

IBM Punch Card Systems in the U.S. Army

by Charles M. Province

Background:

In every profession, there are jobs that go unnoticed-jobs performed by unsung heroes who stand backstage while the stars receive the applause. The military is no different. One mundane military occupation during World War II-and up to the early 1960s-was that of EAM Operator; a person who operated Electrical Accounting Machines. EAMs, called Punched Card Systems by civilians, began keeping track of everyone and everything in the United States military establishment at the start of World War II. From Personnel Accounting to Supply Accounting, the IBM punch card machines debited and credited long before computers became commonplace.

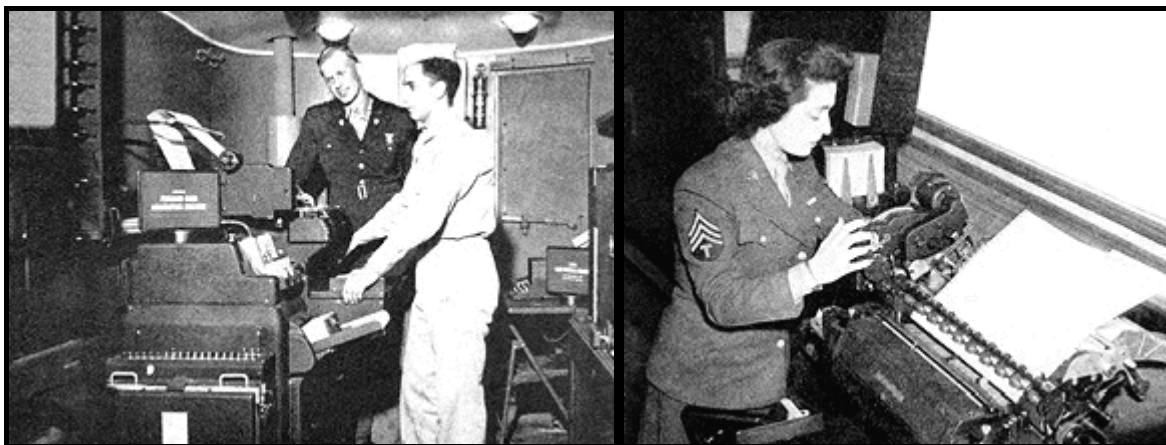
How does the military keep track of hundreds of thousands of soldiers and millions of tons of supplies and equipment? It seems simple today with the massive computing power available. Yet today's inexpensive desktop computer has millions of times the computing power of the first computer used by the Army. Called ENIAC (Electronic Numeric Integrator And Calculator) it was used for artillery trajectory calculations and contained over 18,000 vacuum tubes.

Further back through the dim veil of history, in the BC era (Before Computers), there were EAMs; electro-mechanical devices as similar to modern computer systems as the Ford Flying Flivver is similar to a modern jet fighter. At the time they were a miracle of statistical accounting methodology.

Herman Hollerith, a young Census Bureau statistician, designed the first electro-mechanical punch card system. The 1880 census wasn't completed until 1887, causing concern that the 1890 census wouldn't be completed until after 1900. Hollerith borrowed J. M. Jacquard's 1804 pasteboard method for automatic weaving, designing a 3" x 5" card and building a Card Punch, Sorting Box, and Counter Device. Cards passed over a mercury-filled vat and pins dropped to touch the card. Pins passing through card holes touched the mercury, made electrical contact, and incremented counters. Seemingly clumsy, primitive, and slow, at the time it was high tech. Hollerith's system completed the 1890 census in three years.¹

Hollerith left the Census Bureau in 1903, started his own company, and in 1911 merged with International Time Recording Company and Dayton Scale Company to create the Computing-Tabulating-Recording Company. In 1924, the name was changed to International Business Machines. Thomas Watson, Sr. became president and made IBM a household name.

General George C. Marshall knew the effectiveness of the United States Army in World War II would rely on its ability to increase personnel to staggering numbers; that current old-fashioned clerical methods must be replaced by an efficient, flexible, and fast system. He ordered the creation of numerous types of electronic accounting units. Many types of record units were created to handle everything from manpower to payroll to supplies. The focus here will be the Army's Personnel Accounting System. The Army's field unit was Machine Record Units, Mobile. The MRU's duties were to handle, "... all of the processes and procedures necessary in the administration and operation of Personnel Management and Personnel Record Keeping."



Col. Norman A. Donges reported that, "As early as 1939, the Adjutant General named a team of administrative experts to work in coordination with specialists from the business world in setting up a system capable of keeping track of each individual in the Army. New accounting procedures were developed, making use of the most modern electrical devices utilizing the punch card system. During World War II, mobile units landed on the beaches of Normandy, Sicily, Italy, and the islands of the Pacific even before docking facilities had been established."²

According to Jay Frank the purpose of the mobile MRUs were, "To facilitate statistical control of armies in the theaters of operations, mobile machine records units, each complete and self-contained, are assigned to service troops in the field. These units consist of two huge truck-trailers carrying complete machine records equipment mounted on rubber shock absorbers and sprung carriages, so constructed that operation is accomplished within the body of the trailer, and one trailer equipped for administrative operation. There are two two-and-one-half-ton, six-wheel drive trucks; two generators with a total of eighty horsepower; and one command car."³

Mobile units required approximately two hours to move out of a position or set up in a new position. Personnel consisted of twenty-nine enlisted men, one warrant officer, and two officers for an army corps unit. Men were transported in trucks and they carried full field equipment, including rifles and carbines. Army corps units were usually located in the rear echelon of the headquarters to enable the commander to know, within a minimum of time, the exact status of the forces at his disposal to give answers to questions vital to strategy, furnishing information accurately and with the swiftness of electricity.

The Card:

Everything began with the IBM card. It was a marvel of manufacture and quality control. Made of heavy, stiff, stock paper, it measured 3-1/4" high by 7-3/8" wide with 80 columns numbered left to right and 12 rows from top to bottom. Numbers were punched in a column as 0 through 9. Alphabetic characters were punched in code; a 12 punch and a 1 punch produced the letter A, 12 and 2 = B, 12 and 3 = C, etc.

3		PATTON GEORGE S JR		O-022605 GEN		USA		1 06 07 5		39	
MO		TK OEST BRIG		NY 403							
MORNING REPORT LOCATOR CARD											
REMARKS											
<p> CAUSE A PRESENT - assigned & joined. B PRESENT - assigned but not yet joined. C PRESENT - arrival & assignment, from other theaters, or in cont. US from outside cont. US. D PRESENT - to military control from dropped as AWOL. E PRESENT - arrival & assignment from the cont. US. LOSS F TRANSFER - within cont. US or within theaters. G TRANSFER - from cont. US to outside cont. US/initial theater. H SEPARATION - by own casualty, missing/captured/death. I SEPARATION - other than by death or battle casualty. J SEPARATION - all deaths except listed in action. K SEPARATION - dropped from rolls as AWOL. L TRANSFER - to the cont. US from outside cont. US. M CHECKED - SERVICE. N PRESENT - NOT DISCHARGED - arrival in US. O REPORTED - not from attachment. </p> <p> OTHERS 1 PRESENT - from duty to AWOL. 2 PRESENT - return to duty from AWOL. 3 PRESENT - arrival at new station, theater or unit, reflect with within the cont. US/theaters. 4 PRESENT - sick. 5 PRESENT - from, not yet joined/absent sick. 6 PRESENT - departure on TDOS from cont. US to theaters, or between theaters. 7 PRESENT - returned from TDOS. 8 PRESENT - departure on DG within cont. US or within theaters. 9 PRESENT - departure on TDOS to the cont. US from outside the cont. US. </p> <p> NOTE - "Theaters" includes bases & departments. </p>											
NAME		SERIAL NUMBER		GRADE		BRIEF OF DUTY		APR		MAY	
ORGANIZATION NAME						STATION NAME OR SHIPMENT NO. OR A.P.O. NO.					

The Processing Sequence:

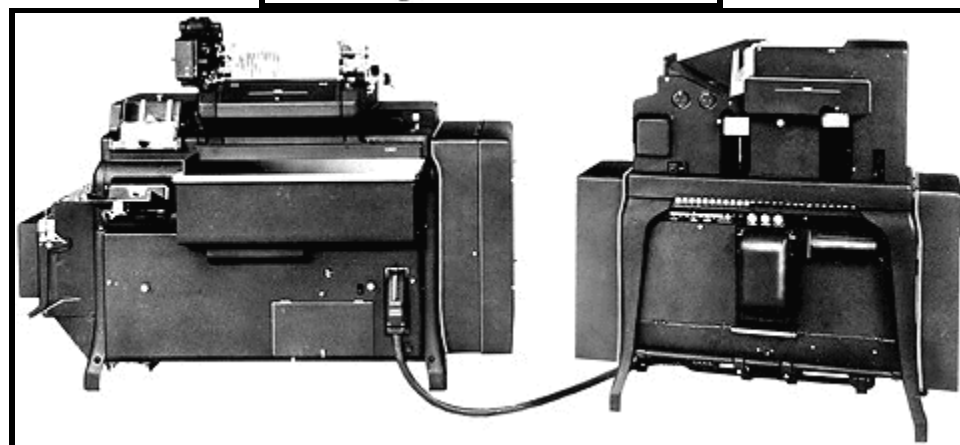
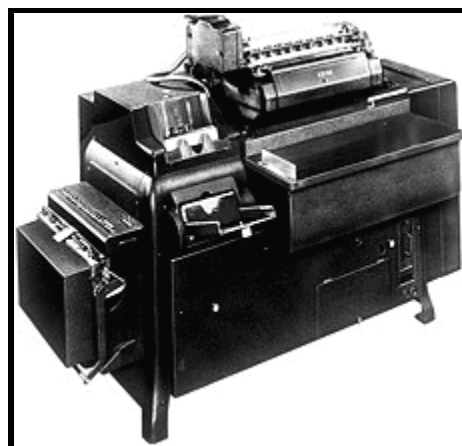
The **Keypunch** transferred information from source documents to cards. In Personnel Accounting the Morning Report was the document of origin. Machine speed depended on the operator's ability. The **Verifier** accepted punched cards for re-keying. Typing errors caused the machine to nick the incorrect column at the top of the card. Error cards were re-punched.



The **Sorter (082) (Left)** sequenced cards at the rate of 150 per minute. The **Sorter (083) (Middle)** sequenced cards at 650 cards a minute. A sorting brush was moved to any of 80 columns to sort a single column. As each card moved into the sorter, it slid over a brass roller. If a punch was encountered, the brush made electrical contact with the roller, and the chute blade routed the card into the correct pocket. The **Collator (Right)** sequence-checked, merged, matched, and selected cards at 240 cards per minute. The collator was the most cursed EAM machine. Card jams were a mechanical nightmare requiring partial disassembly to extract mutilated cards. Read brushes were often ruined.⁴

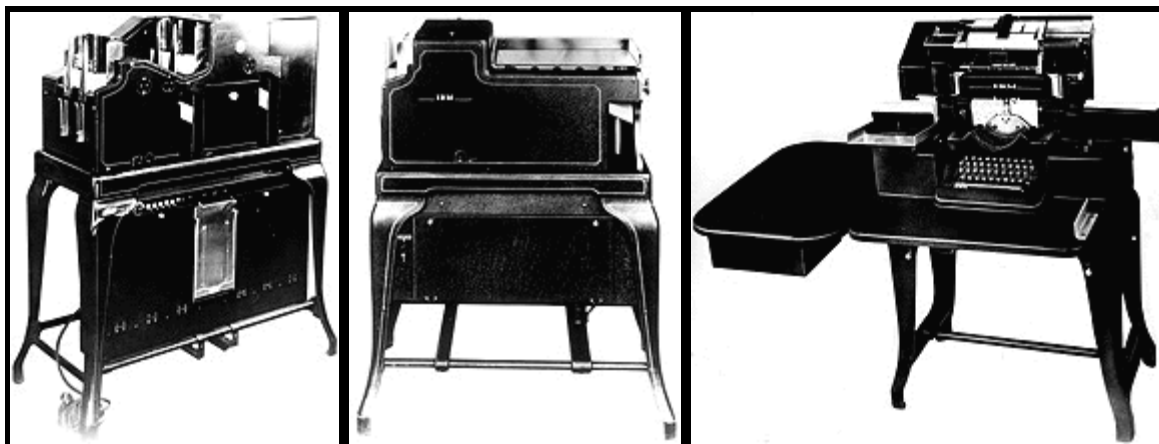


The Tabulating Machine (Left), capable of adding, subtracting, crossfooting, and summarizing totals and printing tabulated reports, was the largest and most complex machine. Its 2' by 2' Control Panel had almost 5,000 wireable plug holes. It printed minor, intermediate, and major totals. The "Tab" Machine could be connected to the Reproducing Gangpunch machine to punch summary cards. Summarizing reduced card counts. **The Summary Punch (Right)** was a combination of the "Tab" Machine and a Reproducer which would accumulate totals for data groups and punch a "summary" card containing the information. This allowed operators to sort fewer cards during the next processing cycle since the "details" were no longer required.



The Reproducer (left) did reproducing, gangpunching, mark sensing, and summary punching. Reproducing duplicated cards, Gangpunching copied detail cards from a single master card, Summary Punching accumulated "Tab" machine totals, and Mark Sensing read No. 2 pencil marks, optimally from an IBM No. 2 pencil. **Interpreters (middle)** printed 60 characters of data on two separate lines at the top of the card at 60 cards per minute. Printing all 80 columns of a card required two passes through the machine. Prior to the

Reproducer and Interpreter, there was a machine called a **Dup/Print/Punch (right)** which was a combination of a keypunch, interpreter, and Reproducer.



Card Types:

MRUs maintained multiple Status Cards (WD AGO Form 301), for individuals with name, service number, grade, unit, date of enlistment, period of oversea service, and similar data. Organizational Master Cards were maintained for each unit or installation. Daily Morning Reports, the backbone of the Army's Personnel Accounting program, were the source for Status Cards. Examples of cards compiled by Mobile MRUs were Morning Report Locator Cards (WD AGO Form 302), Organizational Master Cards (WD AGO Form 308-1), Officers' Qualification Cards (WD AGO Form 367), Enlistment Cards (WD AGO Form 372), Enlisted Separation Cards (WD AGO Forms 0363-1, 363-2, and 363-3). Other cards served other purposes. Accident Cards compiled data about Motor Pool drivers to generate statistics concerning soldiers' driving habits. Language Cards kept track of personnel fluent in foreign languages.

"MRUs also handled all of the casualty reporting during World War II. By preparing casualty punch cards, and transmitting them by air courier to The Adjutant General, MRUs made possible the notification of next of kin with unprecedented speed. These same casualty punch cards were used in compiling overall battle casualty reports, and in preparing a comprehensive round-up of World War II Honor Dead and Missing by state and county of residence."⁵

TYPE	STATION	TYPE ORG.	ORG UNIT	PARENT UNIT	SPEC.	GRADE	UNIT	DATE	SERIAL NUMBER	NAME
71	8026	4-0	HQ23	00003				26052	0-002605	PATTO
REPORT OF CHANGE (FOR INDIVIDUAL OR UNIT)										
0-2605				Laj Gds		USA		<input checked="" type="checkbox"/> BASIC STATUS		
PATTON				GEORGE		S Jr		<input type="checkbox"/> ATTACHED		
HQ I ARMORED CORPS				HQ I ARMORED CORPS		33		<input checked="" type="checkbox"/> DUTY OR OTHER STATUS AT TIME OF THIS CHANGE		
HQ I ARMORED CORPS				CAMP YOUNG APO 351 INDIO CALIF				<input checked="" type="checkbox"/> OTHER (SPECIFY): Lv to DS		
REPORT FOR THE TWENTY-FOUR HOURS ENDING AT 11:58 P.M.				MAY		2		<input type="checkbox"/> DESCRIPTION OF CHANGE		
DAY 26				MAY		1942		<input type="checkbox"/> No change in duty		
								AUTHENTICATING OFFICER ALBERT A. LINDQUIST Captain		
								<small>WD AGO Form No. 301, 11-1, 1941 - PUNCH CARD</small>		

The image shows two IBM punch cards. The top card is an Officer's Separation Card (WD AGO Form 0387-1) for General George S. Patton, Jr. It contains a grid of numbers and characters, including his name, rank (Brig Gen), and unit (Headquarters 2d Armored Division). The bottom card is a Report of Change (WD AGO Form 0387-1) for the same officer, dated March 11, 1946. It includes a 'Corrected Report E' stamp and the signature of R. A. Risden, Capt. Inf Antg, Asst Adj Gen.

Special reports were generated quickly and efficiently. The June 1946 integration of officers into the Regular Army was typical. A 10,000 name nomination list had to be submitted to the Senate by the President before Congress recessed in June 1946. The list was delivered for the President's signature within a 36-hour deadline.

Just Another Number:

To a punch card machine people were nothing more than electrically generated impulses--sets of numbers and characters. There were no exemptions. General George S. Patton, Jr. was nothing more than the letters P-ATTON (coded 11-7, 12-1, 0-3, 0-3, 11-6, 11-5) or his service number O-002605. The Library of Congress' Patton Papers Collection contains punch cards from the General's 201 File constructing a paper trail of Patton's World War II assignments, promotions, and activity. Patton's final Officer's Separation Card (WD AGO Form 0387-1) tells a story to anyone fluent in card code: It is the last IBM card ever processed for General Patton.

Column----Code-----Meaning

- 61-62-----21-----21st day of the month
- 63-----K-----December
- 64-65-----45-----Year, 1945
- 66-67-----11-----Duty to death

Grace M. Hopper, a naval lieutenant in the 1940s, was a chief architect of COBOL in the late 1950s. Admiral Hopper (deceased) is a legend in the computer science field. She is remembered for coining the term "Bug." When ENIAC-the giant electronic brain-suffered a system crash, an operator extracted an electrocuted moth between two vacuum tubes. Grace taped the dead insect into the daily log with the note, "There was a bug in the system."

Nothing New Under The Sun:

General Patton's 1926 essay "**Success In War**" states, "There is nothing new under the sun. The infantryman and the hoplite are for all purposes the same, with exception to the weapons used by them."⁶ The same holds true for virtually any profession, including data processing. Computers are thought to be vastly different from punch card systems, and they are-technologically. The procedures and processes used by modern computers are much the same as those in the old punch card systems:

- 1) Where keypunchers punched data into cards, bar codes and point-of-sale machines now enter data directly into computer files.
- 2) Where sorters sequenced cards, sort programs now do it electronically.
- 3) Where collators merged, matched, and selected cards, programs now do it with electricity.
- 4) Where tabulators accumulated and printed information from cards, programs now send electronic information to laser printers and graphical color output.
- 5) There is nothing new in the methods, procedures, and processes of personnel and material accounting-only the technology used to perform the task.

Source Notes & Bibliography

1. Claffey, William J., Principles of Data Processing. Dickenson Publishing Co., 1968.
2. Donges, Colonel Norman A., How the Army Knows its Strength. Army Information Digest, Vol. 3, No. 7, July 1948, pp 65-69.
3. Frank, Jay., Machine Records Unit-U. S. Army; Statistics Take to the Battlefield. Army Life Magazine, October 1942, Vol. XXIV, No. 10.
4. Province, Charles M., Personal Experiences in an MRU. Unpublished.
5. Donges, How the Army Knows its Strength.
6. Province, Charles M., The Unknown Patton. Hippocrene, 1983.

[Return to Headquarters](#)