with a work order number of CALB in this instance) whose status is RELEASED, UNKITTED. If no such work order exists, a message is displayed as follows.

WORK ORDER CALB IS NOT KITTED, IN PROCESS.

The screen is cleared and the user is asked to reenter.

2. There is a downloaded bill of material matching the entered engine number and start serial number. In this case it will look for a file called 724951_CA-E620250.DAT. If this file is not found, the following message is displayed.

NO BILL FOR ENGINE 724951 SERIAL NUMBER CA-E620250

The screen is cleared and the user is asked to reenter.

If all the checks are successful, the CONTINUE ENGINE KIT interface starts to execute. The first thing it does is to display the following message:

NOW GATHERING REQUIREMENTS.

It then starts to build the requirements file from the work order data in the MANMAN data base. Once the requirements file is built, the system constructs the pick list. The remainder of the prompts and messages are identical to those for KIT AN ENGINE.

MENU OPTION 500 - ISSUE A SINGLE COMPONENT TO AN ENGINE

Using this transaction, it will be possible to issue a single component to an engine assembly. The form presented will be as follows:

CALB-ISSUE A COMPONENT

WORK ORDER NUMBER: CALB

COMPONENT PART NUMBER: MS101-2

ENGINE NUMBER: 724951

ENGINE SERIAL NUMBER: CA-E620250

TAB-NEXT FIELD Bs-PREVIOUS FIELD
PF1-EXIT EET-END OF FORM

As before, the user can terminate the transaction by hitting PF1. The normal usage would be to enter a work order number, a part number, an engine number, and a serial number, and hit return.

The system will make checks as follows:

1. CALB is a work order with a status of "KITTED, IN PROCESS". If not, it will display a message as follows:

WORK ORDER IS NOT KITTED.

The screen is cleared and the user is asked to reenter.

2. There is a matching Bill of Materials file for the engine and serial number entered. In this case, it is the file 724951_CA-E620250.DAT. If such a file does not exist, it means one of two things, either the file was never copied, or the work order is completely kitted and the file was deleted. In either case, the message displayed is as follows:

BILL OF MATERIAL DOES NOT EXIST FOR ENGINE 724951 SERIAL CA-E620250

The screen is cleared and the user is asked to reenter.

3. The part being issued occurs in the bill of material for the work order. If it does not, then a message is displayed as follows:

NO SUCH COMPONENT FOR WORK ORDER CALB

The screen is cleared and the user is asked to reenter.

Once all of these checks are complete, the system will display the following message:

NOW BUILDING REQUIREMENTS FOR COMPONENT MS101-2

The system will examine the MANMAN data base to determine the total requirement for component MS101-2. If the work order shows a zero requirement this component, the system will display the following message:

ALL THE REQUIREMENTS FOR MS101-2 HAVE BEEN MET. HIT ANY KEY TO CONTINUE.

Once the user strikes a key, he will be taken to the ISSUE COMPONENT form.

If there is a requirement for this component, the system starts to build the pick list. The remainder of the prompts and messages are identical to those for the KIT ENGINE transaction.

MENU OPTION 500 - DEBIT A WORK ORDER

This transaction can be used to unkit a work order for an engine assembly. Caution must be exercised in running this transaction, since it does not allow partial unkits, and since this transaction cannot be interrupted once it has been started. Therefore, the operator will need to ensure that all the material issued to the work order is available to be returned.

The initial form for this transaction will be as follows.

CALB-DEBIT A WORK ORDER

WORK ORDER NUMBER: CALP

TAB-NEXT FLD BS-PREVIOUS FLD
PF1-EXIT DEBIT RET-EXECUTE TRANSACTION

Once the user has entered the work order number and hit RETURN, the system will check the existence of a work order CALP with a status of "KITTED, IN PROCESS". If no such work order can be found, the message will be displayed as follows:

WORK ORDER CALP IS NOT KITTED.

If the work order is a KITTED work order, CALP will display the following message:

NOW GENERATING RETURN LIST.

It will regenerate the pick from the MANMAN material movement audit trail. For each part to be returned, a new location may be determined, if required. The criteria for selecting a location is that after the material has been returned, it must not be more than 100 % full.

CALP will next display the following message:

STARTING RETURN SEQUENCE.PLEASE BE PATIENT.....

After a suitable delay, the first pan is brought to workstation 3.

At this point, the screen appears as follows:

PARTS RETURN SCREEN

RETURNING PART: MS101-2 PAN: 010 LOT: 1254567J

REVISION: J QTY: 2

TAB-NEXT FIELD BS-PREVIOUS FIELD
RET-END OF FORM

Once the operator has returned the material to the pan and pressed return, the system will determine if a new pan needs to be fetched. If a new pan needs to be fetched, the message will appear as follows.

PRESS PICK COMPLETE TO RETURN PAN 010 AND FETCH PAN 042.

After the operator has pressed PICK COMPLETE, the system will fetch the next pan and repeat the cycle for this pan.

If there is more material to be returned to the current pan, the form is redisplayed for the next part number/lot combination and the cycle is repeated.

After all the parts issued to the work order have been returned, the message is displayed as follows.

ALL PARTS PICKED. HIT ANY KEY TO CONTINUE.

The system will wait for the operator to strike a key and then display the message as follows.

NOW UPDATING MANMAN DATA BASE.

After the MANMAN data base has been updated, the system will return to the main CAIF menu.

A P P E N D I X D

ACRONYMS

ASO - Assembly Sequence Outline

AOR - Assembly Order Routing

APL - Advanced Programming Language

AQAS - Automated Quality Assurance System

AS/RS - Automated Storage and Retrieval System

BASEVIEW - graphics software

BOM - Bill Of Material

CALB - Computer Aided Log Book

CDD - Common Data Dictionary

CRH - Component Replacement History

DATATRIEVE Data management software

ECO - Engineering Change Order

FIFO - First In First Out

Kit - Collection of tooling and/or components for manufacturing operations

F107 - Cruise missile engine

IBM - International Business Machines

IGES - Initial Graphics Exchange Specification

IMIP - Industrial Modernization Incentives Program

MADSS - Material Automated Dispatch Scheduling System

MANMAN - MANufacturing MANagement software by ASK, Inc.

MPL - Manufacturing Parts List

MRP - Manufacturing Resource Planning

PDP - Programable Data Processor

Postscript - software

QOI - Quality Operation instructions

RJE - Remote Job Entry

TDMS - Tool Data Management System

TIMS - Teledyne Industrial Management System

TIMS2 - Teledyne Industrial Management System specifically for use by the Gainesville, Georgia facility.

TRACS - Tooling Requirements Availability Control System

VAX - Product of Digital Equipment Corporation

VMS - VAX operating system

Routings - A document which sequences operations for the manufacture of a product