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THREE-LANGUAGE IDEOGRAPHIC COMPOSING MACHINE

Interim Report

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ARMY MATERIEL COMMAND

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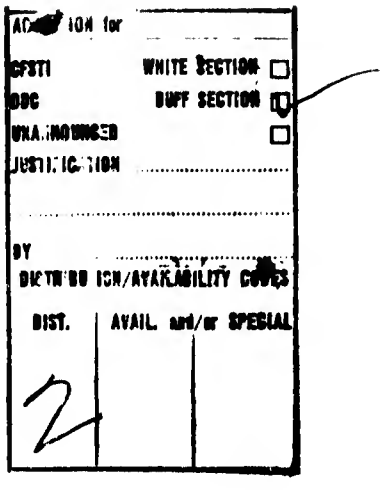
SUMMARY

This report covers the development of a 3-language ideographic photo-composing machine with a vocabulary of 9,615 ideographs. Tests of it are underway at Fort Lee, Virginia.

RELATED TIR'S

11-67	TIR 27.1.5(2)	Weapons and Other Equipment for Unconventional Warfare (AMC)
8-67	TIR 27.1.5.1	Weapons and Other Equipment for Unconventional Warfare (LWL)



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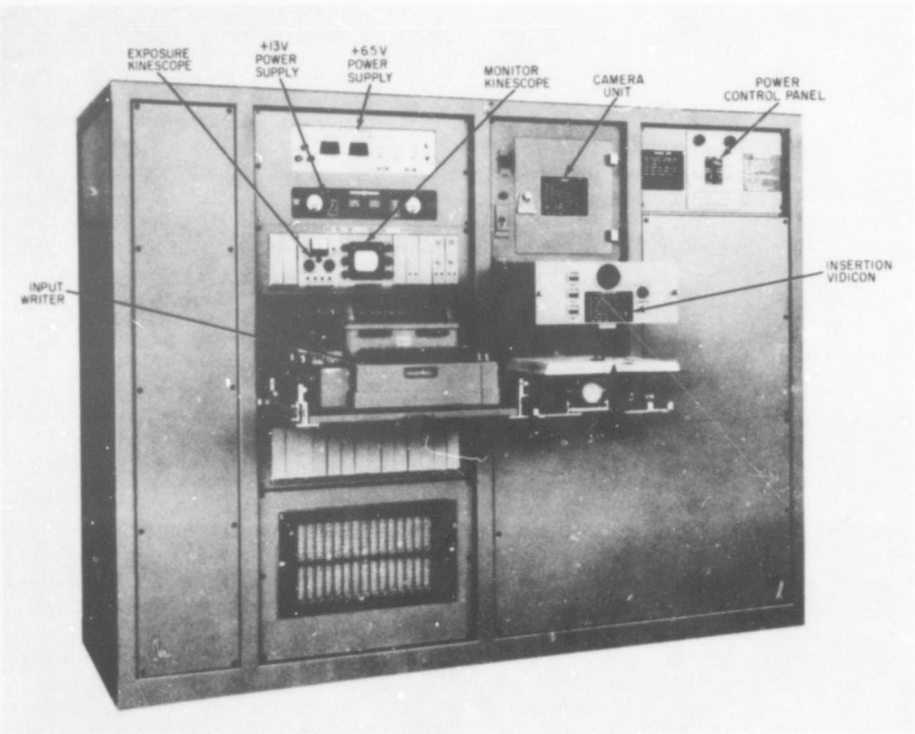
THREE-LANGUAGE IDEOGRAPHIC COMPOSING MACHINE

A. Purpose

The 3-language ideographic composing machine (3-LICM), with a vocabulary of 9,615 characters, is designed to compose Chinese, North Korean, and Japanese ideographs in page format from a keyboard or punched-tape input. It permits the Army to write and publish in the field printed matter of all kinds in these languages. The output of the 3-LICM is a 5-inch-wide film strip containing Chinese, North Korean, or Japanese characters, composed in any one of four type sizes: 12, 18, 24, and 30 points. The characters may be composed either in the classical style, top to bottom and right to left, or in the modern style, left to right and top to bottom. The 3-LICM is 78 inches long, 29 inches deep, and 60 inches high, and weighs 2,400 pounds.

B. Background

The machine contributes to the Army's ability to print propaganda leaflets, orientation literature, and a wide variety of other printed material in all languages having an alphabet or a written form. At present the Army can print in more than fifty languages, and studies now being made will probably add eight Indian and six African languages to the list. The development of equipment and the means for the preparation of copy in Chinese, North Korean, and Japanese, however, was until recently considered impossible, since these languages have no conventional alphabet and rely upon pictorial-form characters (ideographs) for written expression. The number of existing Chinese ideographs has never been accurately established, and estimates up to several hundreds of thousands are not uncommon. On the other hand, studies have shown that the bulk of existing characters are archaic and that 8,000 to 9,000 of those most commonly used are adequate for almost all military purposes. The problem of producing such a mass of ideographs in the field resolved itself into a choice between having copy prepared by skilled calligraphers using the ancient brush, ink, and stroke method, and that of hand setting lead type. The first choice had to be eliminated because there were no calligraphers in the Army, and handwritten ideographs would offend the sensibilities of Orientals, who are intensely proud of the beauty of form of their hand-brushed characters. Such reader reaction would certainly compromise the effectiveness of the printed material distributed to them. On the basis of metal weight, provisions for meltdown, and the handling required, the second method was also considered unacceptable.



FRONT VIEW OF
3-LANGUAGE IDEOGRAPHIC COMPOSING MACHINE

The present machine had it origin in a 1953-54 study of the Chinese language to determine the feasibility of developing a machine that would economically and effectively compose Chinese ideographs in the field. This study brought three important factors to light. They were: that all ideographs are constructed, or "spelled," by using a limited number of basic strokes; that for each ideograph the sequence of the strokes building it seldom changes; and that, with relatively few exceptions, the individual strokes are always made in precisely the same way. The Army reviewed the results of the study, concluded that development of a Chinese ideographic photocomposing machine was feasible, and recommended construction of such a machine. On 8 June 1955 a joint Army and Air Force contract was awarded for the development of a prototype machine.

This prototype, the Sinotype, which was later to confirm the feasibility of the basic concept, was delivered in December 1959. The Sinotype had a basic vocabulary of 2,333 ideographs and was of an electric-pneumatic-mechanical design. It proved to be quite slow in operation, too sensitive to the shocks of field use, and difficult to maintain. For these reasons it was not given any formal tests.

The project was delayed by a lack of funds until May 1961. On 29 December 1961 a contract for the construction of a new machine was awarded. This contract required that the machine be developed in two phases and that the first phase have two subphases. The first subphase of phase one required the development of a prototype machine with the basic vocabulary of its predecessor, the Sinotype, that would be expandable without major changes in the design or structure of the machine to a vocabulary of not less than 6,000 ideographs. The second subphase was designed to expand and refine the basic elements of the project. It required an extensive study of the Chinese language to determine the additional ideographs to be incorporated in a new prototype, the stroking sequence, and other practical details.

On 5 January 1962, while this study was in progress, the US Continental Army Command (USCONARC) approved the military characteristics (MC's) for an ICM. Based on these MC's, the study was expanded in May 1963 to include simplified Chinese ideographs as well as ideographs of the North Korean and Japanese languages. The MC's reviewed the background of the developmental effort and described a machine, with a vocabulary consisting of the 6,000 Chinese ideographs most used in newspaper and leaflet composition, that would be capable of composing in at least 10-, 12-, 18-, and 24-point sizes. It was to accept 600 strokes per minute and was to compose from top to bottom and right to left as well as from left to right and top to bottom. All the functions of the machine were to be controllable by the operator from one position. It was to utilize a standard teletypewriter, punched paper, and a code. It was to photograph and reproduce images of the ideographs selected, preferably by using dry-process techniques. The selected ideographs were to be displayed to the operator in a form sufficiently enlarged to permit easy observation from the operating position and acceptance or rejection before any photographic process was set in motion. Also, during composition it was to permit the use of additional ideographs not included in the machine vocabulary. The film magazine, or reproduction material, was to be easy to place into, or remove from, the machine under conditions of ambient light. The machine was to be not more than 66 inches wide, 29 inches deep, and 60 inches high. It was to weigh no more than 1,800 pounds (preferably no more than 1,200) and was to operate from a 120-volt, 60-cycle, single-phase power source. It was to be mountable and operable in a standard shelter and to be transportable, together with a towed power generator, over unimproved roads and open country in a 2 1/2-ton truck and on the external cargo-carrying gear of helicopters. With the shelter temperature held between 40° and 90° F by heating or air conditioning, it was to be capable of sustained operation under all climatic conditions. It was to be fungus-proof and corrosion-proof and

to be minimally susceptible to contamination by chemical, bacteriological, and radiological agents. Maintenance was to be simple, and the maintenance kit was to be a self-contained unit of the machine and shelter group. Five thousand hours of operation without major maintenance or overhaul were required. The machine was to use military standard, 5-inch roll film not to exceed 50 feet in length and was to include a device indicating the amount of unexposed film remaining in the magazine.

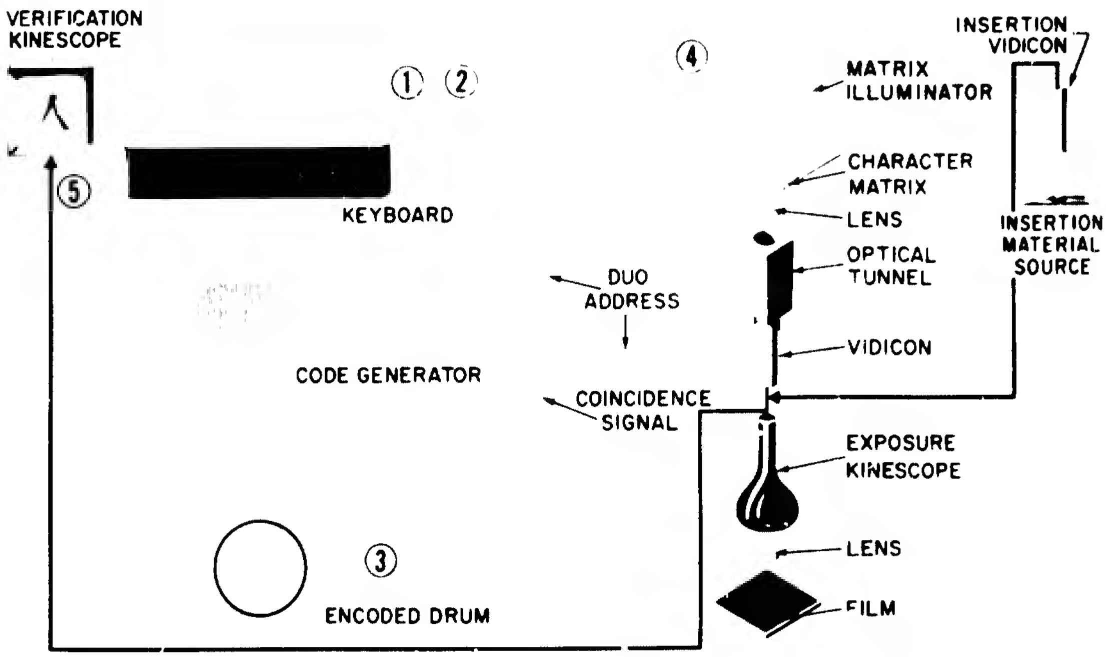
Efforts to execute the parts of the study concerned with the North Korean and Japanese languages developed so little information up to December 1963 that no decision as to the feasibility of including these two languages in the new machine could be reached. Therefore, development of the machine proceeded as an exclusively Chinese ideographic composing machine.

Phase two of the contract required the construction of two additional machines, each having a vocabulary of not less than 6,000 ideographs, with provisions for a vocabulary of 8,000 and 2,000 spaces for ideographs having several widely acceptable stroking sequences. In October 1963 the prototype developed under subphase one of phase one of the 29 December 1961 contract was delivered to the US Army Natick Laboratories (USANL), where it was installed in a standard S-141 electrical equipment shelter before being shipped to the US Army General Equipment Test Activity (USAGETA) at Fort Lee, Virginia, for engineering design tests. Delivery of the prototype called for under phase two of the contract was made in August 1965.

The phase one protoype, which has been tested by USAGETA at Fort Lee, has a vocabulary of 2,500 ideographs, the 2,333 of the Sinotype having been enlarged to that number. Expansion of this vocabulary to 10,000 ideographs in 10-, 12-, 18-, and 24-point sizes was considered feasible. On the other hand, tests have shown that modifications of the machine were desirable, and it was decided to include them in a more simply operated machine having a normal capacity of approximately 10,000 ideographs in 12-, 18-, 24-, and 30-point sizes.

Study had revealed that the Chinese language does have an "alphabet" in the sense that all Chinese characters are written by selecting strokes from a relatively small number (21) of basic strokes. In addition, the student of Chinese is instructed to form ideographs by using definite stroking sequences.

Essentially, every student of Chinese, North Korean, or Japanese learns to write each character by using exactly the same strokes in exactly the same sequence. The 3-LICM takes advantage of two established facts, the existence of Chinese, North Korean, and Japanese "alphabets" and that of a unique sequence of strokes, to provide a keyboard for composing Chinese, North Korean, and Japanese texts. The machine can be operated by anyone who has learned to write Chinese, North Korean, or Japanese. The characters in all three languages, in general, are complex in structure and difficult to construct correctly. Although complete characters are formed from a limited number of basic brush



1. CHARACTER STROKES MADE IN SEQUENCE ON KEYBOARD

   ① ② ③ ④ CHARACTER

2. KEYBOARD GENERATES CODE

   000001 101010 101001 100001

3. CODE MATCHED WITH ENCODED DRUM
4. COINCIDENCE ENERGIZES LIGHT SOURCE BEHIND PROPER CHARACTER ON MATRIX
5. CHARACTER VERIFIED - PHOTOGRAPHED OR REJECTED

SCHEMATIC OF 3-LANGUAGE IDEOGRAPHIC COMPOSING MACHINE

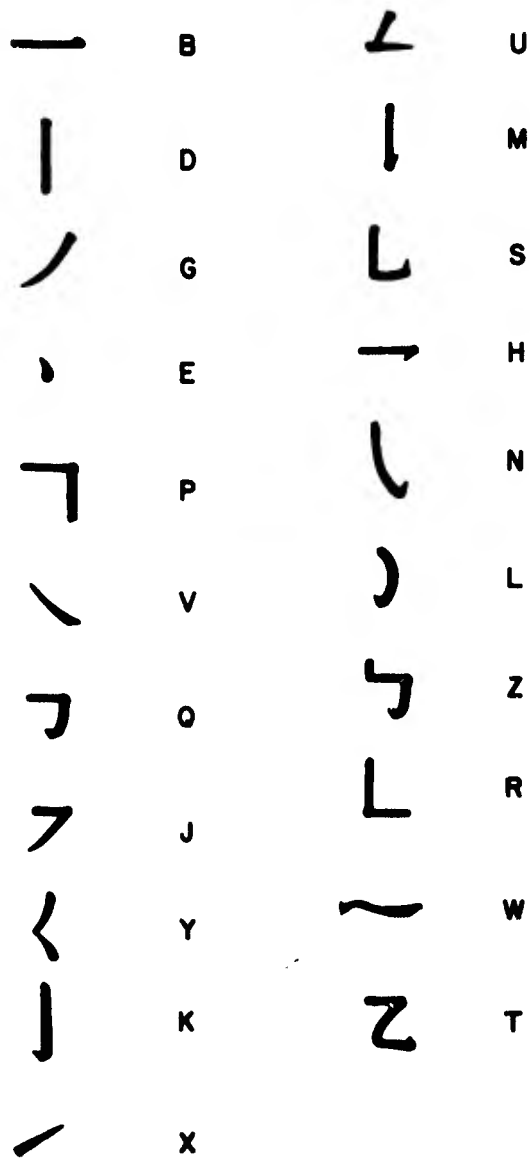
strokes, within an area occupied by a character a given stroke can appear almost anywhere with wide variations in its dimensions. The addition of purely Japanese symbols to Japanese-language ideographs taken from the Chinese compounds the difficulty of three-language composition. It is this complex structure that

precludes composition of three-language characters by conventional keyboard techniques and tends to restrict the scope of a machine such as the 3-LICM. Hence, the successful composition of texts requires the use of preformed characters of one kind or another.

C. Current Development

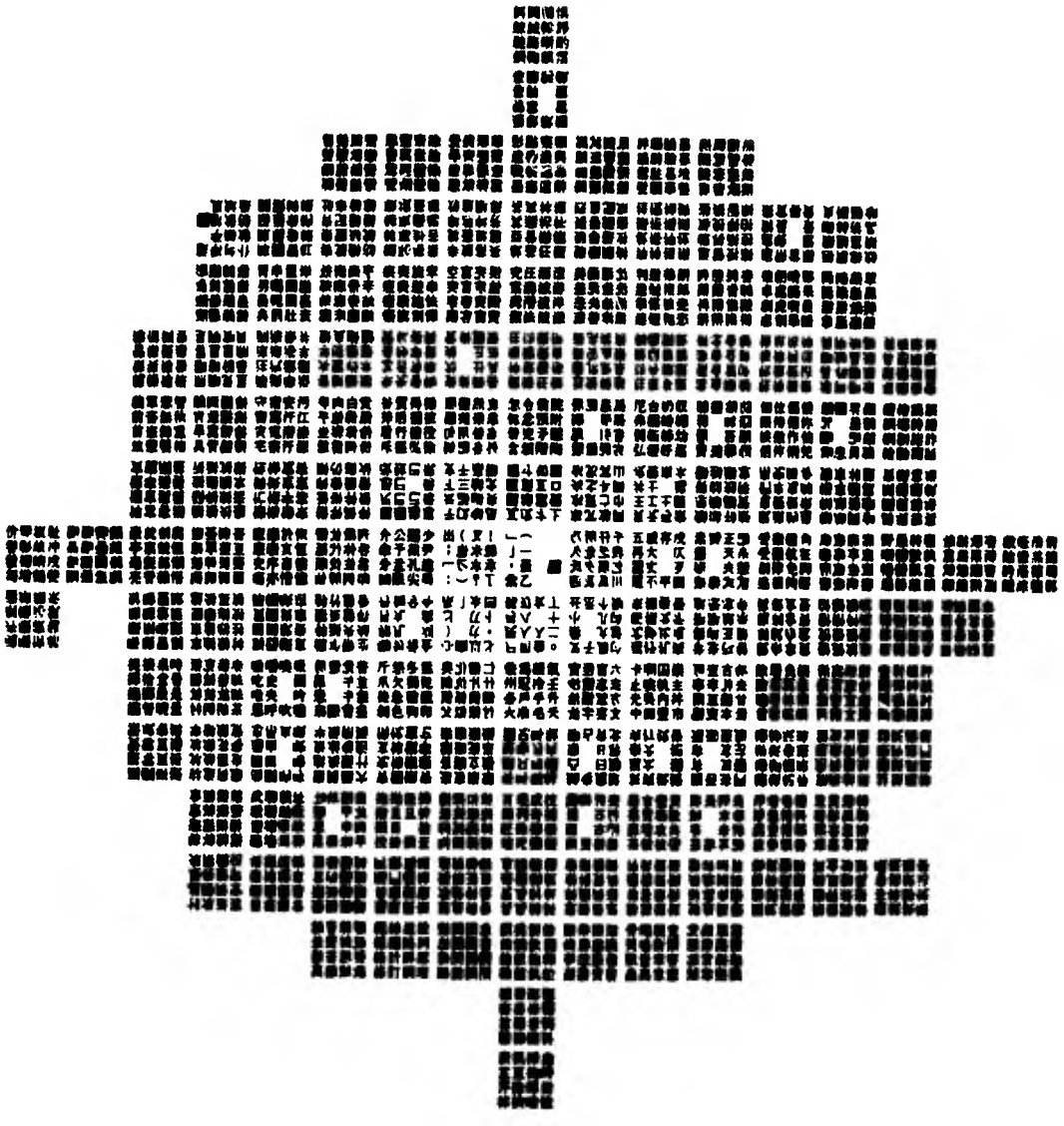
Concurrent with the development of the Chinese ideographic composing machine, the effort to devise a three-language machine to compose in Chinese, North Korean, and Japanese continued. By the end of 1965 a contract for the manufacture of such a machine with a vocabulary of 9,615 characters was awarded, and the machine was delivered to the Army in April 1967.

Conversion of the Chinese ideographic composing machine to one composing in three languages required the addition of the Japanese Katakana and Hiragana (Kana) "alphabetical" symbols. This language, unlike North Korean, which can be composed by using Chinese strokes alone, requires the use of the two types of symbols mentioned, in addition to Japanese ideographs built up by means of the Chinese stroking system. Although both types of Japanese symbols are commonly lumped together under one reference, Kana, they are two separate sets of symbols on the keyboard of the input writer.



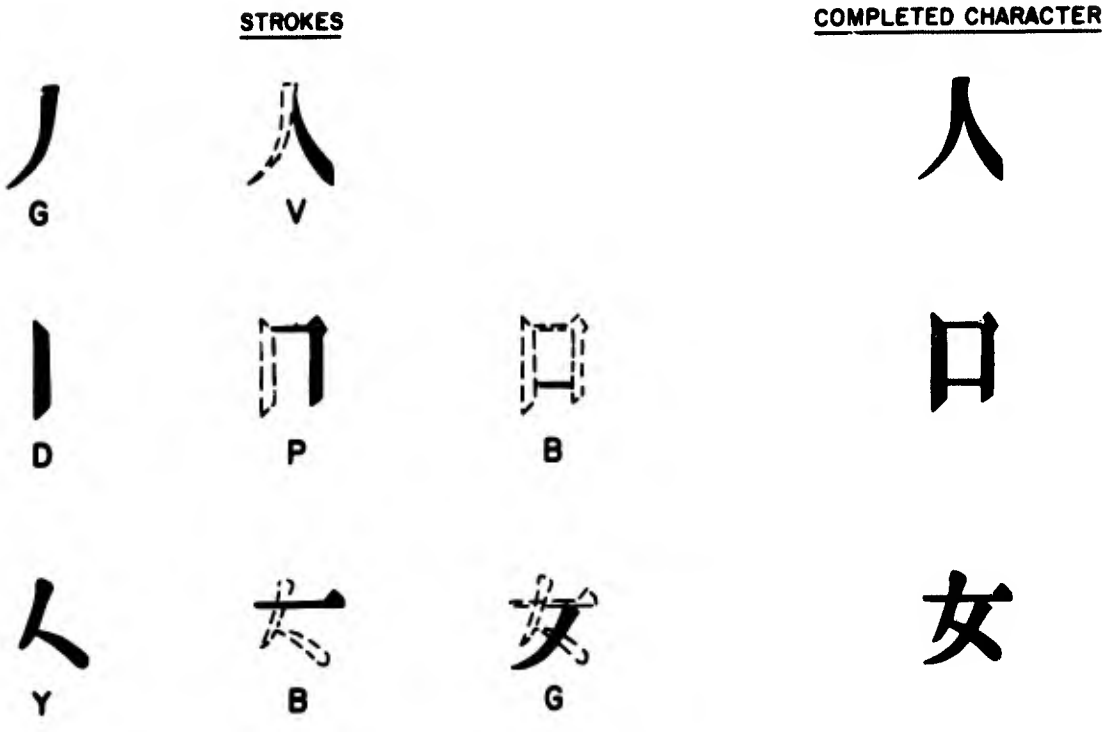
BASIC STROKES AND ENGLISH-LANGUAGE CODE EQUIVALENTS

The modifications made in the original machine affected the input writer, logic system, and optical system. The input writer has square block keys which now have from 2 to 4 alphabetically equivalent Katakana and Hiragana symbols on the forward face of each of 33 keys. No change has been made in the Chinese strokes, entities, punctuation marks, and operational indicators already on the top surfaces of the keys. The English-language code equivalent to each



TYPICAL CHARACTER MASK

Chinese stroke is on the right-hand-side surface of that key. Also, the input writer now has to the right of the keyboard a three-way toggle switch. This is the means whereby modes are switched from Chinese stroke to Katakana or Hiragana symbols in any order or sequence required for composition in any of three languages.



TYPICAL STROKING SEQUENCES

The bit codes for each key were retained so that when the machine is operated for composition in Chinese or North Korean it is compatible for this type of operation. On the other hand, advantage was taken of a sixth bit code not used in Chinese and North Korean composition to provide the code expansion required to incorporate all types of Japanese characters.

Major modifications were made in the input logic and minor ones in the shift register and coincidence detector. These modifications required the addition of seven logic boards. Specifically, in addition to performing all the functions required of it to compose in Chinese and North Korean, the input writer logic includes the mode switching logic needed to shift the operation from Chinese or North Korean to the Japanese symbols mentioned above. A coder for generating bit-code information for the paper tape punch, a decoder for identifying the mode of operation for reading the paper tape, and the logic needed to incorporate such a bit code from the input writer into the system were also necessary.

When composing in Chinese or North Korean, the shift register performs in a normal manner, but for Japanese Kana composition the first 17 channels are

disabled and the character bit codes are inserted directly into the last 11 bit locations. The coincidence detector has been modified so that tracks 90 through 100 are fed into a common and-gate. This provides a control point for these ten tracks "on" and "off," depending upon the mode of operation chosen.

The character mask for the three-language machine is new. It has groups of up to 16 characters and ten more lamp positions than its predecessor. Nine hundred ninety-nine Chinese characters of marginal importance were dropped from the machine memory. They were replaced by 676 other Chinese characters usable in the composition of North Korean texts, and by 152 Japanese Kana characters. As a result of these changes, the total number of characters in the machine memory now is 9,615, including punctuation marks. In addition, a relay was added to switch the "spiral 17" input to the diode boards from the Chinese and North Korean to the Japanese character lamps and vice versa.

D. Basic Principles

The main input to the three-language machine is derived from the keyboard containing the 21 fundamental strokes from which all Chinese, North Korean, and Japanese ideographs can be composed, as well as some complete ideographs, functional instructions, and complete sets of Japanese Katakana and Hiragana symbols. Additional keys are provided to insert commonly used groups of strokes. As an auxiliary function, the input also can be generated from paper tape, and provisions are made for punching the paper tape from the keyboard.

In addition to the 21 basic strokes, there are a number of groups of strokes that do not necessarily have meanings. They occur frequently, however, during the buildup of characters. These are somewhat similar to English syllables, such as "ing," "tion," and "ous." In the Chinese mode these groups are designated entities and there are 28 of them on the keyboard. In the Japanese mode there are 52 each of the Katakana and Hiragana entities or complete symbols. The operator composing in Chinese or North Korean has the option of using entity keys to reduce the number of strokes required to form a character or of spelling out all the strokes. A skilled operator can save time by using the entity keys. This ability will probably be modified somewhat by the requirement of the Japanese mode for a combination of Chinese-type ideographs and purely Japanese symbols.

It has been shown that a Chinese character can be cataloged and uniquely identified by its strokes and stroking sequence. For the great majority of characters, the stroking sequence is sufficient identification. There is a special situation, however, wherein a given stroking sequence leads to two or more different characters. These characters are identified as ambiguous characters and require special treatment in the operation of the machine if a desired character is to be composed. Such characters do not complicate, and in some cases may be normal to, composition in North Korean or Japanese when Chinese ideographs are used.

Japanese Alphabets

Katakana

a	i	u	e	o
ア	イ	ウ	エ	オ
ka	ki	ku	ke	ko
カ	キ	ク	ケ	コ
sa	shi	su	se	so
サ	シ	ス	セ	ソ
ta	chi	tsu	te	to
タ	チ	ツ	テ	ト
na	ni	nu	ne	no
ナ	ニ	ヌ	ネ	ノ
ha	hi	hu	he	ho
ハ	ヒ	フ	ヘ	ホ
ma	mi	mu	me	mo
マ	ミ	ム	メ	モ
ya	yi	yu	ye	yo
ヤ	イ	ユ	エ	ヨ
ra	ri	ru	re	ro
ラ	リ	ル	レ	ロ
wa	yi	u	ye	wo
ワ	井	ウ	工	ヲ
un				
ン				

Hiragana

a	i	u	e	o
あ	い	う	え	お
ka	ki	ku	ke	ko
か	き	く	け	こ
sa	shi	su	se	so
さ	し	す	せ	そ
ta	chi	tsu	te	to
た	ち	つ	て	と
na	ni	nu	ne	no
な	に	ぬ	ね	の
ha	hi	hu	he	ho
は	ひ	ふ	へ	ほ
ma	mi	mu	me	mo
ま	み	む	め	も
ya	yi	yu	ye	yo
や	い	ゆ	え	よ
ra	ri	ru	re	ro
ら	り	る	れ	ろ
wa	yi	u	ye	wo
わ	ゐ	う	ゑ	を
un				
ん				

sound change symbols

JAPANESE KATAKANA AND HIRAGANA (KANA) ALPHABETS

E. Components and Functions

The power unit is 17 inches wide, 14.875 inches deep, and 5.25 inches high, and weighs 45 pounds. Input voltage to the machine is 105-120 AC, and current, 8 amperes. By means of converters and transistors DC voltages of 6.5, 13, 19.5, 28, 500, and 2,500 are made available for various phases of the machine's operation. Tests indicate that commercial power available at Fort Lee is unreliable. Therefore, the tests currently in progress at Fort Lee are powered by a standard Army 30-kw generator.

The machine consists of seven basic system components, an input typewriter, a tape punch and tape reader, a logic system, a magnetic drum memory system, a character mask and lamp system, an optical system, a video system, a camera unit, and an insertion vidicon camera.

The input writer is essentially a specialized typewriter. The keyboard contains keys representing the strokes used to form the Chinese characters, both Katakana and Hiragana Japanese symbols, an English-language code equivalent for each stroke, and keys for the operational functions required to place the characters in their proper position in the text. The primary function of the input writer is to generate a code that represents the information entered on the keyboard by the operator in a form that can be processed by the logic system.

Associated with the input writer is a tape punch and a tape reader. The punch can be used to record on paper tape the operations performed on the keyboard. The tape reader can then be used to play the tape back for automatic composition. As a monitor feature, a hard-copy print-out of the typed strokes can also be obtained.

The logic system accepts information from the keyboard and processes it to generate one of two classes of output: address information and functional information. In the first case, stroke or symbol information is stored in the logic system and is compared with a drum memory to determine whether the information defines a character contained in the machine vocabulary. If the character is contained in the machine vocabulary, the logic system generates information addressed to the optical and video systems, whereby they select the desired character from a photographic memory plate (character mask) and display it to the operator. If functional information for operations, such as line shift, space shift, etc, is presented, the logic system recognizes this fact and generates the proper control signals to perform the indicated function.

The magnetic drum memory associated with the logic system is a rotating magnetic drum with 102 active information storage tracks and 2 timing tracks. Each of the information tracks has a capacity of 10,000 bits. Consequently, the drum can store 1.02×10^6 (1,020,000) bits. The drum rotates at 600 rpm. At this rate the complete memory is scanned once every 0.1 second.

The optical system uses an optical tunnel and imaging lens to transfer a replica of the character selected by an operator and located by the logic system from the photographic memory plate to the input of the video system. The photographic memory plates contain all the characters in the system arranged in 635 groups of up to 16 characters each.

The video system selects the proper character from a group presented at its input, electronically scans it, and presents it to the operator for verification. Upon command of the operator, it then generates a shutter image on a second display in the camera unit.

The camera unit consists of a lighttight box, a film transport, a multiple lens system, and an exposure kinescope. A character generated on the exposure kinescope is imaged by the lens system onto photographic film. The film is positioned to receive the character by the action of the film transport.

The insertion vidicon camera allows the insertion of characters not contained in the machine vocabulary. It is a television camera that picks up information inserted in its field of view and injects this information into the video system when instructed to do so. The insertion camera is fitted with a lens system that allows the size of the inserted character to be varied.

F. Systems and Operation

In terms of the functions performed, the 3-LICM can be divided into four systems, as follows:

1. Special-purpose logic system, containing the input keyboard and the magnetic drum memory
2. Optical system
3. Video system
4. Camera unit

Input information is generated by the keyboard or paper tape in one of four different forms: stroke information; entity (or phase) information, which includes Katakana and Hiragana symbols; punctuation; and operational information (line shift, space shift, erase, photograph).

The first function of the logic system is to decide which of the four classes of information it has received. If the information is stroke information, it is stored in a register. This information is then compared with information permanently stored on a rotating magnetic drum to define the character entered on the keyboard. The drum stores 9,615 character representations. The characters are represented by binary codes, which define the stroking sequence. The codes are 100 bits long and are stored across the drum. Each stroke requires 5 bits; consequently, up to 20 strokes may be used to define a character.

A sixth bit expands the code, thus making possible the incorporation of Japanese symbols. Each symbol is an entity and therefore requires the key containing it to be struck only once. The 9,615 character representations are spaced uniformly around the periphery of the drum. When coincidence is noted between the character code inserted by the keyboard and an identical code stored on the drum, the position of the drum at the time of coincidence is then used to locate the position occupied by the desired character on a photographic plate.

If the information generated by the keyboard is an entity, Chinese ideographic or Japanese symbol, the logic system enters it in the storage shift register. The coincidence operation is then performed. Punctuation information from the keyboard is treated in much the same manner. In this case, however, a unique two-bit code designating a punctuation mark is automatically placed in the storage shift register. Operational information is received by the logic system and processed to generate the proper control signals at the logic system output.

When the system is performing a character-selection operation, the output of the logic system is information indicating the position of the desired character on the photographic plate. This information is used to address a lamp bank and a selectively scanning television camera. The lamp-bank-address information is used to light a lamp that illuminates a group of up to 16 characters containing the desired character. The selected group of characters is imaged onto the face of a vidicon (a television camera tube). The vidicon face is then selectively scanned to pick the proper character from the group. The position of the scanned segment of the vidicon face is controlled by the logic system.

The output of the vidicon is processed and used to drive a display whereby the operator verifies the correctness of the selected character. If the character displayed is the one desired by the operator, he depresses the PHOTOGRAPH bar on the keyboard. The operation of this bar shutters a display similar to the one presented to the operator. The shuttering action exposes film and thus produces the output copy.

The film is carried on a transport in the camera unit. When the exposure operation is completed, the film transport is automatically advanced so that it is positioned to place the next character photographed in its proper location in the text being composed. This photographic operation also clears the logic system, placing the machine in readiness to receive the next character.

The 3-LICM has several auxiliary features that simplify its operation. One such feature allows for the insertion of additional characters from an external source if the particular characters are not in the system's vocabulary. A second camera is provided for this purpose. It is fitted with a lens system that images a document containing the desired character on the face of a second vidicon. The size of the character is controlled by monitoring the display and adjusting the magnification of the lens system to produce a displayed character of the same size as those drawn from the machine's memory. When the size has

been set, the inserted character can be placed in the text in its proper position by stroking the PHOTOGRAPH key on the keyboard.

A minimum spelling feature is also incorporated in the system. With this feature, only those strokes needed to uniquely define the character are entered on the keyboard. For example, if a character composed of 20 strokes is desired but only 5 strokes are required to distinguish the character from the characters remaining in the machine vocabulary, it is necessary to enter only the 5 significant strokes on the keyboard. After entering the fifth stroke, the keyboard locks, indicating that the character has been defined. This character is then displayed on the monitor. If the displayed character is the desired character, even though the stroking sequence has not been completed, the operator is free to perform the photographing operation. If the character presented on the display is not the one desired, the character being sought is not in the machine vocabulary. It is therefore useless for the operator to continue typing.

Whenever the operator strokes the code for a shorter character while typing a complex character, the 3-LICM recognizes the shorter character code and displays it immediately on the monitor. Since the stroked code does not define a unique character, however, the keyboard does not lock, and the operator can continue stroking the sequence for the desired character. The machine continues to display the shorter character until the stroking sequence identifies the desired character. When this happens, the machine recognizes the desired character and replaces the shorter character with it for verification. When the PHOTOGRAPH bar is depressed, only the character last displayed is photographed.

A condition opposite to that of minimum spelling sometimes occurs and this requires special consideration by the operator. It happens when a given sequence represents more than one unique character. In such cases, when the operator strokes the sequence for one of these ambiguous characters, all characters with that stroking sequence are displayed simultaneously on the kinescope for the operator's inspection. The verification kinescope can show a maximum of four such characters. The operator then selects the desired character by depressing the key that denotes the position of the desired character as seen on the verification kinescope. When the proper key is selected and punched, the group of ambiguous characters is removed from the verification kinescope and replaced by the desired character, which can then be photographed.

As noted in the preceding paragraphs, the desired character is recognized through use of the stroking sequence from the keyboard. The strokes and the sequence of strokes on the keyboard are representative of the handwritten format of the Chinese characters desired. The character displayed on the display kinescope, however, is in printed form. This approach was taken to facilitate stroking by any operator familiar with composing Chinese characters in written form.

Also, each of the 21 basic Chinese strokes is assigned a code letter of the English alphabet. One advantage of the English alphabet is that it allows identification of strokes, so that a sequence of strokes can be written as a sequence of

letters. The feature is very useful for cataloging purposes as well as for precoding the Chinese characters to permit operation of the machine by personnel not acquainted with the Chinese language. In addition, the actual hard copy from the keyboard is printed by using the English letters representing the strokes. No such coding is provided for Japanese Katakana and Hiragana symbols.

G. Current Status

The 3-LICM was delivered to the Army in April 1967 and is now undergoing engineering tests by USAGETA at Fort Lee, Virginia. Its immediate predecessor, the Chinese ideographic composing machine, has already been tested extensively by this facility. The current test series will determine the functional quality, power adequacy, mobility, and other characteristics of the new machine.

TENTATIVE PRINCIPAL CHARACTERISTICS

Type	electronic photocomposing machine
Length	78 in
Depth	29 in
Height	60 in
Weight	2,400 lb
Power	
Amperes	25
Volts	120, AC
Cycles	60
Phase	single
Conversions	6.5, 13, 19.5, 28, 500, 2500 v DC
Input typewriter	
Languages	Chinese and North Korean, coded for English; Japanese
Basic strokes	21
Chinese ideographic entities	28
Japanese symbols	52
Punctuation marks	11
Stroke capacity	600 per min
Type sizes	12, 18, 24, and 30 points
Logic system, type	electronic system-wide memory and command
Magnetic drum memory	
Type	electronic
Storage tracks	102
Timing tracks	2
Storage capacity	1,020,000 bits
Rotation rate	600 rpm
Scanning rate	10 per sec

Optical system, type	tunnel and imaging lens
Character matrix	
Type	photographic plate
Characters	
Number per group	16 (approx)
Number of groups	635
Number available	10,000
Capacity of machine	10,000
Number used	9,615
Video system, type	dual, closed circuit
Camera, type	multiple lens
Insertion vidicon, lens	adjustable

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13. ABSTRACT

This Technical Information Report details the development of a photocomposing machine for Chinese, North Korean, and Japanese ideographic characters for the preparation of printed propaganda, orientation literature, and other materials. This development was found feasible in 1954 when studies revealed constants in the composition of Chinese ideographs. By the use of advanced concepts of electric circuitry, video, and photography, a practical electronic Chinese ideographic photocomposing machine was developed. An early prototype had a vocabulary of 2,500 ideographs, and the machine's capacity could be expanded to 10,000 ideographs. The current version of the machine permits composing in Chinese, North Korean, and Japanese by using a vocabulary of 9,615 ideographs. It operates at 600 strokes per minute. Provision is made for kinescopic verification of characters, precomposed ideographs (entities), and ambiguous characters. The machine is 78 inches long, 29 inches deep, and 60 inches high. It weighs 2,400 pounds, is operated in an air-conditioned permanent or semipermanent building, and is transportable in an overseas shipping crate by truck or helicopter. Tests are now underway at Fort Lee, Virginia.

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