INDUSTRIAL DATA PROCESSING APPLICATIONS REPORT

Applications	Distribution and Inventory Control
Type of Industry	Electrical Equipment Manufacturer
Name of User	Thomas & Betts Co. Elizabeth, N.J.

Equipment Used	IBM System 360/Model 30 Data Processing System

Synopsis

"Wherever electricity goes... so do we" is the motto of Thomas & Betts Co., of Elizabeth, N.J. A major supplier of electrical equipment, T&B is involved in a highly competitive industry in which the end user is not only concerned with brand name but also product availability and fast delivery. In order to handle the demands of the more than 1,500 distributors which handle T&B products, the firm has set up a string of six strategically located warehouses which are aided by a computer system designed to optimize warehouse inventories without sacrificing same day shipping service on orders received. The computer handles an array of more than 40,000 products.

Thomas & Betts Co., Elizabeth, N.J., has been using computers since 1958, when the company installed an IBM 305. In 1963, T&B installed an IBM 1401 System to handle inventory control, order entry, billing and payroll. Today, the company has an IBM System/360 Model 30 with a core storage capacity of 32,000 characters. Peripheral equipment includes four tape drives and three IBM 2311 disc drives. An 1,100 line per minute IBM 1403 printer is used to produce output.

Thomas & Betts was founded in 1895 as a manufacturer of conduit fittings for the then infant utility industry. The company started with a product line of only 25 items. That line has grown to more than 40,000 electrical parts of all types, covering virtually every electrical need. Prices range from two cents for an ordinary electric terminal to $6,000 for memory application systems for computers.

The structure of T&B has changed radically since 1958 when it was basically a one plant operation with one subsidiary. Today there are 18 plants and distribution centers and five subsidiaries, and Thomas & Betts has established itself in France, Germany, the United Kingdom and Japan.

During a recent 10-year period, T&B's consolidated sales have climbed 180 percent, with net income rising 210 percent. Yearly sales are in excess of $52 million and the company employs more than 1,600 persons.

The highly competitive nature of the electrical equipment manufacturing industry pervades the management philosophies of Thomas & Betts. A manufacturer can no longer expect his distributors to carry inordinately large inventories as a cushion against the large rush order. This type of operation cuts into profits for both the manufacturer and the distributor and leads to a great deal of paperwork, much of which is unnecessary. At the same time, a slow distribution system causes the end user the irritation of not having his goods on time and can have a major effect on good will and future sales.

In order to combat distributing slowdowns, T&B's 1,500 distributors are served by warehouses in six strategic cities from coast-to-coast -- Atlanta, Kansas City, Chicago, Los Angeles, San Francisco and Seattle. In addition, the main warehouse located next door to the company's main manufacturing facility and home office in Elizabeth supplies the East Coast and serves as the main distribution point for the other six redistribution centers.

THE SYSTEM

The company is currently using a modified version of IBM's IMPACT (Inventory Management Program and Control Technique) software package to monitor and control the inventory levels of the six redistribution centers, automatically determining when and how much inventory should be consigned to each center.

The computer has made it economically feasible to evaluate inventory and forecast sales more frequently than was possible when these jobs were done using manual methods. Previously, inventory was evaluated twice a year on the West Coast and three times a year in other locations. Forecasting was done on the basis of historical shipments rather than orders received. Today, evaluation and forecasting is done every four weeks. Thus, inventory levels and on-hand quantities of more than 16,000 stock-keeping units are constantly reviewed and revised to reflect current demand. Built into the system are such factors as safety stock and reorder points, as well as exceptional conditions (unusually large orders, for example) which can be adjusted by management manually before they are reflected in the system when future needs are forecast.

When a distributor's order is received at one of the six warehouse locations, it is sent to a typist who prepares a multiple form which includes a packing slip, a bill of lading, a warehouse file copy and a copy for the home office in Elizabeth.

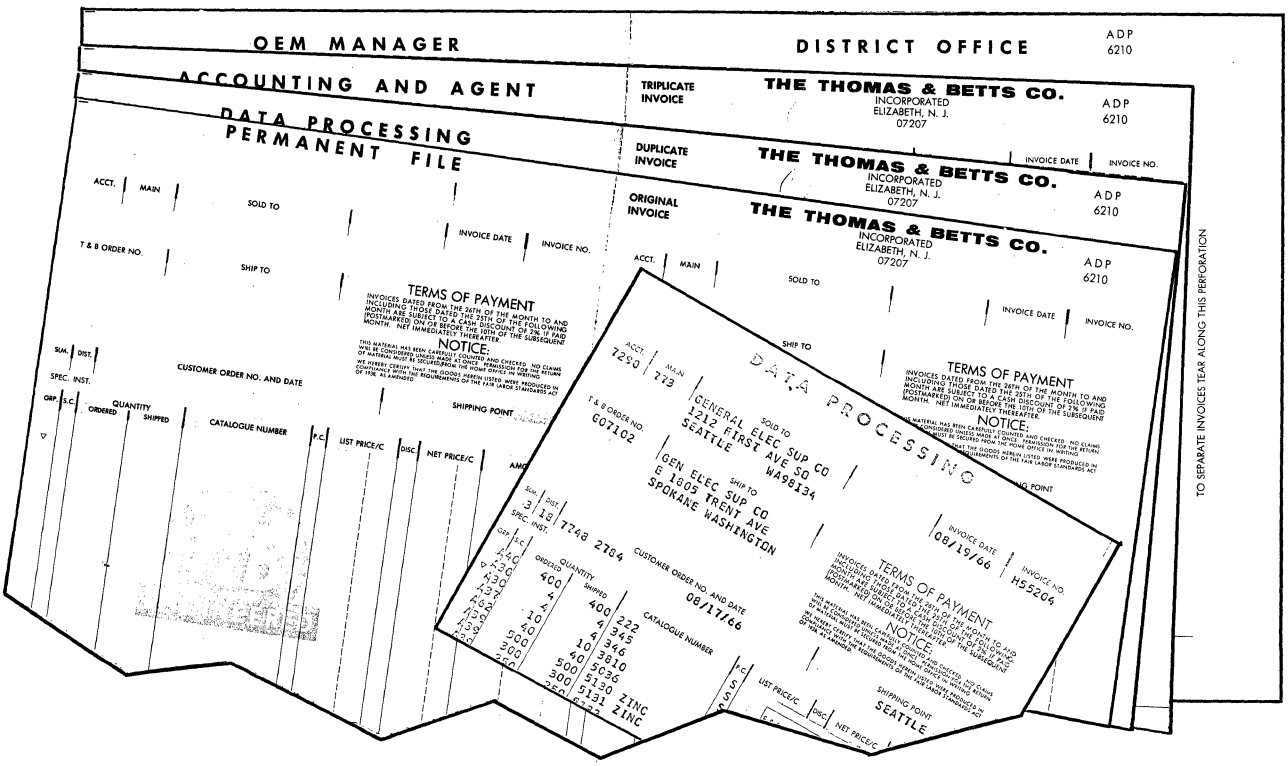
The order is then sent to the warehouse floor where the needed goods are picked, if available, and then forwarded to the distributor. If the goods are not stocked, the warehouse will TWX the customer service department in Elizabeth the order information so that immediate action can be taken.

At the end of the day, each warehouse airmails its daily orders to the order processing department at the home office, where cards for each item ordered are pulled from tub files and the orders are edited to assure they have been filled out correctly. The orders are then sent to data processing where header information is added and the orders are keypunched. The next step is a card-to-tape computer run which picks up customer name and address information stored on discs. A billing run then produces customer billing for the redistribution points. All billing is done directly from Elizabeth after the customer order has been shipped.

When the bill is produced, the computer simultaneously updates the master inventory and the sales statistics file. Items that are back-ordered are recorded for billing when the back-order is shipped.

The IMPACT system is the result of the incorporation of several basic principles of scientific inventory control. It is broken down into two basic parts:

1. The Initialization System
2. The Operating System



THE THOMAS & BETTS CO. INVOICE IS IN FOUR PARTS: PERMANENT COPY, DATA PROCESSING COPY, ACCOUNTING AND AGENT COPY AND OEM MANAGER--DISTRICT OFFICE COPY. A COMPLETED DATA PROCESSING COPY IS SHOWN.

The Initialization System

Based on current and historic input demand data, the initialization system selects the forecast model for each item. The information that is fed in daily from the distribution points on orders received serves as input and constantly keeps inventory and sales figures for each location. The computer determines the initial safety stock and inventory level for each item and determines the number of times per year the item will be ordered. It also, on a simulation basis, estimates the inventory behavior for the year. The same system, using annual figures, is used to reinitialize parts of the system every year.

The Operating System

The operating system is broken down into three basic subsystems:

1. The Record-Keeping System
2. The Forecasting System
3. The Reviewing and Ordering System

The record-keeping system maintains on-hand, back-order and on-order balances by item and by redistribution center location. It maintains a record of the demand -- again by item and location -- which includes the number of times the item has been ordered during the current forecasting period, the cumulative quantity ordered and the number of times the item has been back ordered. This latter information is fed into the forecasting system. As a by-product, this system also generates service and status reports.

FOUR-WEEK WAREHOUSE FORECAST REPORT--FOR PERIOD ENDING 01/05/68 PAGE NO. 212

CAT NUMBER TAB	PACK	W H	F M	LATEST DEMAND	LIN SRV	FORECAST PREVIOUS	FORECAST CURRENT	MAD	SUM OF ERRORS	DSV2	SSV1/V2	PUR K	ORDER PREV.	POINT- CURR.	ORDER QTY	IT SV	MANFG LT	D C	E X	T S	D F	S G
54135		C	H	50		388.6	354.7	388.4	2019-			1.4	961	904	1000				A	.	.	
0622600	500	A	H	150		250.7	240.6	160.8	594-			1.6	887	831	500				A	2.	1.	
		F	H			38.0	34.2	46.8	93			1.2	168	155	250				A	3.	3.	
		G	L	50		90.4	88.4	106.6	289-			1.4	1000	1000	500			00	C	1.	2.	1
		B	H	250		234.4	236.0	205.1	272			1.4	503	476	500				A	.	.	
		H	H	500		333.4	350.1	166.5	99-			0.8	509	527	1000				A	3.	1.	
		**ITM NOT RE-FCST. NO FM. WHS T CAT NO 54135																				
54136		C	H	800		1171.4	1134.3	880.0	4155-			1.6	2922	2545	1500				A	3.	.	
0622800	500	A	H	50		327.0	299.3	183.3	7-			1.6	1031	990	500				A	.	2.	
		F	H	50		204.4	189.0	158.4	866			1.6	806	762	500				A	1.	.	
		G	L			204.5	194.3	51.2	62			0.2	1000	1000	500			00	C	3.	1.	1
		B	H	150		484.5	451.0	449.6	415			1.4	1033	988	1000				A	.	.	
		H	H	100	0	296.9	277.2	233.1	383-			1.0	582	556	1000				A	1.	.	
		**ITM NOT RE-FCST. NO FM. WHS T CAT NO 54136																				
									76-			1.4		1100	1000							
															500							

THE FOUR-WEEK WAREHOUSE REPORT CAN BE TRANSLATED AS FOLLOWS: "PACK" IS THE NUMBER IN A STANDARD PACKAGE, "W" IS THE WAREHOUSE LOCATION CODE, "F/M" IS FORECAST MODEL, "LATEST DEMAND" IS THE NUMBER SOLD IN THE PREVIOUS FOUR WEEKS, "LINE SERVICE" IS THE PERCENTAGE OF DEMAND SATISFIED. BLANK MEANS 100 PERCENT. UNDER "FORECAST", "CURRENT" INDICATES NEXT FOUR WEEKS, ADJUSTED; MEAN ABSOLUTE DEVIATION (MAD) IS THE MEASURE OF FORECAST ERROR, EASED TO CALCULATE ORDER POINT. SUM OF ERRORS IS THE DIFFERENCE BETWEEN FORECAST AND LATEST DEMAND ALGEBRAICALLY SUMMED. "DSV2" IS A MATHEMATICAL TREND POINT NO LONGER USED. PURE K IS A STATISTICAL SAFETY FACTOR USED TO CALCULATE THE ORDER POINT. UNDER "ORDER POINT" PREVIOUS, MEANS REPLENISH WAREHOUSE WITH INVENTORY; "ORDER QTY" IS ECONOMIC ORDER QUANTITY; "IT SV" IS ITEM SERVICE IN CASES WHERE AN ITEM IS TREATED DIFFERENTLY FROM AVERAGE; "MANFG LT" IS MANUFACTURING LEAD TIME TO BE USED AS FACTORY OPERATIONS ARE BROUGHT INTO THE SYSTEM; "DC" IS DECRUMENTING COUNTER, "EX" IS EXCEPTION CODE, "TS" IS TRACKING SIGNAL TRIPS: "DF" IS DEMAND FILTER TRIP, EVENTUALLY ENABLING A COMPARISON TO BE MADE AGAINST PREDETERMINED LIMITS AND "SG" SHOWS THAT SOMETHING HAS (FROM DF) TRIPPED.

Every four weeks the accumulated demand information for the past four weeks is used to reforecast demand for the coming four-week period. The ability to accumulate this information in the computer daily gives T&B a measurement of the service percentage at which each redistribution center is performing.

The warehouse service report is a by-product of the demand record-keeping system. Customer service is measured with three criteria on the report:

1. Line items -- The number ordered and the number shipped at the time of the original order.

2. Dollar Demands -- Dollar value of inventory ordered and dollar value of inventory shipped at the time of the original order.

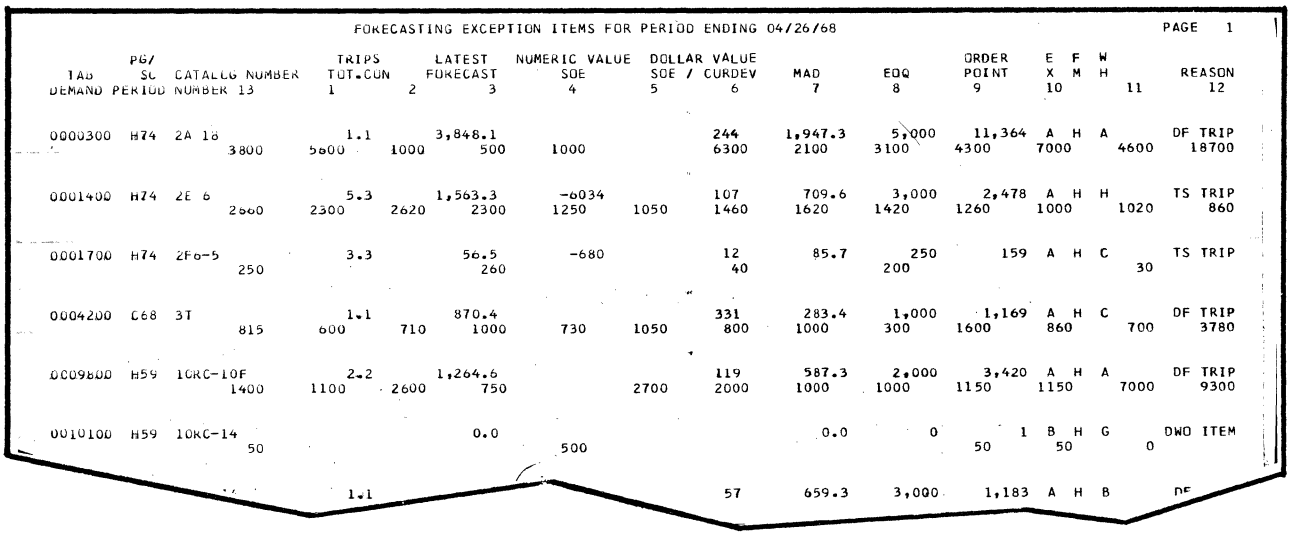
3. Customer Orders -- Number of orders received and number of orders shipped complete at the time of the original order.

The report is also issued every four weeks, covering the four-week period just ended.

Optimum service is reached when the warehouse ships 100 percent of its orders to the distributor the same day those orders are received. T&B estimates that the system is enabling the warehouses to operate at approximately 95 percent efficiency. This accumulated demand information was unavailable when distribution was handled manually.

The forecasting system calculates the expected demand for each item at each T&B redistribution center. It determines the average deviation from the previous forecasts and calculates a new safety stock factor and reorder point again for each item at each location. A principle part of the forecasting report is a statistical projection of target inventory by location. The report shows, by inventory dollars, the optimum inventory level for each warehouse.

The system is self-monitored and when forecasts are either consistently high or low beyond certain limits, management receives an exception report and the causes are investigated.



FORECASTING EXCEPTION ITEMS FOR PERIOD ENDING 04/26/68 PAGE 1

TAB / DEMAND PERIOD	PG/ SC	CATALOG NUMBER	TRIPS TOT.CUM	LATEST FORECAST	NUMERIC VALUE SOE	DOLLAR VALUE SOE / CURDEV	MAD	EOQ	ORDER POINT	E X	F M	W H	REASON
		NUMBER 13	1 2	3	4	5 6	7	8	9	10		11	12
0000300	H74	2A 18	1.1	3,848.1		244	1,947.3	5,000	11,364	A	H	A	DF TRIP
		3800	5800 1000	500	1000	6300	2100	3100	4300	7000		4600	18700
0001400	H74	2E 6	5.3	1,563.3	-6034	107	709.6	3,000	2,478	A	H	H	TS TRIP
		2660	2300 2620	2300	1250 1050	1460	1620	1420	1260	1000		1020	860
0001700	H74	2F6-5	3.3	56.5	-680	12	85.7	250	159	A	H	C	TS TRIP
		250		260		40		200				30	
0004200	C68	3T	1.1	870.4		331	283.4	1,000	1,169	A	H	C	DF TRIP
		815	600 710	1000	730 1050	800	1000	300	1600	860		700	3780
0009800	H59	10RC-10F	2.2	1,264.6		119	587.3	2,000	3,420	A	H	A	DF TRIP
		1400	1100 2600	750	2700	2000	1000	1000	1150	1150		7000	9300
0010100	H59	10RC-14		0.0			0.0	0	1	B	H	G	DWO ITEM
		50			500				50	50		0	
			1.1			57	659.3	3,000	1,183	A	H	B	DF

(3)

THE MANAGEMENT BY EXCEPTION REPORT'S DATA COMES FROM THE FORECAST RUN. DEMAND PERIOD NUMBER LINE SHOWS THE DEMANDS BY PERIOD FOR THE LATEST 13 PERIODS (FOR THE LATEST YEAR). EACH LINE OF ITEM INFORMATION IS FOLLOWED BY A LINE OF DEMANDS. IN THE REASON COLUMN, TS TRIP IS TRACKING SIGNAL TRIP; DM, DEMAND FILTER TRIP; DWO, DISCONTINUE WHEN OUT; AND (NOT SHOWN) NEW ITEM AND RATIO OF ORDER POINT TO FORECAST.

The reviewing and ordering system reviews the status of each item at each location weekly and determines when and how much to order according to the previously calculated re-order points and order quantities. The warehouse reorder report shows the items that are being sent from Elizabeth to replenish the other locations by comparing the net available with the precalculated re-order point.

WAREHOUSE REORDER REPORT DATE 05/03/68 PAGE 10

CATALOG NUMBER	CHICAGO	LOS ANGELES	SAN FRANCISCO	SEATTLE	ATLANTA	KANSAS CITY
	162755	162756	162757	162758	162759	162760
1667	10					
1675	320	160	90			
1700						10
1703		30				
1706						100
1709	100					
1725	20					
1740					10	

THE WAREHOUSE REORDER REPORT IS GENERATED WEEKLY AND SHOWS THE ITEMS, BY WAREHOUSE LOCATIONS, WHICH ARE BEING SHIPPED FROM ELIZABETH TO REPLENISH BRANCH INVENTORIES. THE NET AVAILABLE IS COMPARED TO THE RE-ORDER POINT (REISSUED EVERY FOUR WEEKS IN THE FORECAST RUN), AND REPLACEMENT INVENTORY IS CONSIGNED IF NECESSARY.

RESULTS AND FUTURE PLANS

Centralized distribution and inventory control has given Thomas & Betts a number of competitive advantages. The company is able to maintain tight control over warehouse inventories, and optimize inventory levels in line with current demand per product. This substantially reduces the need to over-inventory while enabling most orders to be filled within 24 hours. The distributor, in turn, saves because fast availability reduces his inventory requirements.

The system has also provided T&B with better balanced inventory, reduced back orders, lower expediting costs, fewer customer service calls and improved customer service.

At the present time, Thomas & Betts is not using its inventory system to optimize production scheduling based on future needs. This program, however, is under consideration and a distinct future possibility.

Also in the blueprint stage for the future are increased data links to the six warehouse locations. However, T&B's management does not believe there are economic justifications for real time applications at this time and is investigating batch data communications as an alternative.