

Applications Inventory Control
Type of Industry Aerospace Defense Contractor
Name of User The Martin Co.
Denver, Colo.

Equipment Used GE-225 Data Processing System
IBM 7094 Data Processing Systems (two)
General Dynamics S-C 4020 Computer Recorder

Synopsis

As integrating contractor on the Titan II ICBM rocket, Martin Co., Denver, Colo., is responsible for coordinating activities of half a dozen major contractors and several thousand subcontractors. Some 500,000 parts are used in each missile and the inventory needed for Martin plants averages 10,000 commodity type items and 9,000 requirement type items.

To meet the massive inventory control problems generated by this complexity, Martin has steadily upgraded the efficiency of its EDP operations through a concept which calls for "batching" of peripheral equipment for greater efficiency and flexibility. This concept has eliminated previous on-line operation of the peripherals with two IBM 7094 computers and a General Dynamics S-C 4020 computer recorder. This procedure slowed up the entire configuration and produced many opportunities for error and delay. Now, the peripherals are now controlled by a GE-225, equipped with a disc storage unit and a GE Datanet-60 controller. The 225's function is to control peripheral operations while the 7094s do the actual processing.

Martin Co. credits the present inventory control system not only with providing faster updating of records, improving forecasting techniques and providing faster access to inventory data, but also with permitting the application of improved management controls. In addition, it has led to substantial savings which were estimated at \$38,000 for the first year of operations and \$40,000 for each subsequent year.

Few manufacturers have such massive inventory control requirements as do the defense contractors of today's Space Age. These needs have consequently led them on a constant quest for better ways to maximize EDP efficiency, often resulting in highly imaginative new operating concepts. Among the latter is the one which underlies the inventory control program of the Martin Co., whose Denver, Colo., plant turns out the largest USAF missiles. Its central feature is the batching of peripheral data processing units under the control of a GE-225 computer to increase equipment utilization and flexibility.

Through the implementation of this concept, Martin Co., Denver, has replaced paper with microfilm as its basic control and audit record. It also has placed its routine decision-making requirements for common usage, low value, standard items within the computer. As a result, the company claims that it has achieved numerous internal operating efficiencies in the area of material control, as well as substantial cost savings.

Inventory Control at Martin Co., Denver

As integrating contractor on the Titan II inter-continental ballistic missile, Martin is responsible for coordinating the activities of half a dozen major contractors and several thousand smaller sub-contractors. Some 500,000 parts are used in each Titan missile and the inventory needed for Martin's plants alone averages 10,000 commodity type items and 9,000 requirement type items.

Previously, Martin's peripherals operated on-line with two IBM 7094 computers. The varying speeds of the units, however, slowed up the entire configuration. This method also allowed greater opportunity for error, created problems whenever it became necessary to back up, and made it necessary to stop the main frame every time paper had to be changed in the printers or microfilm had to be replaced in the General Dynamics S-C 4020 computer recorder.

Martin's present "batched peripherals" concept was developed to eliminate operating inefficiency and to obtain maximum utilization of every item of processing equipment. Its implementation involves the use of a system composed of the two IBM 7094s, a GE-225 computer, the 4020 computer recorder, three printers and a card punch. The 225 is equipped with a GE Disc Storage Unit (DSU) and a Datanet-60 controller. Its function is to serve as the "nerve center" of the entire system.

All inventory control data is processed on the two 7094s. Magnetic tape output is fed into the 225 and the data is then stored in the disc storage unit. The DSU schedules and operates the 4020, the three printers and the card punch. All peripherals operate simultaneously, rather than sequentially.

With the GE-225 computer thus coordinating all peripheral operations, equipment can be used more effectively. Simultaneously, the card punch can be operated at maximum capacity; combined output of the three printers is 2,700 lines per minute, and the 4020 can produce 7,000 lines of microfilm per minute. In this way, the operating performance of the system and its component units is substantially improved.

Inventory Control Procedures

In the inventory control application, the GE-225 is programmed to specify the exact nature of the output medium (hard copy, cards or microfilm). When microfilm is called for, the data passes from the DSU through the Datanet-60 controller to the 4020, where 16mm microfilm records are produced in the desired format at the rate of 7,000 lines a minute.

The three printers and the card punch, also under the control of the 225 are, meanwhile, free to process additional work. This includes an average daily output of 41,000 updated nomenclature records, 21,000 updated master balance records and 2,000 cards.

Previously, Martin updated its maximum/minimum inventory control reports twice a week in four separate computer runs. Using a high-speed printer for hard copy, the updated reports were then bursted and bound into thick volumes. Thirty boxes of forms were consumed each week, and the required "library" of inventory records covered an area the size of a good-sized wall. Computer time required for updating averaged 12 hours a week.

Under the present system, implementation of the file maintenance program has been out to an average of 20 minutes of processing time a day. Preparation of microfilm output takes slightly less than two hours a day.



TWO IBM 7094 COMPUTER SYSTEMS process all inventory control data.

Inventory records are checked by an action program for required purchasing and expediting action each time new transactions are processed. This is accomplished by comparing the present usage trend with the inventory and "on order" levels.

If the stock level is low and there is insufficient material on order, a purchase notice is printed. If the stock level is low, but there is sufficient material on order or in inspection, an "on order" or "inspection expedite" notice is printed.

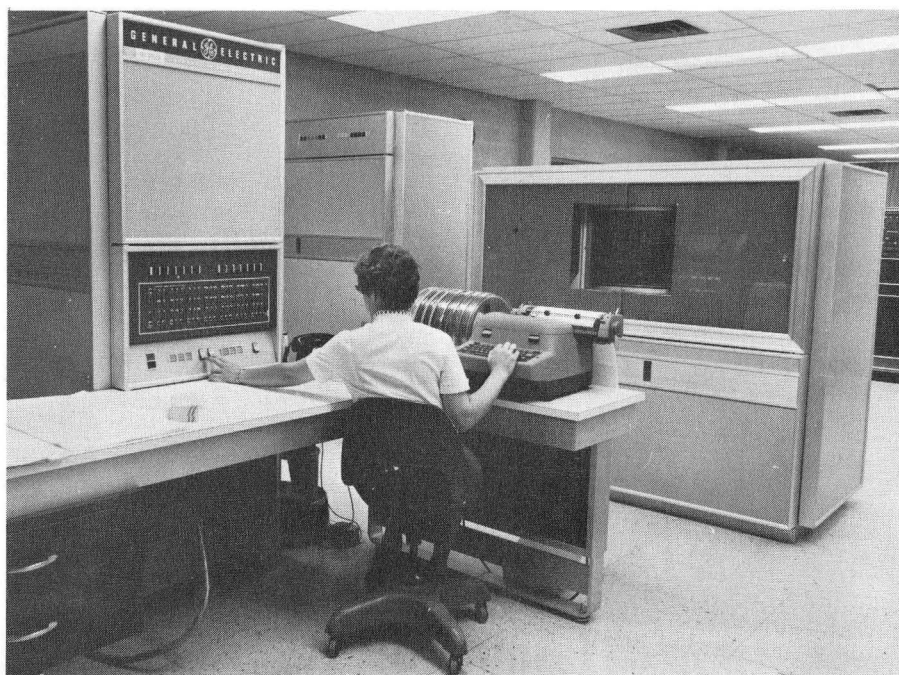
The purchasing notice (a machine-produced purchase requisition) contains not only the amount to be purchased and the delivery date but also information that permits human analysis should sudden increases or decreases in production warrant temporary compensating action.

The action program draws static information from the machine record itself, and then performs several calculations to develop other data to be printed. The data printed includes special handling codes, superseded part numbers, quantities needed for destructive testing, and lead time, in addition to identifying information. Some of the calculated elements are schedule (normal lead time or expedited) and quantity.

The quantity or the purchase notice is an EOQ (Economic Order Quantity). Industrial engineering studies were made to determine carrying costs and purchase costs. The best balance between these figures was computed for various categories of annual usage. Since the usage trend is available, as well as the unit price, the computer is able to consult a table and decide how many months' stock to buy under given circumstances.

For purchasing purposes, different types of parts must have different kinds of control. For instance, high-value parts must be purchased to exact requirements and be given meticulous control, while inexpensive, fast-moving parts can be purchased in bulk according to usage.

To separate parts falling in these various control categories, Martin has taken an ABC separation and adapted it for machine processing. This classification separates materials and parts into three different classes.

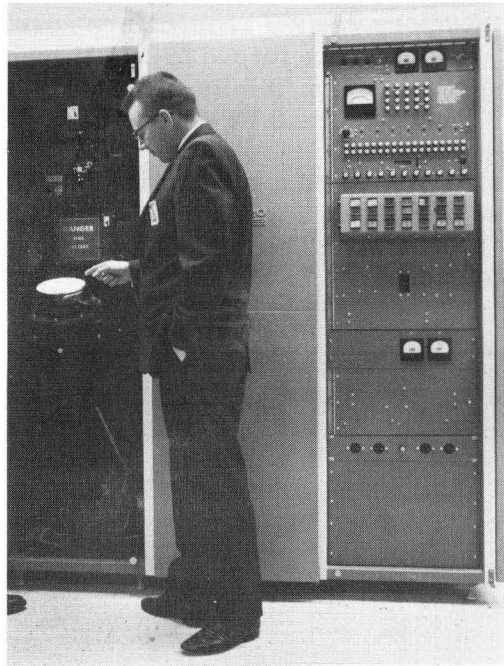


GE-225 COMPUTER receives magnetic tape 7094 output and stores it in the DISC STORAGE UNIT (at left) which schedules and operates peripherals.

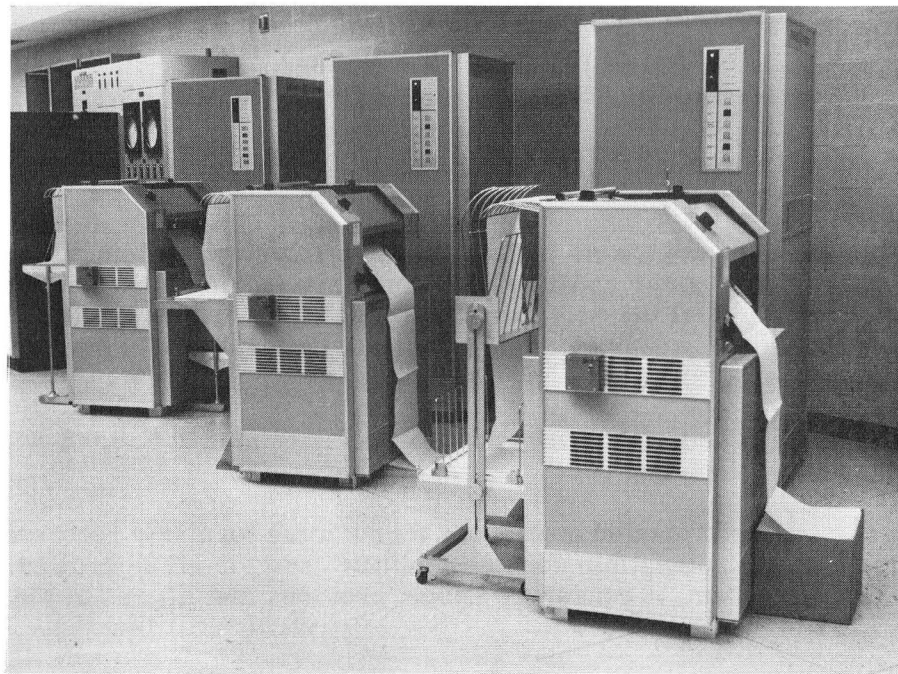
Periodically, all items are computer-checked on 25 different characteristics such as unit price, usage, open requirements, special handling, and so forth. All of this information has already been entered in the record to serve other needs. A special computer program judges the relative importance of the various characteristics and makes a determination of the detail of control needed.

Active inventory records produced through regular computer updating are distributed among eight analysts. Under the previous updating procedures, all active records had to be collected from these analysts, transported to a facsimile posting machine, and transfer posted, line by line, to active ledger cards. The ledger cards had to be manually selected and inserted into the machine.

Similarly, distribution of the computer print-out was costly and cumbersome. The continuous forms were carried from the data processing department to the inventory control department in grocery carts. All output ledger sheets for requirement items had to be hand-bound into 30 separate volumes twice a week, and then distributed to 30 analysts involved in this phase of inventory control.



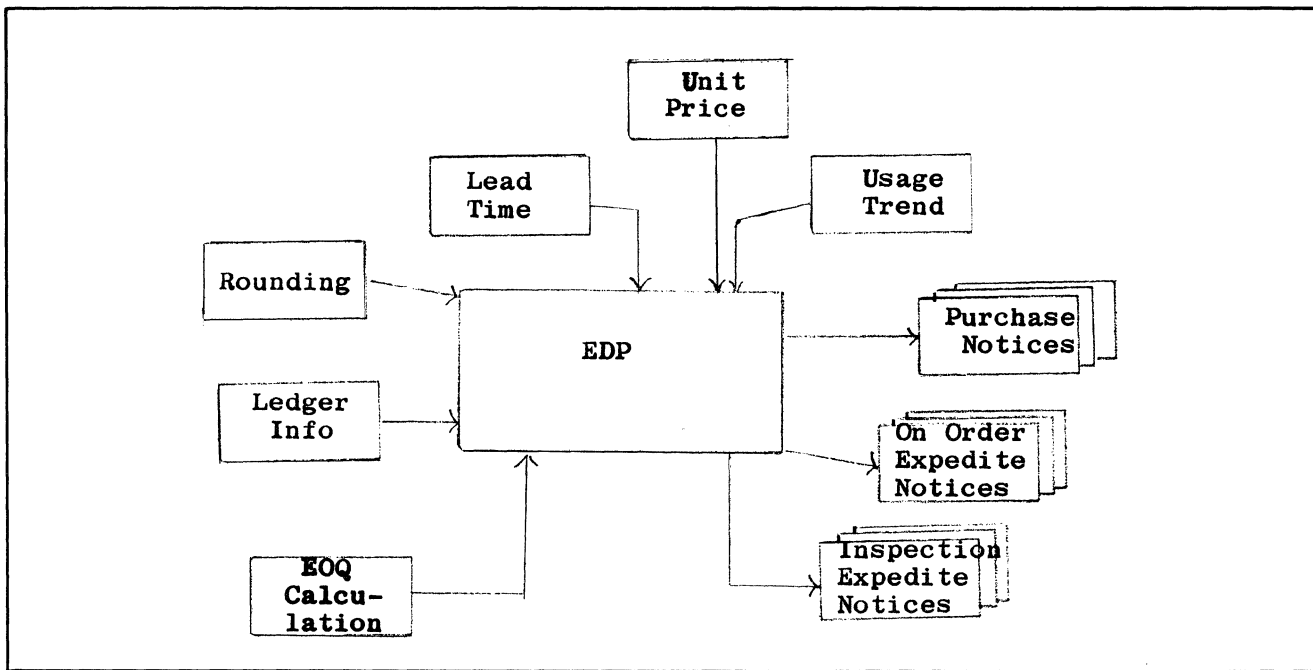
GENERAL DYNAMICS S-C 4020 COMPUTER RECORDER produces 7,000 lines of microfilm per minute to replace paper as Martin's basic control and audit record.



THREE PRINTERS under control of GE-225 system have a combined output of 2,700 lines per minute.

In addition, since the inventory control records are constantly referenced by each analysts in Material Control, analysts were forced to leaf through a large book to look up each requirement item. In the case of maximum/minimum records, the analyst had to search through many files in order to locate the item he sought.

Past history records also presented a substantial maintenance problem under the old system. Starting with the first activity on any material code, past history records had to be kept to provide the necessary audit trail. This was an obvious necessity as such records furnish a constant source of reference.



The Martin Co. - EOQ (Economic Order Quantity) System.

Results

Martin Co., Denver, credits its present inventory control system not only with reducing processing costs, providing faster updating of records, improving forecasting techniques, and providing faster access to vital inventory data, but also with permitting the application of such management controls as ABC separation and Economic Order Quantity purchasing to the inventory handling process.

First-year savings under the new system were estimated at \$38,000 with annual savings thereafter expected to average \$40,000.

Where three different printed continuous forms were formerly required for inventory control reporting, a single compatible document is now used for all controlled material. Since this document is on microfilm, it conserves space, provides fast access to the user, and greatly reduces handling time.

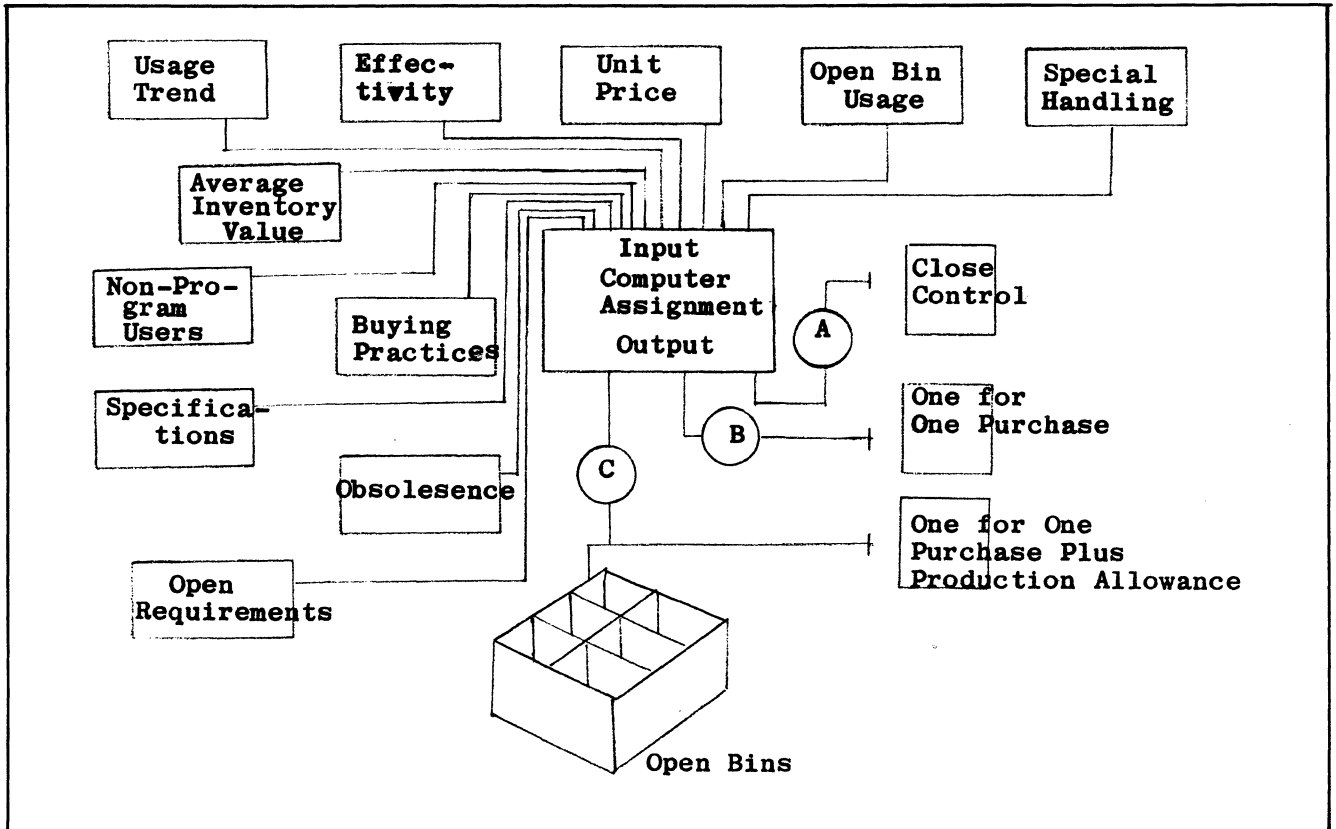
Estimated Inventory Control Cost Savings

Previous Cost

Computer processing	\$44,754
Transfer posting machine	940
Transfer posting operator	5,500
Paper for transfer posting	1,656
Ledger sheets	5,880
Bursting	960
	\$59,690

Current Cost

Computer processing	\$17,339
Microfilm	2,100
Conversion	480
New program	2,000
	\$21,919
 Net Savings, first year	 \$37,771
Annual Savings thereafter	\$40,261



The Martin Co. - ABC Separation System.

The facsimile posting operation has now been completely eliminated. Similarly, the grocery carts are gone. One man can easily handle the microfilm records for the entire updating run. With 3,000 frames (one document per frame) on each cartridge of microfilm, the inventory records library now consists of a few reels of film and a microfilm reader. High-speed microfilm readers provide faster, easier access to information. Hard copies can be made quickly and economically when required.

*Forms bursting and binding operations have also been eliminated. Manual binding operations are no longer necessary.

The resulting savings in paper costs have been great. Previously, Martin estimated its cost for a single sheet of paper -- unprocessed -- at 3/4 cent. Microfilm costs 1/4 cent per frame -- completely processed.

In addition, analysts now have more time in which to perform their primary function, the study and control of the company inventory situation. Audit trails are simpler because auditors are only required to refer to current active microfilm or the year-to-date films for any information they need.

As a result of the new procedures brought about by the new system, inventory control records are now updated daily rather than twice a week. This means that inventory data is today more current than ever before.