

# INDUSTRIAL DATA PROCESSING APPLICATIONS REPORT

**Applications** Procurement Control

**Type of Industry** Aerospace Defense Manufacturer

**Name of User** Large Jet Engine Dept.  
General Electric Co.  
Cincinnati, Ohio

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**Equipment Used** GE-225 Data Processing System  
Friden Collectadata Data Collection System

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## Synopsis

Unlike most defense plants which depend on often sporadic military buying, General Electric Co.'s Large Jet Engine Dept. in Cincinnati holds long-term USAF and Navy contracts. This factor has enabled the department to automate paperwork and to develop a purchasing control system, centered around a GE-225 computer, which incorporates the continuity and stability enjoyed in civilian large-scale manufacturing operations.

This system, known as Mechanized Materials Management (MMM), is used to buy annually more than 140,000 lots of materials worth over \$185 million. MMM procedures begin with the explosion of a marketing contract to indicate materials requirements and in-house availability, and provide computer input for preparation of purchase orders. The same card input is used for checking procedures, and production of travelers. These travelers provide identification for individual orders and follow-up computer input covering all stages of materials delivery and inspection.

Incoming receipt and movement data are transmitted via a Friden data collection system to the computer room and punched onto a paper tape which provides input for computer preparation of receipt cards, and reports and updating of inventory records.

Payments to suppliers similarly fall under the control of the MMM system. The system, in addition, provides computer input for preparation of some 30 materials reports used by various sections of the Large Jet Engine Dept.

Use of an automated purchasing system which covers all functions from writing requisitions and purchase orders to monitoring in-process inventory and automatic payment of vendor invoices today permits the General Electric Large Jet Engine Dept. in Cincinnati to handle a substantially greater range of materials operations and customer services. This system, designed to speed processing of purchase orders and related activities, also aids GE in meeting production schedules and contractual delivery dates. Underlying these achievements is the department's improved ability to promptly secure the complex array of parts and equipment that go into a modern jet engine.

Designed around a General Electric GE-225 computer, MMM prints about 75,000 purchase orders, purchase order amendments and receiving documents a year, prepares 250,000 checks for supplier invoices, maintains a continuous record of all open orders and in-process inventory, and regularly produces approximately 30 by-product reports for operating personnel and management.

The GE-225 computer has a memory capacity of 16,384 words. For the MMM application, input is provided through a paper tape reader. Output takes the form of punched cards and printout prepared on a 900 line per minute printer. In addition, a Friden Model 30 Collectadata data collection system with 10 transmitters is used to assemble materials receipt and movement data.

The GE-225 handles this workload in only 10 hours a week and operates with an accuracy -- better than 99 percent -- which manual methods cannot hope to match.

Although defense plants normally are not ideal prospects for computerized paperwork because military buying is generally highly technical and somewhat sporadic, GE's Large Jet Engine Department was fortunate in developing long-term contracts with the U.S. Air Force and Navy which made purchasing repetitive enough for an automated system incorporating the continuity and stability of similar civilian operations.

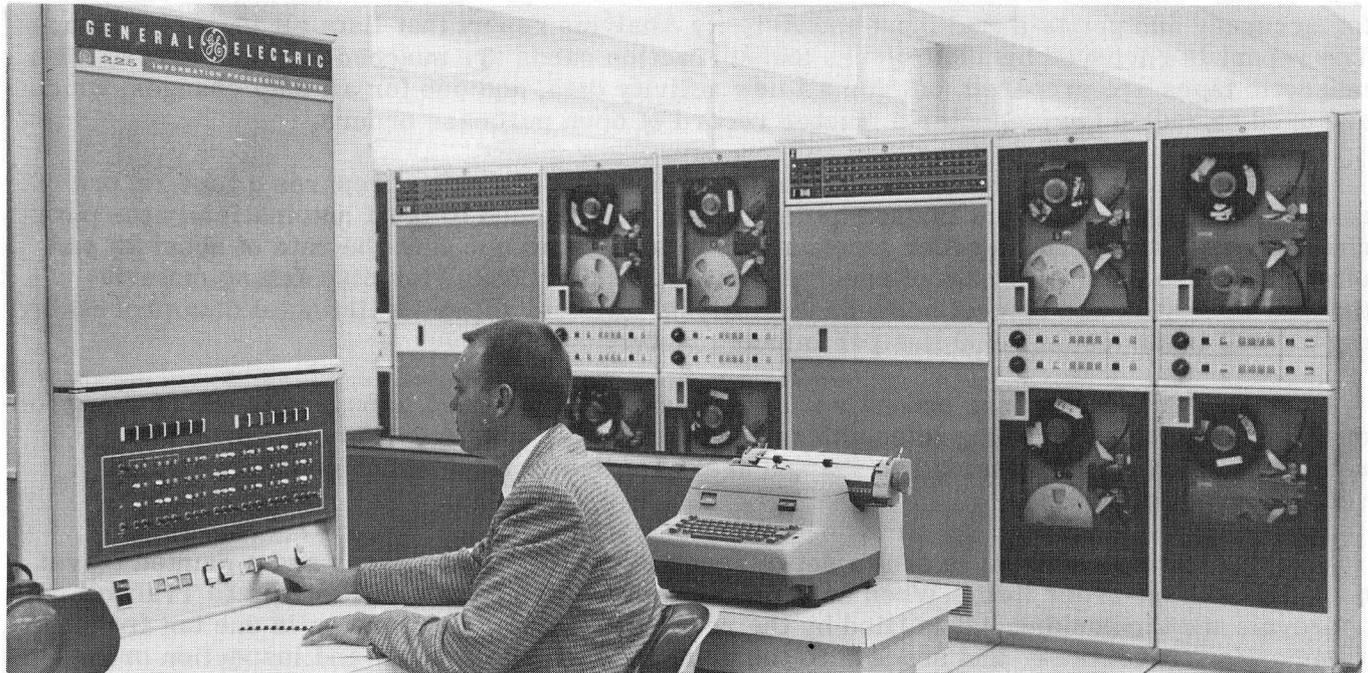
The present automated purchasing system of the Materials Operation evolved from a completely manual system. The initial phase of development involved a detailed study of buyer records, routines and activities. The result was two completely different, but partially mechanized systems. A Teletype ordering system was incorporated in the Large Jet Engine Department to prepare purchase orders and amendments. In the Production Engine Department, an IBM Cardatype system was utilized to accomplish substantially the same job. Both systems operated satisfactorily, but with definite limitations relative to capacity and management reporting.

A second step forward was realized late in 1960 when all purchasing was combined into one organization in the Large Jet Engine Department. Consolidation precipitated a mass conversion of the Teletype system to an expanded Cardatype system. The prime benefit of this action was standardization of all orders and records, but the limitations of capacity and reporting became even more noticeable.

Extensive review and study of the needs of the operation was conducted by organized groups of purchasing management. The recommendations of these and other teams were consolidated into a general plan requiring a computer application. IBM 650 and 1401 computers were installed, all manual and punched card purchasing records were converted into magnetic tape records, and a highly integrated, mechanical materials system became operational in 1961. This system produced the first computer-generated purchase orders issued by any General Electric operation.

Subsequently, advances in computer technology and a clear realization of the potential of extensive computer use by Materials Management dictated that expansion of the system be studied and implemented immediately. A new system was therefore developed and put into effect that incorporated advanced methods of reporting, document generation, and status maintenance. Along with the system came a more powerful computer, the General Electric 225.

The system has been extended beyond the function of purchasing and today incorporates the use of data collection equipment to mechanically control the elements of work in the receiving, inspection and inventory functions. (This present system's value to the Materials function has become evident, but it is by no means considered the "ultimate" system. Rather, it is the foundation for further improvement and advancement).



GE-225 DATA PROCESSING SYSTEM implements all Mechanized Materials Management procedures.

### The MMM system

MMM starts with a marketing contract, which Production Control explodes into materials requirements which are prepared either in a paper form or in the form of a punched card material requisition for each item. These requisitions go first to the Surplus and Obsolete crib, which determines if the requested materials are available in surplus. If they are not, the requisition is forwarded to the purchasing section.

When a requested item is not already on order, a buyer has a "request for quotation" form prepared. A technical clerk then assembles blueprints and specifications for the component and mails them with the form to perspective suppliers. Bids are evaluated and the successful vendor selected by the buyer. He then fills out a purchase order check sheet listing part number, quantity, supplier, delivery date and other data that will be needed for the computer to write the purchase order and maintain a status record. The materials operation issues long term purchase orders, generally for periods up to one year, to minimize its clerical effort, more effectively utilize computer capabilities, and to make its business more

attractive to vendors. The MMM system will handle purchase orders which contain as many as 99 items and up to 75 schedule delivery dates and quantities per item.

All purchase order sheets whether written for new orders, for order amendments, or to return rejected materials to suppliers, are reviewed for accuracy by an edit clerk, who also codes certain information, such as traffic routing and small business identification. The check sheet data is next keypunched into a series of cards and is mechanically verified.

Each evening a daily updating run is initiated by feeding all cards for new purchase orders and amendments into the computer. The punched cards correcting previous data errors are also processed by the computer at this time.

The computer, programmed to detect more than 40 error conditions, check each entry for accuracy and prints a Bad Input and Activity Analysis report that lists all incorrect data. The report is reviewed by audit clerks and correction cards are punched for each error. Two magnetic tapes are prepared, one for all new activity data, and one for all data changes, which are used to update the computer's master record of open purchase orders.

When all information in the system is current, the computer prepares a tape record of all new orders placed. This is used to print later reports, and to print automatically the purchase orders and purchase order amendments which are produced at the rate of about 25 per minute. It also prints out sets of receiving cards, "travel books" for dispatching material through Receiving and Inspection, a Daily Analysis of Receipts, and a listing of data processing errors and inquiries on a 900 line per minute printer.

The printed purchase orders and amendments are returned to buyers in the morning for checking, signing and mailing to suppliers. Along with the acknowledgement, cards are retained in the data processing section and are periodically reviewed to determine which vendors have not replied.

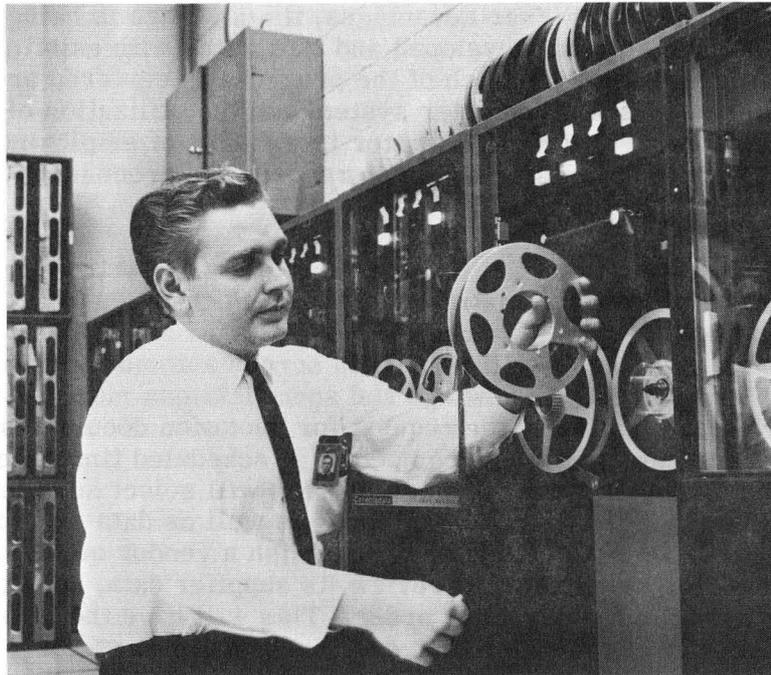
The receiving office is sent a set of receiving transmission cards and a printed travel book for each on-order item. When an item is received, the freight bill is sent to Traffic for approval, and the packing list is filed by the receiving clerk. The clerk pulls one tag from the shipment's "travel book" and sends it to the print file, where the print and inspection procedure sheet are pulled for that component and returned to Receiving. He also sends a receiving record to Quality records, which provides specific inspection requirements for the part, and inserts a receiving transmission card for the shipment into one of the 10 Friden Collectadata data collection transmitters located in the receiving areas. The "material received" messages go to a data collection receiver in the computer room where they are converted into eight channel punched paper tape. When processed by the GE-225 computer, information from the paper tape is transferred to magnetic tape.

The receiving clerk next puts all documents pertaining to the shipment into an envelope and sends it with the material to inspection. Movement of the shipment to a dispatch station is reported to the computer by inserting another card into the data collection transmitter.

At the dispatch station, the two remaining tags are removed from the "travel book". One is placed in a material location file, and the other on a customer commitment load board. The material is assigned to inspection, based on the customer commitment date. The inspector uses the prints and specifications which accompany the material to check its quality, and he notes the results on the Receiving Inspection Record card which he forwards to Quality Records for filing as the official record of inspection.

Completion of inspection and availability of the material is signaled to the computer by again placing a receiving card into a data collection transmitter. All receipt and movement data that has been flowing into the computer room is punched into paper tape by the Friden Collectadata data collection receiver. This tape is used by the 225 in the following ways:

1. To prepare materials receipt cards
2. To update materials in process inventory records
3. To update open order status records
4. To print reports on materials received and those in process for use by buyer or manager.



FRIDEN MODEL 30 COLLECTADATA RECEIVER punches materials receipt and movement information collected through 10 transmitters into paper tape.

Payment of suppliers is also followed closely by the MMM system. First, invoice editors at Accounts Receivable circle all information that must be keypunched. A code is also noted on each invoice indicating form of payment and cash discount terms. Punched cards are prepared for each item on each invoice, and three times weekly these invoice cards are mechanically matched to the purchase order and receiver tapes to distribute charges and print checks for suppliers.

In addition to following a materials requisition from purchase order to payment, virtually all reporting and record keeping of the Materials function is handled by the MMM system. The GE-225 regularly prepares some 30 materials reports used by Purchasing, Materials Management and other operations. These reports include:

1. Daily analysis of receipts
2. Delinquent materials

3. Expediting
4. Purchasing dollars committed
5. Orders placed with small business
6. New orders placed
7. Materials received and in-process
8. Complete analysis of purchases categorized by vendors, buyers and dollar value.

### Results and Future Plans

Though the MMM system has provided the Materials Operation with program and system flexibility, as well as many other advantages, its coverage is being extended. Fertile areas still remain to be investigated, developed and integrated with existing and planned information systems. Achievement of much of the progress is centered around the future installation of a GE-600 large scale computer system and the utilization of GE's software package, Integrated Data Storage (IDS). The latter is a means of employing disc storage memories most effectively in organizing business records for processing, storage and prompt retrieval as needed.

It is planned to incorporate a master tape record by GE Control Number. With this information, it will be possible to automatically process mechanized materials releases from the production ordering units. When this can be accomplished along with conversion to random access processing, the MMM system will be able to screen automatically all requests for material to determine what blueprint drawings and specifications must be ordered and sent to vendors, and to generate automatically the request for quotation documents. Another expansion plan is to automate vendor selection. The computer, at scheduled time intervals, will print requests for quotations on specific components. Buyers will select suppliers to quote on the business. Vendor bids on various quantities of parts as well as data on vendor quality and service records will be fed into the computer to establish a vendor quotation file. Then, for every materials release, the computer will review its supplier data, select the source of supply and automatically write the purchase order. This will have the advantage of permitting buyers to spend the majority of their time on vendor negotiations.

Through the combined efforts of Materials, Systems, and Computations personnel, a program for generating reports has been developed. This is a single computer program composed of many varied sub-routines which essentially can produce all of Materials' standard reports and the majority of special reports requested. This will eliminate the programming of special jobs and reduce the time cycle for obtaining special reports to a minimum. This program will be implemented in the near future.

In the future, study and work will continue toward integrating the MMM system with other operations in the Large Jet Engine Dept. The purpose is to attain the most compatible, efficient, and economical system for all operating functions within the department and to provide the department with a highly automated system which will cover the total cycle from the moment an engine is received until the engine is shipped to the customer.