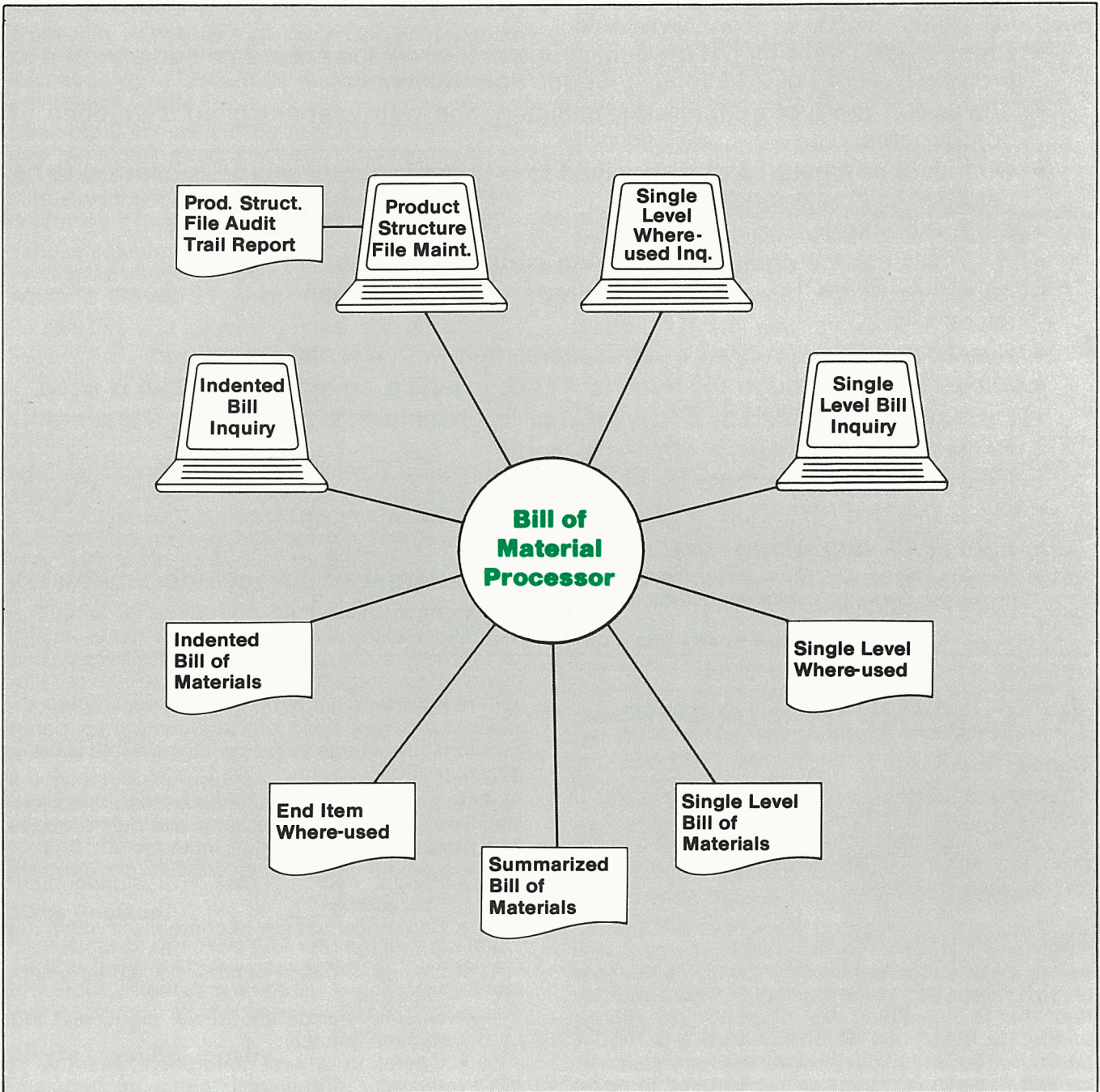# BILL OF MATERIAL PROCESSOR
in Texas Instruments COBOL (ANSI '74)

Application Overview

Bill of Material Processor (BOMP) keeps track of all the raw materials, parts and sub-assemblies that are used to create a finished product whether it be a catered meal or a home appliance. It is one of the key elements to a successful manufacturing system. It includes the following capabilities:

- All features accessible through convenient menus.
- Comes with a complete User's Manual for operator to use.
- Nearly all reports, though initiated interactively, are run in background so the terminal is free for other tasks.
- Information displayed on the screen can be printed at the touch of a button.
- Any reports can be displayed on the terminal for immediate inquiry.
- Accepts user specified parameters on most reports to pinpoint the exact desired information.
- Creates audit trails for the product structure file with the exact time and operator to provide a record of additions, changes and deletions.
- Allows full product structure file maintenance with user-assigned sequence of components.
- Quantity per parent can be specified to four decimal places and is allowed to be negative to create modular bills.
- Scrap/shrinkage can be specified.
- New bills can be created by copying parts of old ones.
- Allows obsolete, forecasted/planned and active bills with up to 12 levels of sub-assemblies.
- Replaces all occurrences of an obsolete item with a replacement part.
- Allows inquiry through the terminal to see in which assemblies an item is used.
- Displays the indented or single level bill of materials for any item on the screen.
- Prints *Single Level Bill of Materials* report.
- Prints *Single Level Where-Used* report.
- Prints *Indented Bill of Materials* and *Summarized Bill of Materials* reports.
- Prints *End Item Where-Used* report.
- Interfaces to MCBA's Inventory Management (I/M) and Customer Order Processing (COP) packages.

Application Details

Control File

An easily maintainable control file allows the user to specify whether or not audit trail records should be kept. Also, the label for the user defined field in the product structure file which displays and prints on reports is specified here.

Product Structure Maintenance

A product structure is created by specifying relationships between pairs of items where one is a component that is assembled with other components to create the other item which is called a parent. A parent will have relationships with one or more component items. A component may be used in many different assemblies each of which would be considered a parent. Each of these component-parent relationships needs to be specified in the product structure file.

On-line product structure file maintenance is provided through add, change/inquire and delete modes. The product structure record includes:

- Parent item number (15 alphanumeric characters)
- Sequence number of component within this structure
- Component item number (15 alphanumeric characters)
- Quantity-per parent (seven digits with four decimal places)
- Operation where component attaches to parent

- Scrap/Shrinkage factor (four digits with one decimal place)
- Activity code indicating whether this parent-component relationship is currently active, planned for the future or obsolete
- Record number of both parent and component in the item file to speed data processing
- User defined field (six alphanumeric characters - could be a date)

Components will display and print according to the sequence number which is entered by the user.

One of the important considerations of the capability to specify the operation where each component is used is that the user can now see if any of his shortages are in fact not crucial until later in the assembly. It is also a consideration when costing scrapped assemblies.

The ability to specify how much each component shrinks or is scrapped, on the average, gives the user the capability of being more accurate in estimating component usage.

Obsolete structures can be so noted. This allows the user to maintain structures he no longer wants to use but for whatever reason does not want to delete. He can leave them on file to be reviewed later to then determine if they should be modified or deleted.

Various safeguards assure valid data such as preventing the user from making an item a component of itself.

Forecasted bills (planning bills) are an artificial grouping of items, in bill of material format, used to facilitate master scheduling and/or material planning. For example, forecasted bills can be used in master scheduling to explode requirements properly for optional components.

Modular bills are a type of planning bill which is arranged in product modules or options. It is often used in companies where the product has many optional features; e.g. automobiles. This is done by specifying a negative quantity-per for the optional part and a positive quantity-per for the alternate part.

A *Product Structure File Audit Trail Report* can be printed at any time showing all additions, changes and deletions to the product structure file together with the time and the user identification with which the entry was made.

Copy Old Bills

A convenient feature exists to copy the structure of an existing bill to a new item number. Then modifications can be made to create a new assembly without starting from scratch. A new activity code and a new user defined field can be specified for the new bill.

Mass Replace

Replacing an obsolete part with another is simple with this feature. After the user specifies the obsolete and replacement item numbers, the old part, wherever it occurs in all bills, is replaced by the new part.

Single Level Bill Inquiry

Designed for video display, the single level bill inquiry shows all the components on the next level down for any specified parent. If the screen cannot contain all these components the user is allowed to page through all remaining components a screen at a time. A special function allows the user to view components displayed on previous screens.

There is an option to "blow through" phantom items, which means that instead of showing components that are neither stocked nor controlled, the first level of components normally stocked can be shown. Phantom items are those that are specified as non-stocked and non-controlled in the item file.

Single Level Bill of Materials

The single level bill is the most popular format in actual usage. Like the Single Level Bill Inquiry, but with more data per component, the *Single Level Bill of Materials* shows all components one level down from each parent item. One, few or all parent items may be selected at run-time for this report. The user may select to print active, planned and/or obsolete components and show either inventory and/or engineering data.

Single Level Where-Used Inquiry

The user can display every parent of a specified component by simply entering its item number. The parent item numbers are shown together with their descriptions, low level codes, units of measure, product categories, attaching operations, engineering release numbers and various flags. Like the other inquiries, the user can page forward or backward through all screens of data.

Single Level Where-Used

The *Single Level Where-Used* report is just the reverse of the single level bill. Here, for a given component, all of its parents one level above are shown. One, few or all component items may be selected at run-time for this report. One common use of this is when a component is to be replaced by some other component, this report can be run to show all the to-be-replaced component's direct parents.

Indented Bill Inquiry

For quick reference on the screen, the user can specify any parent and whether or not to show active, planned and/or obsolete components. Every component is shown within as many levels down the structure as the user desires. Each level is indented more than the previous level to visually simulate the assembly process. The information for each component includes the level, sequence number, quantity per parent, unit of measure, description, attaching operation, activity flag, stocked flag, controlled flag and whether it is purchased or manufactured.

Usually there are more components than will fit on one screen so the user can page through all components by use of a function key. Another function key displays pages of components previously shown.

Indented Bill of Materials

The *Indented Bill of Materials* shows *all* components of a specified parent. It is called indented

because the output actually indents the component item number for each level as it goes down the structure. The exact entire structure for each specified parent item is printed. For example, if one component is used in four different parts of the structure, it appears on the report four times at the appropriate places in the structure. One, few or all parent items may be selected at run-time for this report. Some uses of this report are : 1) to see the entire product structure for a parent, and 2) to see all the raw materials/purchased parts used for the parent. The act of executing the indented bill is sometimes referred to as an "explosion" of a parent's components, as it seems to explode or expand outwardly.

The user may select whether or not active, forecast and/or obsolete components will be printed as well as a maximum number of levels to show. Either inventory base data or engineering data can be printed.

End Item Where-Used

The term "end item" refers to any item that may be sold, either as a full assembly or as a replacement part. End items are sometimes referred to as finished goods. It is generally the top item in a product structure though it may itself be a component of a larger assembly.

The *End Item Where-Used* report shows just the reverse of the indented bill. Here, for a given component, all its parents are shown. It is indented to visually show the various levels all the way up to the end item. One use of this report is to identify all end items that may be affected by a change or replacement of a component. The act of executing an indented where-used is sometimes referred to as an "implosion" of a component's parents. Tracing up a structure is like closing in on the end item, i.e. the structure gets smaller as you get closer to the top.

Any range of item numbers can be selected to print showing active, forecast and/or obsolete parents.

Summarized Bill of Materials

The summarized bill shows *all* the components of a specified parent. It is called summarized because each component is shown only once, summarized by quantity-required (per this parent) at the lowest level the component appears in the parent's structure. This is the classical parts list where each part is listed once along with total quantity required to make one parent. One, few or all parent items may be selected to print on this report. There is an option to print only purchased items and another to limit the number of levels of components.

Special Functions

Additional features include the following:

- As this is a multi-company system, the name of the company being processed appears in the upper right-hand corner of the screen.
- Descriptive and easily understood error messages are displayed in response to invalid input.
- A special report management subsystem allows reports to be printed immediately or to be spooled on disk for later display or printing of one or more copies.
- Each item carries a low level code which identifies the lowest level in any bill of material at which the item appears. There is a special module that automatically sets these codes by tracing through all bills. This assures accurate, efficient data processing.

Coding Standards and Documentation

Complete source code is provided. It is written using Warnier-Orr structured coding techniques. Extensive use is made of copy library modules to make modification easy. The paragraph and data names are very descriptive, taking maximum advantage of COBOL's self-documenting feature. It is written to make changes and maintenance easy.

The *Software Reference Manual* provides complete technical documentation. Installation Instructions give a step-by-step guide to getting the package up and running. Technical Notes, Program Specifications, File Definitions and Screen and Report Formats contain the necessary information for the programmer.

The easy to understand *User's Manual* contains an Overview, a Glossary and User Notes covering the main features. The user is guided through the operation of each function by the Application Overviews, concise Run Instructions and Sample Screens and Reports. File Load Sheets are included to expedite data entry.

Each manual is provided in a neat three ring binder with convenient thumb tabs.

Interfaces to Other MCBA Packages

BOMP uses the item file from MCBA's Inventory Management package which is the only prerequisite. Customer Order Processing (COP) uses the BOMP product structure file to explode any line item that is non-stocked and allocates its stocked components. COP's picking list in this case can be used as a final assembly order. I/M, BOMP and COP are designed to smoothly function together.