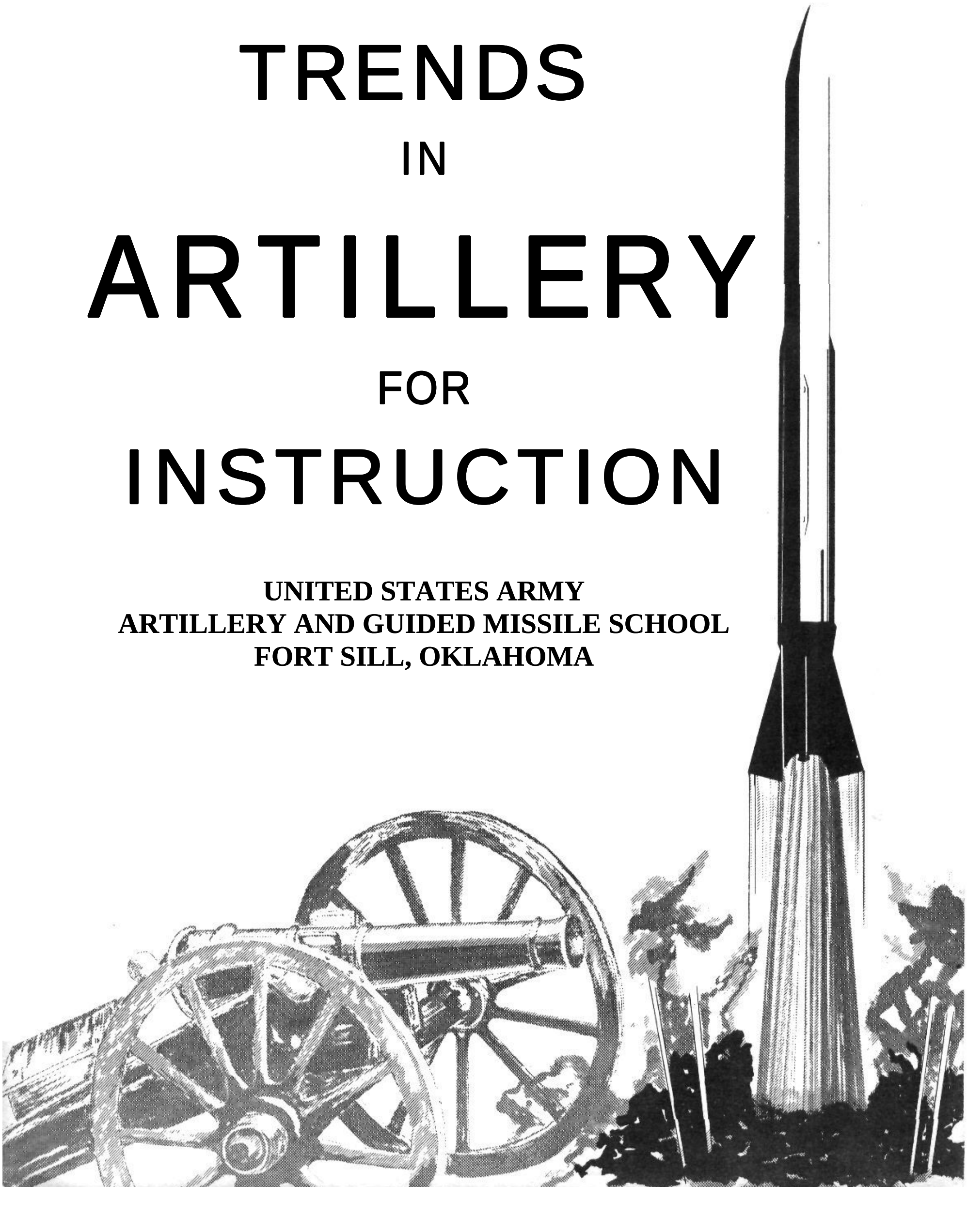
Tactical and Technical

TRENDS IN ARTILLERY FOR INSTRUCTION



UNITED STATES ARMY
ARTILLERY AND GUIDED MISSILE SCHOOL
FORT SILL, OKLAHOMA

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19 June 1957

The Tactical and Technical Trends in Artillery for Instruction is a Nonresident Training Aid. It is designed to provide Artillery personnel with tactical and technical data peculiar to field artillery. It will serve to keep Artillery personnel abreast of the most recent developments in field artillery. Suggestions for additional material are especially invited from the field. Correspondence concerning the publication should be addressed to the Assistant Commandant, U.S. Army Artillery and Guided Missile School, Fort Sill, Oklahoma, ATTN: Director, Department of Publications and Nonresident Training.

T. E. de Shazo

T.E. de SHA ZO
Major General, USA
Commandant

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This training aid is for use by the Department of Publications and Nonresident Training, U.S. Army Artillery and Guided Missile School, for Extension Courses, USAR Schools, Staff Training Programs of the Reserve and National Guard units, nonresident conferences, orientation, and other instructional purposes.

Edited and published by Department of Publications and Nonresident Training, U.S. Army Artillery and Guided Missile School, Fort Sill, Oklahoma.

OFFICE OF THE ASSISTANT COMMANDANT

I hope that Tactical and Technical Trends in Artillery for Instruction will continue to advance the know-how of Artillerymen and stimulate their thinking.

Originality of thinking is certainly not confined to this School and Center, and new ideas and suggestions are encouraged from our readers.

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Paul A. Gavan

PAUL A. GAVAN
Brigadier General, USA
Assistant Commandant

DEPARTMENT OF PUBLICATIONS AND NONRESIDENT TRAINING

COLONEL A. S. BRITT, JR., ARTILLERY, DIRECTOR

ARMY EXTENSION COURSE PROGRAM--SERIES VS COURSES

The conversion of The Army Extension Course Program from the series (20, 30, etc.) concept to the present system of courses (Battery and Advance) involved many changes including a rearrangement of the order in which some of the subcourses were issued. If an arbitrary conversion of all enrollments had been made, many students would have been penalized by losing credit for subcourses completed or by having to complete additional subcourses for eligibility for promotion. The students who were nearing completion in the 30- and 50- series would have been hard hit.

To avoid this situation, all students who were enrolled in the 30- and 50- series on 1 July 1956 were given the option of completing the series in which they were enrolled or converting to the course enrollment. Later, by agreement with the National Guard Bureau, the option was extended to include students enrolled in the 20- and 40- series as well. Under this agreement, no student has been penalized by the changeover. The agreement included two qualifying conditions:

a. The student must complete the series in which enrolled by 1 January 1958.

b. The student must maintain his enrollment by completing a minimum of 30 credit hours in each enrollment year.

Cancellation of enrollment subsequent to 1 July 1956 voids the option and the student must reenroll in the course program. He will, of course, be given credit for any subcourses completed under the series program which are still a part of the course system.

It must be recognized that changes in the courses from time to time are inevitable if the program is to be kept current. However, no student will be required to lose credit for courses deleted or revised. He will always be given credit for them and allowed to complete the course for which he enrolled, so long as his enrollment is continuous.

THE PENTANA CONCEPT IN EXTENSION COURSES

As the current extension courses are revised, the revision will be in consonance with the Pentana concept. It is expected that all necessary revisions will be completed by 1959.

PROGRESS THROUGH STUDY

It is a truism that professional men, including Army officers, do not stand still in their professions. They either progress or regress. Certainly the Army must continue to progress and the individual officer, therefore, must seek every means to progress. This is especially true in this period of new weapons, new organization, new weapons systems, and new concepts of their tactical employment, In lieu of individual attendance at service schools, Army Extension Courses provide the best and most convenient means of maintaining and improving professional military qualifications. The studies can be accomplished concurrently with your present assignment or civilian occupation. The subcourses are organized into convenient study units, the lessons lending themselves to solution in a single evening session. There is no valid reason why every officer should not avail himself of their benefit. In short--a DA Form 145 is a free ticket to opportunity. Use it to ENROLL TODAY, and join the 12,000 already enrolled in the Extension Course Program of your school; the U. S. Army Artillery and Guided Missile School. The 1957-58 program is outlined on pages 7-13.

PROGRESSION IN EXTENSION COURSE STUDY--AN OPEN LETTER TO STUDENTS

Whatever your reason for enrolling in extension courses, you have a decision to make. That decision is "how much time, per week or month, will I spend on these subcourses?" By Army Regulations, you are limited in your decision only by the provision that you must complete a minimum of 30 credit hours of work in each year of your enrollment. The maximum number of hours which you complete is entirely your own decision.

Because the study is done at home at your convenience, learning through extension courses is the most convenient and, at the same time, can be the most difficult method of acquiring military knowledge. At home, you choose the time for study, the amount of time you devote to a session, the number of sessions you hold during a week, and whether you study in pajamas and slippers or in "tie and tails." Yet here, too, are the maximum distractions...children, radio and TV, and friends dropping in or telephoning. Also, other activities, such as bowling, baseball games, and theater and bridge dates, will disrupt study schedules. At home, you lack direct contact with the instructor, between-student discussion, or any of the other aids to learning inherent to resident instruction. Last, but by no means least, in the resident course, good study habits are imposed on the student, if not by direct order, certainly by the very environment and the example of other students.

All of which brings us to the point of this piece.

Mere completion of the 30 credit hours in a 12-month period falls far short of being a really satisfactory year of study. This minimum can be attained in spite of distractions. It is the absolute minimum progress permissible if the Army Extension Course Program is to return any real value for its cost. Those of us who have had long years of experience in the study and in the administration of extension courses know full well that this minimum represents only about one-half the amount necessary for really satisfactory learning progress. To derive real benefit from the study of extension courses, a student should progress at a minimum rate of at least 60 hours per year.

Let's analyze the two minimums. We assume that either would be accomplished over a year's time and not jammed into a short period. The required minimum entails an average of 2 1/2 hours of study per month, or about 1 lesson (session) per month. The preferable minimum asks for an increase to 5 hours or 2 lessons (sessions) per month. A seemingly large figure like 60 hours dwindles in size when reduced to 12 component parts.

Completing a minimum of 60 hours of extension course study in 1 year is easy if disciplined study habits are formed early and adhered to throughout. It is, however, a difficult target if you permit yourself the habit of saying, "This is vacation month, I'll do 10 hours next month." You must discipline yourself to say, "Next month is vacation month, I must do 8 or 10 hours this month or I'll get behind schedule."

Now...What's in it for you besides work? First, much faster progress through whatever course of study you start; second, much easier learning because you keep yourself "in the swing of it;" third, 20 retirement points per year instead of 10; fourth, qualification for promotion at an earlier date. Any one of these advantages represents a good return for your effort.

What's in it for the Army? Fewer dollars spent on notices of cancellation; fewer clerical hours (dollars) spent on warning notices to dilatory students; more people whose military knowledge is fresh, up-to-date, and correlated; with the inevitable result of a better trained Active Army, National Guard, and Army Reserve.

Think it over...You can't lose.

ATTENTION MR. COMMANDER

In the Navy, many ship commanders require junior officers, on their reporting aboard for duty, to immediately begin study to improve their general naval knowledge and to acquire the necessary specific technical knowledge about the ship itself. An increase in the proficiency of these junior officers is an inevitable result.

A similar program will pay as handsome a dividend in an artillery unit as it does aboard a naval vessel. The study medium is ready made and is available to you for your junior leaders. The medium is the Extension Course Program of this School. One copy of a DA Form 145, "Army Extension Courses, Application for Enrollment," indorsed and approved by you and forwarded to EXTENSION COURSE DIVISION, FORT SILL 10, OKLAHOMA, will get your young man started.

What courses or subcourses? Does he need instruction in Gunnery? The Special Extension Course, "FA Gunnery," is the answer. Other special courses in communications, Army aviation, survey, supply, motors, electronics, and intelligence, should provide a tailor-made solution. If they do not precisely fit your specific need, a course selected by you from the body of the catalog will be given the same fast and careful service as would one selected by us and listed in our catalog.

Our business is education. Our sole reason for existence is to help improve the level of knowledge among Artillerymen, of all ranks. wherever stationed. We ship the school to the student.

While you are checking our catalog for a program of study for your juniors, take a closer look. Could it be that there is something in it for you too?

THE 1957-1958 FIELD ARTILLERY EXTENSION COURSE PROGRAM

The following listing of field artillery extension courses with their component subcourses is extracted from the U. S. Army Artillery and Guided Missile School 1957-1958 Extension Course Catalog.

FIELD ARTILLERY BATTERY GRADE EXTENSION COURSE

For the convenience of promotional authorities in determining grade levels of instruction for promotion purposes, it is considered that a second lieutenant should successfully complete 175 hours of instruction in the battery grade extension course and that a first lieutenant should complete the entire course.

Subcourses are listed in the order in which they are administered.***.

Subcourse		Credit hours
1	Artillery Materiel and Ammunition	16
2	Artillery Organizations--Battery and Battalion	9
3	Map and Aerial Photograph Reading II	20
6	Conduct of Observed Fire	12
8	The Field Artillery Forward Observer	11
9	The Field Artillery Firing Battery	15
11	Field Artillery Communication, Battery	14
12	The Infantry-Tank Team in the Attack	14
14	Supervision of Tactical Wheel Vehicle Operation and Maintenance	18
94	Introduction to Guided Missiles	14
23	Field Artillery Communication, Battalion and Higher	11
35	Infantry Tactics, the Company	18
21	Combat Intelligence I	12
15	Exercises in Mathematics	27
17	Artillery Survey	15
18	Fire Direction I	18
19	Fire Direction II	24
24	Reconnaissance, Selection, and Occupation of Position (RSOP)	17
32	Defense of Artillery	15
51	Field Artillery Battalion Staff	24
52	Field Artillery Battalion in Offense and Defense	26
53	Offensive Tactics, Battalion I	21
54	Defensive Tactics, Battalion I	19
58	Battalion Task Force, Offensive Action	20

Subcourse (continued)		Credit hours
59	Reinforced Tank and Armored Infantry Battalions, Defensive Action	20
63	Field Artillery Liaison	13
74	Field Artillery Rockets and Guided Missiles	12

FIELD ARTILLERY ADVANCED EXTENSION COURSE

For the convenience of promotional authorities in determining grade levels of instruction for promotion purposes, it is considered that a captain should successfully complete 235 hours of instruction in the advanced extension course and that a major should complete the entire course.

Subcourses are listed in the order in which they are administered.***.

Subcourse		Credit hours
50	Artillery Organizations--Group, Division, Corps, and Army	9
74*	Field Artillery Rockets and Guided Missiles	12
76	Safeguarding Defense Information	10
83	Training and Methods of Instruction II	21
15*	Exercises in Mathematics (Elective)	27
6*	Conduct of Observed Fire	12
17*	Artillery Survey	15
18*	Fire Direction I	18
19*	Fire Direction II	24
80	Employment of Atomic Weapons	15
56	Offensive Tactics--Regiment I	23
57	Defensive Tactics--Regiment I	21
61	Combat Command in the Attack	14
86	AAA Automatic Weapons Battalion	20
22	Artillery Intelligence	11
72	Division Artillery in Offense and Defense	30
73	Corps Artillery in Offense and Defense--	
	Part I, Intelligence	9
	Part II, Operations	15
27	Troop Movement	17
64	The Artillery S4	12
71	Leadership II	12
79	Artillery Meteorology I	12
66	Communication Responsibilities of Commanders and Staff Officers	11

Subcourse (continued)		Credit hours
68	Movement by Air	14
69	Joint Air-Ground Operations	8
67	Combat Intelligence III	21

* These subcourses are included in the battery grade extension course and the advanced extension course. If there has been a major change in doctrine in the instructional material or if 6 years have elapsed since the student has completed these subcourses, they will be included in requirements for certification of completion of the advanced extension course.

FIELD ARTILLERY SPECIAL EXTENSION COURSES

Each special extension course is designed to make related subcourses pertaining to a single phase of field artillery available in one integrated group. Commissioned officers, warrant officers, and enlisted men of all components are eligible for enrollment in the special extension courses subject to the provisions of AR 350-60 and DA Pamphlet 350-60. Subcourses listed in each special extension course are shown in the order in which they are administered.***.

Army Aviation

Subcourse		Credit hours
106	Air Navigation	21
107	Meteorology for Army Aviation	20
82	Employment of Army Aviation	16
6	Conduct of Observed Fire	12
51	Field Artillery Battalion Staff	24
52	Field Artillery Battalion in Offense and Defense	26

Communication

Subcourse		Credit hours
109	Signal Communication for all Arms and Services	20
11	Field Artillery Communication, Battery	14
23	Field Artillery Communication, Battalion and Higher	11
46	Fundamentals of Electronics	27
66	Communication Responsibilities of Commanders and Staff Officers	11
51	Field Artillery Battalion Staff	24

FA Gunnery

Subcourse		Credit hours
15	Exercises in Mathematics	27
6	Conduct of Observed Fire	12
9	The Field Artillery Firing Battery	15
79	Artillery Meteorology I	12
18	Fire Direction I	18
19	Fire Direction II	24

Intelligence

Subcourse		Credit hours
3	Map and Aerial Photograph Reading II	20
16	Map and Aerial Photograph Reading III	16
21	Combat Intelligence I	12
103	Combat Intelligence II	20
67	Combat Intelligence III	21
22	Artillery Intelligence	11
76	Safeguarding Defense Information	10
51	Field Artillery Battalion Staff	24
52	Field Artillery Battalion in Offense and Defense	26

Missiles

Subcourse		Credit hours
94	Introduction to Guided Missiles	14
112	Fundamental Missile Subjects	12
15	Exercises in Mathematics	27
74	Field Artillery Rockets and Guided Missiles	12

Motors

Subcourse		Credit hours
100	Track and Wheel Vehicle Maintenance and Management	22
101	Vehicle Recovery	8
14	Supervision of Tactical Wheel Vehicle Operation and Maintenance	18
27	Troop Movement	17
51	Field Artillery Battalion Staff	24

Observation

Subcourse		Credit hours
108	The Field Artillery Observation Battalion	18
15	Exercises in Mathematics	27
17	Artillery Survey	15
104	Celestial Orientation for Artillery	18
79	Artillery Meteorology I	12
110	Artillery Meteorology II	32

Administration

Subcourse		Credit hours
102	Individual Clothing and Equipment	8
13	Company and Organization Supply	18
51	Field Artillery Battalion Staff	24
64	The Artillery S4	12
31	Fundamentals of Military Justice II	16
28	Mess Management	18
141	Basic Administrative Records	10
142	The Enlisted Service Record	7
143	The Officer Qualification Record	8
144	Military Boards and Investigations	14

Survey

Subcourse		Credit hours
15	Exercises in Mathematics	27
3	Map and Aerial Photograph Reading II	20
17	Artillery Survey	15
104	Celestial Orientation for Artillery	18

Electronics

This special extension course is offered to provide the artillery officer and enlisted specialist a background of general electronics to prepare him for more advanced instruction in the specialized fields of communication, missile guidance, electronic detection devices, guided missiles, and radar. While the course is long, exacting, and comprehensive, it is the minimum necessary for the student who has no electronics background. Those students who have had education and/or training in this field may enroll in specific subcourses of their own selection to round out their background of knowledge. Before making any selection a student should study the entire scope of the course and its component subcourses to insure that his selection of subcourses will fill the gaps in his knowledge of the subject.

Subcourse		Credit hours
15	Exercises in Mathematics	27
116	Electrical Fundamentals--DC	21
117	Electrical Fundamentals--AC	19
118	Power Supplies and Regulation	19
120	Theory and Application of Electron Tubes	21
121	Fundamentals of Radio	21
122	Transistors	17
123	AM Radio Receivers and Transmitters	21
125	FM Radio Receivers and Transmitters	21
126	Electronic Test Equipment	15
127	R-F Transmission Lines	15
128	Wave Propagation and Antennas	21
130	Single-Sideband Transmission	21
131	Higher Frequency Techniques	19
132	Transients and Waveforms	21
133	Special Purpose Oscillators and Amplifiers	21
135	Pulse Techniques	17
136	Cathode Ray Tubes and Associated Circuits	21
137	Servo Systems and Data Transmission	21
138	Radar Components	21
140	Radar Systems	15

FIELD ARTILLERY MISCELLANEOUS SUBCOURSES

The subcourses are listed and administered for the student desiring instruction in specialized fields.

Subcourse		Credit hours
7	Training and Methods of Instruction I	10
26	Leadership I	12
29	Armored Unit Employment I	11
105	Terrain Evaluation	13
111	United States Military History	30

With the exception of those listed below, all of the above subcourses are in administration now. Those not in administration and their availability dates are:

Subcourse		Available
2	Artillery Organizations--Battery and Battalion	August 1957
8	The Field Artillery Forward Observer	August 1957
73	Corps Artillery in Offense and Defense--Part I and II	October 1957
74	Field Artillery Rockets and Guided Missiles	September 1957
80	Employment of Atomic Weapons	November 1957
121	Fundamentals of Radio	December 1957
122	Transistors	February 1958
126	Electronic Test Equipment	October 1957
130	Single-Sideband Transmission	May 1958
132	Transients and Waveforms	September 1957
137	Servo Systems and Data Transmission	May 1958
138	Radar Components	May 1958
142	The Enlisted Service Record	September 1957

ROTC SUBJECT SCHEDULES AND MANUSCRIPTS

Subject schedules for the advanced course in Field Artillery ROTC units and the manuscripts for the Artillery portion of the General Military Science ROTC curriculum are now being revised. These revisions will include the Pentana concept of organization, latest techniques of field artillery, and coverage of special weapons peculiar to this branch. It is planned to have these revisions in the hands of PMSTs this summer.

USAR SCHOOLS MATERIAL

The organization of the Program of Instruction (POI) for school year 1957-58 will permit each yearly phase of the two artillery courses to "stand alone." Thus, initial enrollment may be made in any yearly phase of the courses.

The instructional material for school year 1958-59 will follow resident instruction as closely as possible, to include material on ROCID, ROTAD, and ROCAD.

STAFF TRAINING MATERIAL

The new staff training catalog will be available for distribution on or about 1 September 1957. Instructional material listed will include material on ROCID, ROTAD, and ROCAD. It is expected that all staff training instructional material will be converted to the new organizational concept at one time. Since the organizations concerned are experimental, changes are expected to occur. The annual revision of each class will reflect approved changes to the new concept.

RECENT TRAINING FILMS

The following training films, even though not released as yet, have been forwarded for approval.

TF 6-2401, the CORPORAL Battalion, Part I, "Introduction to the System."
TF 6-2403, the CORPORAL Missile, "Fueling Operation."
TF 6-2424, Artillery Orientation by Sun and Star, Part II, "The Hour Angle Method."

COMMANDERS!

Are you keeping a progress card on each Extension Course student whose application you approve? We suggest that this is a good method to show a personal interest in the progress of your men.

DEPARTMENT OF COMMUNICATIONS AND ELECTRONICS

COLONEL G. W. SEAWARD. ARTILLERY, DIRECTOR

SHORT TITLES FOR RADIO NETS

To minimize the amount of "brute memory" required for mastering communication nomenclature and systems concepts, a new simplified system of short titles has been devised for identifying the various artillery radio nets.

Simplicity in the system is obtained by assigning descriptive basic letters to the main categories of radio nets according to the net function;

e. g. "F" for fire direction, "C" for command. Particular nets within the main categories are further identified by adding a numerical suffix. Accordingly, the primary fire direction net would be "F1," the alternate fire direction net would be "F2." For dual purpose net designation, the basic letters which describe each function are combined. A combination command and intelligence net, for example, is designated as a "C1" net. Altogether, seven main categories have been assigned descriptive basic letters. Those categories and their assigned letters are:

Command Net	C
Fire Direction Net	F
Intelligence Net	I
Light Direction Net	L
Sound Ranging Net	R
Survey Net	S
Target Area Base Net (Flash Ranging)	T

The type of modulation used in a particular net is shown on charts and diagrams by the type of line connecting the individual stations in the net. Frequency modulated (FM) nets are depicted by a solid line (———); amplitude modulated (AM) nets are depicted by a solid line with a series of spaced X's superimposed (—X—X—X—). In verbal descriptions, the term "AM" or "FM" is added to the short title, e. g. "Command and Intelligence Net AM."

Two major considerations influenced the design of the new system. First, since the short title bears a more logical resemblance to the full title, net recognition and system assimilation are facilitated. Second, a complete system of short titles, applicable to all functions of radio in field artillery communication systems, is obtained.

The system has been approved for purposes of resident instruction at the School. These short titles will be used in all future radio net diagrams used with instructional material and in field manuals prepared at the School.

Because of the simplicity of the new system, in correlating the short title of each net with the function performed, it is felt that the student will find radio net diagrams easier to learn and understand. While the greater benefit should accrue to the new soldier, through elimination of a difficult memory task, experienced personnel will also welcome elimination of one of those traditional "hard-to-remember" elements of required military knowledge.

If you enjoy receiving "Trends" and if it assists you in keeping up to date--keep your Extension Course enrollment active to insure receipt of a copy of the next issue.

DEPARTMENT OF GUNNERY

COLONEL W. E. SHOWALTER, ARTILLERY, DIRECTOR

AN ALL AROUND PROBLEM

The tactical concepts necessitated by the atomic battlefield, with its increased distances and rapid movement of forces, have made it imperative that the artillery be able to attack targets in any direction with equal speed and effectiveness. The trend of greater separation and mobility seems likely to increase with future developments in ordnance and tactical doctrine; therefore, the ability of the artillery to deliver accurate, timely fire in any direction must also increase. This requirement gives birth to the "6400-mil problem."

It is true that the artillery can presently attack targets in any direction, given enough time; it is also true that eventually we will have weapons capable of 6400-mil, on-carriage traverse, and a computer which will give us accurate data, regardless of direction. Our problem is to devise a system to use from the present time to the push button stage, and a system which will back up the push buttons in case nothing happens when we push.

In devising a 6400-mil system, we have problems both at the FDC and at the weapons. Looking at the former, we must first solve a problem in geometry (determining range, vertical interval, and direction) then we must convert this geometric solution to ballistic data which can be applied to the weapons. Presently we use a graphical solution of the geometrical problem. We plot the battery and target and measure the range and direction. However, if we expect targets in all directions, the firing chart for an 8-inch howitzer battalion would have to measure 4 feet across. Charts of this size would hopelessly crowd the FDC and make the chart operator's job all but impossible. Could we use a multiple numbering system or several charts? It is possible, but think of the confusion when a chart operator has to determine which set of numbers he is to use to plot a target and when he has to select the proper chart for each mission.

Turning to the ballistic problem, when we convert range to elevation, we run into registration problems. If we use 9 rounds per registration, it would require 72 rounds (8 registrations) to register 1 charge throughout the 6400-mil sector by using our present transfer limits. With a requirement to register several charges, we could well use all our ammunition and time simply determining corrections. Can we use met corrections instead of registration corrections? Yes, but if we had to fire 3 charges we would have to compute 24 mets every 2 hours.

What about numbering the GFT fan and establishing deflection indexes? The fan would have to be numbered with 7 rows of numbers for deflection, and woe to the chart operator who reads the 5th rather than the 6th row in obtaining deflection to a target. We now register and account for the effect of weather in the displacement of the index, but the corrections for wind must be applied in opposite directions when firing at targets 3200 mils apart.

So much for the FDC problems, let's look at what happens at the weapons. Deflection is presently limited to 3200 mils. With a 6400-mil field of fire, which direction is the gunner to lay the weapon when he hears deflection 2762? One set of aiming posts is not visible throughout 6400 mils of transverse. How is the gunner to decide which of the two (or more) sets he is to lay on? How can the trails of weapons, particularly medium or larger weapons, be shifted quickly so the mission is not delayed?

How much aiming post displacement will there be when a shift of 2000 mils is required? Is our present method of correcting for displacement adequate under this condition?

Many questions have been asked up to now; what about answers? The Department of Gunnery has sound answers for some of these questions, ideas about answers for others, but would welcome suggestions on any or all of the questions.

For some School solutions let's look at the firing chart problem. Considering size limitations, several charts are probably the best solution we have at present. Our desire is to do away with the firing chart and compute the geometric solution. For this we need a computer, either graphical or mechanical, which will give us range, direction, and vertical interval for targets sent by coordinates, polar coordinates, or shifts from a known point. We can now make a graphical computer which will give us this data by using coordinates or shifts from a known point and which is reasonably simple to operate.

To solve met messages we can make a graphical met computer that can solve a given met in less than a minute. To convert range to quadrant elevation we can make a circular GFT that will give the quadrant elevation for a target, automatically including the necessary site and comp site.

We are reevaluating transfer limits and corrections to see if the former are realistic, and if the latter will not permit a wider application. At the weapons, we have found that aiming post displacement is not an insurmountable problem. With well trained gunners we can compensate for large displacements by our present method. We are evaluating the change from 0-3200 mils deflection to 0-6400 mils in either deflection or azimuth. We are also devising a system to indicate the direction of fire desired when using our present 0-3200 mil sights.

We would particularly like to receive recommendations or ideas on solving the following problems: The graphical computer mentioned above, or a solution to the firing chart problem. A solution to the 7 rows of numbers presently required on the GFT fan. A way to use registration corrections from one field of fire in another widely different field of fire. A simple device to enable us to shift trails rapidly on medium or larger weapons. These are only a few of the areas where your ideas will help give our artillery the necessary 6400-mil capability. There are many others which will suggest themselves as you think of the problem.

Major General David G. Barr, USA, once stated, "There is nothing the Artillery won't or can't do; no place the Artillery won't or can't go." As artillerymen we are now faced with a problem which we must solve so that there will continue to be "nothing the Artillery won't or can't do."

ARTILLERY FIRING TIMES

Many Artillerymen speak in glowing terms of the speed of delivery of fire back in the days of the so-called "BC" method. Accurate data are not available to compare the time required to fire a mission "back when" and the time required today. However, an approximate comparison can be obtained by comparing overall time for missions from extracts from War Department Analysis of FA Service Practice (for bracket problems, which list the total average times for all regular Army units) with tests conducted early in 1956 by US ARMY A&GMS using students in the Officers Basic Course and officer candidates.

War Department Report	US ARMY A&GMS
1936 -- 10 min 6 sec	1956 -- 6 min 13 sec
1937 -- 8 min 52 sec	
1938 -- 9 min 50 sec	

If we add a generous factor of 2 minutes to the average times from the US ARMY A&GMS tests to allow for the nonadjusting batteries to fire, the comparison of times indicates that with the FO method and the FDC we can fire the battalion on a target as rapidly as we could fire a battery "back when." The US ARMY A&GMS considers the following problem time rating to be a fair standard for area problems in which the battalion is massed after an adjustment of four rounds or less: For 105-mm howitzer--4 minutes 25 seconds, superior; 7 minutes, satisfactory: For the 155-mm howitzer--5 minutes 25 seconds, superior; 8 minutes, satisfactory.

As a result of experience gained in Korea, the US ARMY A &GMS has developed a new method of fire direction which is incorporated in the revision of FM 6-40. The new method does not change any of the principles of gunnery. It is designed to increase the accuracy and speed of firing. Using the graphical firing table fan, which combines the graphical firing table and range deflection fan, permits the determination of fire commands directly from the chart. The new system employs two charts for each battery, a primary and a check chart. Data are determined on the primary chart at the battery FDC and checked on the check chart at battalion FDC. If the battery is operating alone, both charts are located at the battery FDC. A flexible communication system has been introduced into FDC which permits the interconnection of all elements of the gunnery team and facilitates the handling of missions. The new FDC system is the latest step forward in the evolution of gunnery procedures. The new method has not had the extensive troop testing that other systems have had but indications are that it will improve the speed and accuracy of processing missions. As new communication equipment is developed, complete integration of wire and radio within the fire direction system can be expected which will decrease mission time even further.

NEED FOR ELECTRONIC COMPUTERS

In almost every service or branch that has a fire control problem, computers are being used effectively--that is, except in the Field Artillery. The Navy has been using computers in controlling their gun fire for over 30 years. Many different types of computers are used in aircraft today, including one which points the aircraft guns on a target. Within the present antiaircraft positions are computers which not only solve the gunnery problem, but also transmit signals that automatically point and fire the weapons.

In 1949, two Field Artillery officers, Lt Col Robert E. Arn and Lt Col (then Maj) William A. King, partially completed a computer which would be of assistance to the Artillery in the solution of its fire control problem.

Why do we need electronic computers to solve our fire control problems?

Prior to the atomic age, we could usually depend on a target staying in one place for at least 10 minutes. Manufacturers' capabilities and supply lines were such that the artillery commander could count on adequate ammunition for adjustment and/or registration. Except in unusual cases, artillery weapons were only expected to fire on targets within 400 mils of the original laying azimuth. Enemy countermortar and counterbattery capabilities were in many cases non-existent.

But the new organizations required to defeat an atomic age enemy throw a different light on the problem. We may not have the time to neutralize a target by adjustment because of the enemy's mobility. Conditions of supply will force us to make more effective use of each and every round. Artillery weapons will often be expected to fire throughout 6400 mils--without exception to caliber or range and without appreciable delay. After 2 or 3 volleys, enemy counterbattery may be expected to accurately locate our weapons.

Along with these conditions we have other elements which we must consider in the gunnery problem. Some of these elements are:

a. Weather conditions.

b. Muzzle velocity.

c. Trajectory, either high or low angle with problems peculiar to each.

d. Gun-target relationship in terms of range, direction, and height.

e. Projectile performance.

f. Propellant temperature.

g. Charge.

All of these elements must be applied properly to determine a deflection and quadrant elevation throughout 6400 mils of traverse. In the past we have done all right, having as computers only our own minds augmented by graphical equipment and firing tables. Owing to the new requirements of the Artillery, we must now compute firing data to an accuracy of ± 50 yards and ± 3 mils in a matter of seconds.

What general advantages can a computer offer us when compared with human performance?

a. Accuracy--On problems of many variables and complex theory, a machine will almost always outperform the human in determining accurate data.

b. Speed--The speed of a computer is in the vicinity of 100,000 times as fast as a human.

c. Memory--A computer can store and subsequently apply tremendous amounts of information, especially when considered relative to a given problem and compared to human capabilities.

d. Cost--The cost of a computer must be judged in terms of how much it costs initially, its maintenance and shipping, as opposed to transporting, feeding, clothing, training, and keeping a human computer on the job.

A battery commander will have very little trouble with emotions, fatigue, and human error and forgetfulness when he has a computer in the FDC. He would be able to train competent computer operators in about one-fourth the time required to train a FDC team using the present equipment. It is hoped and expected that a really good computer would offer no serious maintenance problem to the battery or battalion.

The weight of the computer would not hinder its mobility because of its envisioned compactness and ease of handling.

Eight years have passed since Lt Col Arn and Lt Col King started the Field Artillery in the electronic computer field. Today the Artillery Board is testing a gun data computer for the Field Artillery.

Napoleon's XCII maxim, "In battle . . . , skill consists in converging a mass of fire upon a single point; when the fight is on, he that has the skill to bring a sudden, unexpected concentration of artillery to bear upon such a point is sure to win," holds true for the war of the future as well as the wars of the past. Gun data computers may well be the mainspring in the fulfillment of this requirement.

THE ROLE OF THE BATTERY IN THE NEW DIVISIONS

With new type divisions being formed, or soon to be formed, what effect will these changes in organization have on the artilleryman as he continues to wrestle with the gunnery problem? Here, without looking specifically at any one division or type of division, are some of the things to come as gunnery is applied to the new organizational concepts.

The technical changes in procedures and equipment will initially be very minor. The same procedures prescribed in the new FM 6-40 will be followed. Firing data will be produced on one chart and checked on another chart. The same sequence of commands will still be used and the communication system, although modified, will still interconnect the same agencies with each other. What then will change?

First, the battery commander and his battery officers can prepare for a greater amount of independent action. The battery FDC will normally be the final source of technical fire direction; higher headquarters may control fires, but will seldom produce firing data. This means that battery FDC's cannot depend on another headquarters to see that the No Fire Line is recorded or that the necessary targets are replotted. It means that the battery FDC computes the met corrections and VE or they won't be computed. Often the decision to fire on a target will be made by the battery FDO, as will the decision as to the amount and type of ammunition to be fired. The battery FDO will issue the fire order. If additional fire is needed or if a special method of attack (TOT for instance) is required, the decision to request it and the responsibility for arranging it will rest with him. The battery FDC will compute any special corrections that are necessary.

Next. The firing battery will be required to engage targets on a wide front, possibly throughout 6400 mils, and may frequently be required to engage two targets simultaneously. The battery will at times be split into two platoons which will operate either separately or under battery control. It may be necessary for the battery, particularly the light battery, to be displaced by platoon in order to continue to render fire support. The battery will often maintain liaison officers in supported units, and be required to mass its fires with fires of other types of weapons to include mortars.

In addition, the "island of resistance concept," rapid movement, and wide dispersion of the pentana army will necessitate greater use of radio. In general, the requirement for fast dependable communications will be increased and the time for installation will be cut down. The responsibility for the entire communication network will rest, in many cases, with the battery commander. Therefore he will be required to take a much more personal interest in its planning and execution. Because of increased dispersion of units, the distance and frequency of battery moves will be greater; thus, we are faced with the concept of more moving and communicating with no decrease in shooting quality or quantity.

Having indicated that the battery commander will have a bigger job and will be on his own more often, let's now look at the additional capabilities he will have. We have already indicated several additional, or augmented activities of the battery FDC; to fulfill these there are more people, both officer and enlisted. The FDC, because it might have to split to support two platoons, is designed for such a split, and has the personnel and equipment available for operating in two parts for a limited time. (Note: Although primarily applicable to mortar and 105-mm howitzer batteries, this applies to a lesser degree to 155-mm and 8-inch howitzer batteries.) The met corrections, which will assume increasing importance, will be better since they will be based on a met message from an electronic met station located closer to the battery position.

The battery in division artillery will be part of a more varied team and will be able to call on other batteries of several different calibers for support in accomplishing its mission. The Artillery, on the battlefield of the future, faced with new problems and greater challenges, must continue to render close and continuous support to the Infantry and maintain its position as the "greatest killer on the battlefield." Whether or not it solves these problems and meets these challenges depends on the battery commander and his officers as never before.

The School is modifying its instruction to equip the battery officer with the necessary knowledge for his new role, but in large measure, the self-reliance, leadership, and tactical knowledge needed by the artillery of the future can come only from personal initiative on the part of the battery officer.

SLOPPY GUNNERY

In the continuous research program which is carried on by the Department of Gunnery, some projects stem from the field of new developments. Others are the result of reexamination of present day procedures and techniques as well as the principles and statistics supporting these techniques. Within the program to reexamine old principles, a study was made to to determine the adequacy of our precision fire procedures and to ascertain what was responsible for poor precision registrations. The results of this study reaffirm the importance of exacting performance in all aspects of the gunnery problem.

The field data for the study were collected from routine service practices; however, flash bases were established in order to obtain accurate fall-of-shot data. Every effort was made to get random samples of precision registrations, but since the individuals engaged in the service practices knew they were participating in a research program, it is probable that missions generally were above average. Each mission observed was studied in terms of accuracy, number of rounds, and total time. Any missions considered less than excellent were carefully analyzed to determine why.

Practically all poor registrations could be attributed to human errors, falling generally into the following three categories:

1. <u>Firing Battery Errors</u>.

a. Inaccurate leveling of bubbles (if cross level or longitudinal bubble is off 1 graduation, a 1 1/2-mil error results).

b. Failure to take up correct sight picture when aiming post displacement occurred.

c. Failure to set off deflection, site, or elevation from lower to a higher number.

d. Failure to approach aiming posts from left to right when laying for direction.

e. Failure to relay properly with correct deflection setting after each round when there was no change in deflection between rounds.

f. Failure to make last motion of the elevation handwheel in the direction which offered the greater resistance and to relevel with correct elevation after each round.

g. Failure to protect all rounds from temperature change. Some rounds were exposed to direct sunlight while others were shaded, resulting in large differences in powder temperature between rounds.

2. <u>Observer Errors</u>.

a. Obvious missensing of rounds.

b. Inaccurate measurement of deviation of burst from target.

c. Failure to measure deviation and sensing range at exact instant of burst.

d. Failure to study terrain so that terrain sensings could be made.

e. Failure to recognize need for, or request verification of, data when actual fall-of-shot differed from the expected impact point due to weapon or FDC errors.

3. <u>FDC Errors</u>.

a. Use of wrong sensing card or misreading sensing card.

b. Erroneous deflection or elevation sent to weapons. This could have been avoided by a check of data before it was sent.

c. Miscellaneous factors which were not specific errors, but detracted from the satisfactory operation of the FDC, such as--

(1) Noise

(2) Excess equipment on charts

(3) Unserviceable equipment, e. g., warped fans.

During the latter phase of the study, many missions were fired during which gunnery instructors were used on the weapons and in the FDC. Observer sensings were closely checked at the OP before being sent to the FDC. When setting off data on the weapons, the gunnery instructors followed approved procedures for <u>each</u> round. On all such missions fired, there occurred a significant reduction in the amount of dispersion for range and deflection.

For missions fired with the 105-mm howitzer, the following comparison was made between the results of routine registrations and those which were conducted with gunnery instructors on the weapon and in the FDC.

Personnel	Number of missions	Completed within six rounds (FFE)	Percent	Completed within nine rounds (FFE)	Percent
Gunnery instructors	37	28	76	34	92
Unknown skill	31	14	45	25	81

Errors were made by both skilled personnel and personnel of unknown skill. In 1 mission, the wrong sensing card was used; in another, 9 rounds were fired in FFE without a range sensing of over. These two missions were declared invalid and were dropped from further consideration. When known errors were eliminated from the remaining missions, the rounds were reconstructed using corrected data and the problems reanalyzed. The following comparisons resulted:

Personnel	Number of missions	Completed within six rounds (FFE)	Percent	Complete within nine rounds (FFE)	Percent
Gunnery instructors	36	24	94	36	100
Unknown skill	30	20	67	28	93

Appraisal of these results did not bring out any errors which were new or different from those encountered at nearly every service practice, but the lessons learned should be brought to the attention of all artillerymen. They are, first, the system for obtaining adjusted elevation and deflection is sound. Second, faulty registrations result from human error at weapons, FDC, or on the part of the observer; and third, the probability of a shot falling where it is supposed to is greatly increased by the proper and continuous training of weapon crews, adherence to accepted practices, maintenance of high standards, and strict supervision.

If you are experiencing prolonged registrations during service practice, take a close look at what's happening at your OP, FDC, and firing battery.

Scratch "sloppy gunnery" from their techniques and the results will surprise you; they did us!

STATUS OF **FM 6-40**

The new FM 6-40 will be similar to FM 101-10 in binding, 8 × 10 inches in size, and of approximately 480 pages. It should be issued to all units about the same time this article is published. Instruction on material in the new manual has been started for all classes currently at the School.

So far, only minor criticisms have been offered by the students in regard to the material in the manual. However, we would like to stress that we are sincerely inviting comments on the material in the revision of FM 6-40. If you have any comments or recommendations, please let us hear from you as soon as possible so that they may be included in any changes to the manual. Changes will be made by page replacement similar to the method used with FM 101-10.

CORRECTION

The second sentence of the seventh paragraph of the article "High Angle Fire Direction Made Easy" in the April issue of "Trends" (line 20, page 11) should read, "This correct site is obtained by multiplying the angle of site (a constant value) by <u>successive 10-mil site factors, corresponding to</u> successive apparent adjusted elevations, until 2 successive sites are within 1 mil."

EXTENSION COURSE STUDENTS!

Have you informed your unit commander or unit advisor of your Extension Course progress this month?

DEPARTMENT OF MATERIEL

COLONEL VINCENT M. ELMORE, JR., ARTILLERY, DIRECTOR

THE CORPORAL FIRING BATTERY

The Corporal is a field artillery, surface-to-surface, guided missile capable of delivering atomic artillery fires to a range several times greater than that achieved by cannon artillery.

In this brief discussion of a Corporal firing battery, we will begin with a description of the layout of a typical battery, then follow the operations of the battery from the time the missile is received until it delivers an atomic warhead on the target.

There are two general areas occupied by a typical Corporal firing battery. These are the guidance position, which contains the fire control equipment, and the firing position. Each firing position is further subdivided into 2 firing section positions and 1 or more missile storage areas. A checkout area is normally located in each firing section position. The firing section position contains a launcher, a firing set, and various special items of equipment needed to erect, service, and fire the missile.

The missile comes to the battery in a long metal cylinder carried on a 40-foot flatbed trailer. The missile is taken into the checkout area where it is uncrated and put on handling rails. The assembly and test section, consisting of electronic, propulsion, and assembly personnel, then begins the missile checkout.

The missile electronic personnel cable the missile to the missile test station. The test station houses the test equipment required to check all electronic components in the missile. While this is being done, the propulsion personnel check out the propulsion components by using air test sets and gages.

After the assembly and test section has completed the checkout, the Corporal is picked up by the erector and taken to the missile storage area or the firing section position for fueling. This operation consists of placing the correct amount of fuel and oxidizer in the appropriate tanks.

In the firing section position, the missile is erected on the launcher and connected to the missile firing station by a 130-foot cable and last minute component checks are made. The missile is also connected to a source of high pressure air. Firing section personnel pressurize the missile air tanks and await the order to fire.

During this time, the guidance platoon has been busy cabling and checking out its equipment. Guidance equipment includes the radar, computer, and doppler radio set. The radar is used to track the Corporal and to send guidance commands to the missile; the computer is used to compute commands for guidance of the missile; and the doppler radio set is used for measuring missile velocity and sending a command to the missile to accomplish propellant shutoff. After the component checkout is completed, the guidance platoon performs a loop check to determine whether all components will function properly together.

After all checkout is completed, the count down procedure begins. Count down continues until the missile has been fired and requires close coordination between the FDC, the guidance position, and the firing section position.

The missile is fired by pressing the firing button on the firing panel, a remote control panel connected to the missile firing station by a 500-foot cable. When fired, the missile first rises vertically, then programs into the radar beam and pitches down range toward the target. After the missile enters the radar beam, the fire control system on the ground and the guidance components in the missile detect and correct for deviations from the standard trajectory and enable the missile to deliver its warhead to the target.

PRECAUTIONS WHEN USING M500 SERIES FUZES AND FUZE SETTERS M23 AND M26

MTSQ Fuzes M500, M500A1, M501, and M501A1 are combination mechanical time and superquick artillery type fuzes. Settings for time action (2 to 75 seconds) and an impact element for superquick action are provided. A total of 142, 816 rounds were fired between 1 July 1954 and 10 July 1956 using the M500 and M501 series fuzes. Seven malfunctions were reported, and all seven malfunctions occurred on the trajectory. Since several early bursts have occurred when firing these fuzes, the following information from TB ORD 512 with changes 1 and 2, TB ORD 580, and the Ammunition Development Conference held at Fort Sill 5 and 6 February 1957 is passed along to help reduce the number of accidents evolving from the use of these fuzes and setters.

At the time of manufacture, these fuzes are subjected to torque tests. Fuze lots beginning with lot numbers listed in table II, TB ORD 512, change 2, 27 April 1955, and higher series do not require torque tests at ammunition supply points. The torque test is required on other fuzes unless stamped "torque tested." An exception is that when fuzes are set twice and not fired, they must be torque tested by qualified Ordnance personnel.

Excessive torque: If the torque required to set the fuze is greater than that specified in the TB, difficulties may result at the time of use with inaccurate fuze settings due to slippage of the fuze setter or the inability to turn the fuze with the fuze setter. Such fuzes should be returned to Ordnance.

Insufficient torque: If the torque required to set the fuze is below the specified limit according to the TB, inaccuracies may result from movement of the lower cap after the fuze has been set. This may occur during handling or in firing. Fuzes requiring insufficient torque should not be fired under any circumstances since they may result in early bursts.

Reports have been received from using personnel that when setting fuzes with the M23 and M26 mechanical fuze setter, the settings on the fuze vary as much as 3 to 5 seconds from that setting placed on the fuze setter. Repeated checks by the School and tests conducted by the U. S. Army Artillery Board failed to duplicate the error of 3 to 5 seconds. The greatest amount of error attained was 0.3 second. Since the time rings are cast in a common die, possible error on the fuze time ring is eliminated. The fuze setters are calibrated by the manufacturer or Ordnance before issue and should be correct within 0.2 second. Correct readings should result providing the fuze setter is properly used by trained personnel.

When setting fuzes with the M26 fuze setter, use the time ring (inner ring 25 seconds, outer ring 75 seconds) corresponding to the time ring on the fuze (fig 1). It is quite easy to use the wrong scale. Be sure to tighten the wing nut on the fuze setter to prevent the movable index from turning while setting the fuze. This may occur when the fuze requires excessive turning torque.

After a fuze has been set, compare the readings on the fuze and the setter to make sure they correspond. When a difference occurs, continue turning the fuze around to safe (S) and reset it to the appropriate setting. If the same error occurs and the error is greater than 0.3 second, set the fuze at safe (S) and return it to Ordnance. If incorrect settings result even though correct procedures have been used in making the settings, the fuze setter should be turned in to Ordnance.

When using the M23 fuze setter, the corrector should be set at 30 (fig 2). If set at 0, there will be an error of 3 seconds in the setting.

All fuzes when shipped should be set on the safe (S) setting with a safety pull wire installed. This safety wire extends through the fuze body and under the setback pin, preventing accidental arming of the setback pin during shipment or storage. In preparing the fuze for firing, the safety wire must be removed before the fuze is set. When removed, care should be taken in handling not to drop the fuze or fuzed round, as a jolt in the appropriate direction could arm the setback pin. If dropped, the fuze or fuzed round should be properly tagged and returned to Ordnance. If a fuze has been set in preparation for firing and is not fired, the fuze should be reset to safe (S) and the pull wire replaced in its proper position.

It is possible during transporting or handling fuzes to arm the timing mechanism. A jolt in the appropriate direction could cause the hammer, which is mounted by a straight leaf spring in the head of the fuze, to strike the setting lug on the timing disc. If ticking sounds emanate from the fuze during preparation, it is an indication that partial gear train activation is occurring. No further attempt should be made to adjust the fuze. Using personnel should take cover immediately and qualified Ordnance personnel should be notified so that the fuze or fuzed round can be destroyed or rendered safe. Charges in the fuze itself are sometimes sufficient to cause fragmentation of fuze components, and an attempt to remove the fuze without proper protection and safety precautions could be fatal.

When setting these fuzes, they should be turned in a counterclockwise direction, that is, in the direction of increasing numbers. If a correction is given and the fuze setting or number has been passed, continue in the same direction and reset to safe (S), then continue to proper setting. The direction must never be reversed (decreasing in numbers) because backlash in the gear mechanism will result in fuze setting error.

If defective or damaged fuzes or fuzed rounds are detected by using personnel, they should be returned to Ordnance.

Additional information regarding the M500 series fuzes may be found in TB ORD 580 and changes 1 and 2 of TB ORD 512. User comments are welcomed.

A new 100-second MTSQ fuze is under development and it is believed that this fuze will overcome the shortcomings found in the current M500 series fuzes. Information on this new fuze will be published as it becomes available.

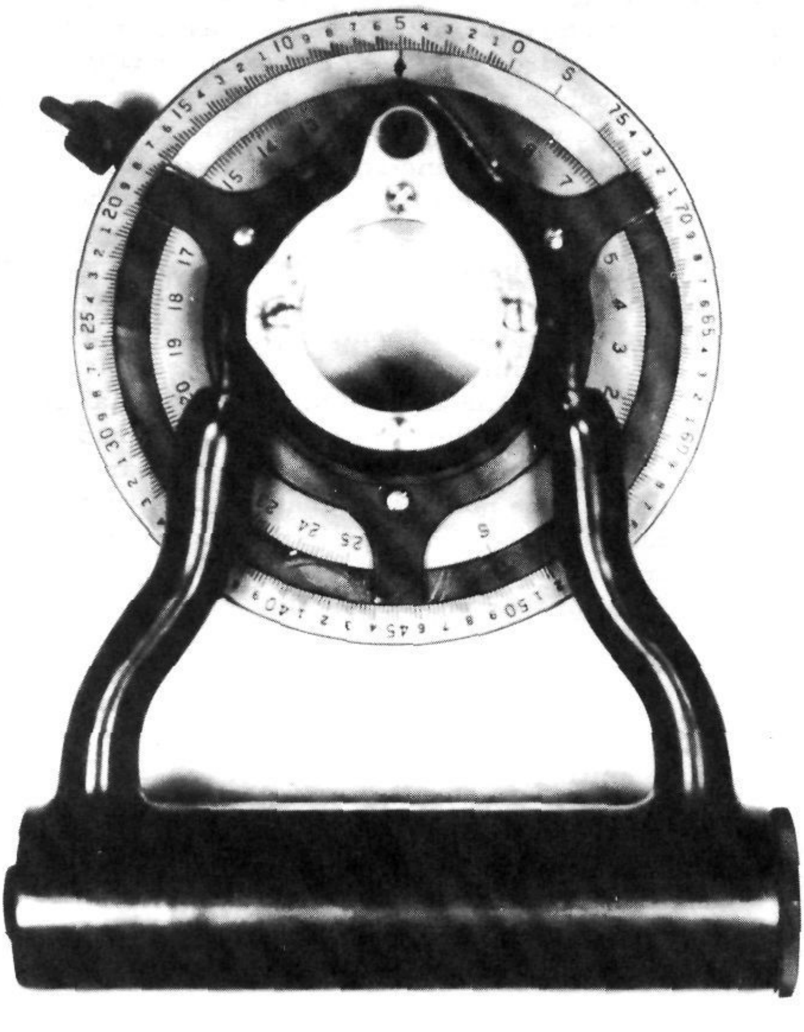

Figure 1. M26 fuze setter.

Don't get caught in a "bind" each spring for retirement points or qualification for promotion--continue your Extension Course work during the summer and fall.

Figure 2. Proper corrector setting on the M23 fuze setter.

DEPARTMENT OF MOTORS

COLONEL J. W. MILNER, ARTILLERY, DIRECTOR

PROGRESS REPORT ON TACTICAL WHEELED VEHICLES FOR USE IN ARTILLERY UNITS

World War II furnished a good background of experience for determining desirable military characteristics of vehicles for artillery use. Based on this wartime experience, the military characteristics of future vehicles were drawn up and presented to Ordnance. After World War II, the Ordnance Corps began an extensive design and testing program. Although this program was not completed by the time new vehicles were required for the Korean emergency, sufficient work had been done by Ordnance and by commercial firms to standardize and produce the vehicles now in use in the Army. After Korea, the post World War II concepts were completed and tested, but were generally found not to be sufficiently superior to the vehicles in production to warrant the expense of changing. Although work continues on new and improved models, the vehicles now issued to troops will probably be the standard vehicles for some time to come.

At present, the vehicles most commonly issued to artillery units are called the interim vehicle family and are listed below:

1/4-ton--M38	L-head engine Jeep.
--M38A1	F-head engine Jeep.
3/4-ton--M37	Dodge, 6-cyl, L-head engine, cargo model.
--M42	Same as M37, except for radio facilities and modified canvas top.
2 1/2-ton--M34	Reo, single rear tires.
--M35	Reo, dual rear tires, flat bed body.
--M135	GMC, single rear tires, hydramatic
--M211	GMC, dual rear tires, flat bed body, hydramatic.
5-ton--M41	International, single rear tires.
--M54	International, dual rear tires, flat bed body.

In addition to the cargo vehicles listed above, vans, tractor trucks, recovery vehicles, and other vehicles based on the same general components may be found in some artillery units.

A new 1/4-ton truck, 4×4, the XM151, employing an independent coil spring suspension and unit body construction, is being considered to replace or supplement the M38 and M38A1. The independent suspension system reputedly gives better performance in crosscountry mobility and better overall riding qualities.

A new 5-ton truck, 8×8, the XM282, based on 2 1/2-ton Reo parts and considerably lighter than the present 5-ton trucks, has been built and is being tested. The vehicle is light enough to be phase I air transportable. This vehicle has not yet been accepted.

A new 10-ton truck, 6×6, the XM125, designed to be used as a prime mover and ammunition vehicle for heavy artillery, is being tested and will be issued if it passes the tests.

The vehicles listed above probably will be the only vehicles used in units for the next few years, but Ordnance has formulated a long range concept of a future family of wheeled vehicles.

Basically, the purpose of the wheeled vehicle family concept is to provide a better selection of truck sizes and to reduce the problems of supply and maintenance. This concept envisions 3 or 4 sets of basic components, such as engines, transmissions, axles, and body components. From these basic components, vehicles of different capabilities would be constructed by adding sets of wheels and enlarging the bodies. It is envisioned that, from these 3 or 4 sets of basic components, a whole series of vehicles ranging from 1/4-ton to 10-ton could be assembled.

For example, the light series might be assembled as follows: a 1/4-ton vehicle would be a 4×4 vehicle, a 3/4-ton vehicle would be a 6×6 vehicle, and a 1-ton vehicle would be an 8×8 vehicle. This same concept would be extended to the larger vehicles also. Presumably the vehicles within a particular class would be designed to give uniform cross country performance.

To test the validity of this concept, a 1-ton, 8×8 vehicle has been constructed using the basic components of the XM151 1/4-ton truck. Test results of the 8×8 vehicle have not yet been published.

This concept, if successful, offers great possibilities of solving the problem of spare parts supply and should also simplify procurement problems.

DEPARTMENT OF OBSERVATION

COLONEL E. G. HAHNEY, ARTILLERY, DIRECTOR

BASIC GUIDANCE FOR FIELD ARTILLERY BALLISTIC MISSILES

It has been more than a decade since ballistic type guided missiles were first used successfully in wartime. The brunt of the V-2 attack was borne by the city of London. There was no defense against this weapon, since it traveled at too high an altitude, and at so rapid a speed that its engine's roar could be heard only after impact. Bombing of the V-2 launching sites could not silence this method of warfare and it was only through the invasion of Europe that the attack was finally stopped. The success of this method of warfare prompted the United States Army to begin development of a family of ballistic surface-to-surface missiles (SSM) with much improved accuracy.

Any method of guidance for these missiles is analogous to the fire direction of cannon artillery. In a typical cannon artillery situation, a forward observer adjusts fire by starting with an azimuth and a reference point. The forward observer calls for fire with data in relation to the reference point, determines the deviation between the burst of the first round (volley) and his target, and transmits a command to correct the error. The basic missile guidance problem also begins with a reference: an azimuth (e. g. radar-target line), and a standard or ideal trajectory. Sensings or errors are derived, based on the comparison of the actual and predicted flight paths of the missile (standard trajectory). From these errors, a correction is computed to maintain the missile on its predicted course.

The control of a guided missile in its trajectory is normally divided into two parts: attitude control and path control.

Attitude control causes the guided missile to have the proper orientation about its own center of gravity. An example of this is roll stabilization, which is essential in obtaining proper response to fin or rudder movements. Attitude control is normally the function of the automatic pilot within the guided missile.

Path control causes the guided missile to follow the proper azimuth to target and to impact at the proper range. Path control is a function of either ground stationed components (command guidance) or on-missile components (inertial guidance). Path control is usually assisted by some sort of programming, or preset guidance, which will cause the guided missile to perform specified maneuvers at certain times.

Generally, the most critical element of ballistic SSM guidance is the control of range. Many missile systems achieve this range control by turning off the rocket motor at a critical time (thrust termination; the German V-2 was an example of this). In so doing, the missile will have the velocity, position, and angle of elevation necessary to impact at the target. This may be likened to selecting a muzzle velocity and angle of elevation for cannon artillery. Under standard conditions, for every muzzle velocity and angle of elevation, there will correspond one, and only one, range. So it is with ballistic guided missiles. A computer is normally employed to make inflight corrections for nonstandard conditions.

It has been the purpose here to touch on some of the many facets of ballistic missile guidance and to acquaint the reader with some of the descriptive terms. Ballistic guided missiles add a long range power punch to the artillery, and thus make it continue as one of the most formidable combat arms in the conduct of war.

ASTRONOMICAL ATTACHMENT FOR TRANSITS AND THEODOLITES

Recently, a device has been added to the surveying equipment set number 17 which will enable the artillery surveyor to determine azimuths by observation of celestial bodies without previously required lengthy mathematical computations. This device is the astronomical attachment, azimuth determination, reflecting, for transits and theodolites (stock Nr 6675-346-3530). The accessory set consists of the attachment itself, 3 adapter rings, 2 counterweights, screwdriver, end thrust wrench, refraction table, and manual, all contained in a metal case with carrying strap. Issue of the device is expected in early summer 1957. Authority: Engineer Supply Manual 5-1-6600, group 6675, component: 6675 S 45.

The attachment is mounted on the objective end of the telescope of the surveying instrument, and furnishes a rapid means of determining direction by mechanically solving the celestial triangle. The data required to determine an azimuth are: (1) declination of the celestial body used, (2) latitude of the observer's station, and (3) approximate time (to obtain the local hour angle). With the declination and hour angle set on the scales of the attachment, the telescope, with the horizontal scales set to zero, is pointed to an azimuth mark. The latitude is then set on the vertical scale of the instrument, and the alidade is rotated until the axis of the telescope is approximately in meridian. The celestial body is then viewed and tracked until it is in the center of the crosshairs of the telescope. The horizontal scale is read and the azimuth of the required line determined. Azimuth accuracies of from 1 to 3 minutes should be expected.

THE TELLUROMETER DISTANCE MEASURING SYSTEM

Taping as a major means of measuring distance for the artillery surveyor has long been recognized as being too slow and having too limited an area of application. These deficiencies are magnified in the light of modern tactical concepts.

A new electronic device called the Tellurometer appears to provide the answer to this problem. This equipment, manufactured by Tellurometer

(PTY) Ltd, Cape Town, Union of South Africa, is remarkable in its ease of operation, simplicity, and accuracy. It measures distances of from 500 feet to 30 miles by measuring the time required for a radio wave to travel from a master station to a remote station and return. The components of the two stations are physically similar but are not interchangeable. One master station can operate with any number of remote stations. Each station consists of the following components:

Component	Dimensions	Weight
Tellurometer instrument	21″ × 17″ × 10″	24 lbs
Instrument carrying case	22″ × 18″ × 11″	14 lbs
Power pack	22″ × 18″ × 11″	10 lbs
Tripod	36″ × 6″ × 6″	9 lbs
Battery (standard 6-volt car battery)		28 lbs

A demonstration of the Tellurometer was witnessed by Department of Observation representatives on 2 and 3 May of this year. This demonstration showed the equipment to be capable of measuring a distance of 8 miles with an accuracy of better than 1:15,000 in less than 15 minutes. This time included 10 minutes for setting up and orientation. A precise measurement with an accuracy of approximately 1:300,000 required a total time of 30 minutes. The precise measurement included taking simple psychrometer and barometer readings and applying a correction based on the readings.

Of particular interest is a very efficient radio built into the instrument for coordinating the activities of the master and remote stations. In practice, this radio system operates very well at distances of 70 miles, approximately twice the measuring capability of the Tellurometer.

The Tellurometer is now being tested by the Engineer Research and Development Laboratories, Signal Engineering Laboratories, and Coast and Geodetic Survey. One such set is expected at the School in January 1958. It is planned to determine the improvements in survey methods and instruction that can be realized from such equipment.

APPLICATION OF HELICOPTER TRIANGULATION

A recent letter from the 25th Division Artillery suggested an application for helicopter survey that is worthy of passing on. The objective of this application is the rapid tying together of all units of division artillery.

Having established his surveyed base (control base), the division artillery survey officer makes a map reconnaissance and selects a sufficient number of terrain features for approximate hovering points to insure strong geometry for three point resection by all organic and attached artillery units. At a predesignated time, the survey officer flies through all preselected hovering points, designates each by a number, and gives the necessary count down and read commands. By SOP, all units and the control base track and record data for all points. As the control base receives data for each aerial point, location computations are commenced. As computations for each point are completed, coordinates are sent to the survey officer who rebroadcasts this information to all units in the survey system. When coordinates of all aerial points are received by the units, a selection is made of the three points providing the strongest geometry for computing control. From these points, horizontal and vertical control and direction are computed for the unit survey control point. If desired, direction can be improved by astronomic observations. In this manner, one flight establishes uniform control throughout the entire division artillery.

Don't wait--sit down tonight and work that Extension Course lesson you put aside last month.

DEPARTMENT OF TACTICS AND COMBINED ARMS

COLONEL F. T. UNGER, ARTILLERY, DIRECTOR

SPECIAL WEAPONS EFFECTS INSTRUCTION

Effective with the last Associate Field Artillery Officers' Advanced Class of Fiscal Year 1957, which reported to the School on 20 May 1957, special weapons effects instruction will be "spread out" over a period of 4 1/2 weeks in lieu of the 3 1/2 weeks which were used to present this instruction. The change will not involve an increase in the amount of special weapons effects instruction, but will increase the time available to students to absorb instruction.

RADIOACTIVE FALLOUT

Radioactive fallout consists of that residual radioactive matter that falls to the earth's surface as a result of a nuclear explosion. This radioactive matter can be the result of fallout earth particles (surface burst) or of the composition of the nuclear weapon. The casualty producing potential of fallout is far greater than that of the prompt effects of nuclear weapons. Although exposure to radiation can be harmful, military operations will often require deliberate exposure. In view of this military requirement, it is probable that the proportion of psychological casualties may be higher than heretofore.

Effective defense against fallout requires organizations, procedures, and equipment for radiological surveillance and warning systems which are not now available. The only known effective means of reducing the effects of radiation are displacement from the contaminated area, shielding, and decontamination. Every unit must be equipped to detect fallout, and every unit becoming aware of a nuclear explosion must begin taking protective measures based on a unit SOP. Units in the vicinity of a surface burst or other fallout producing burst must begin countermeasures immediately after the burst occurs even though they may not learn for quite some time whether they are in the affected area or not.

Extensive use of fallout as a means of influencing military action will result in a greatly increased requirement for troop airlift to traverse contaminated areas. Methods have been developed under hypothetical tactical situations to predetermine the effects of fallout on tactical and logistical operations.

It is apparent from the foregoing that an urgent requirement exists for units and equipment which have a capability of rapidly and accurately predicting and reporting effects of a nuclear burst wherever it occurs in an area of operations. However, before developing organization, equipment, or doctrine, it is necessary to determine a suitable method for predicting and reporting fallout. Studies have been initiated by Headquarters, U. S. Continental Army Command, on this subject and it is anticipated that the results will provide an improved solution to the problem of fallout prediction. At present, it appears that reporting and prediction for our own weapons can be accomplished at the artillery FDC as an extension of target analysis. However, little or no advance warning of the explosion of enemy nuclear weapons makes it most difficult to predict fallout occurring therefrom. Further study and the development of electronic or other military equipment is required to produce a satisfactory solution to this problem.

MORTAR BATTERY

The mortar battery is an integral part of the infantry and airborne division battle group, and is not organic to the division artillery. However, the battery is a full-fledged artillery unit, and the 4.2-inch mortar is considered and accepted as an artillery weapon. This does not mean that the School is satisfied with the present mortar. However, the School recognizes that the battery may be equipped with a more suitable mortar in the future, and that further development of mortars may well increase the flexibility of the artillery.

The bulk of the personnel of the mortar battery will be field artillery trained, and will be assigned field artillery MOS's. The first Army training test (ATT) for this type of unit was recently prepared at the School, and has been forwarded for approval. This ATT will be administered by the appropriate division artillery. The training texts for the mortar battery were likewise prepared at the School and were later published as TT 57-6-140, Heavy Mortar Battery, Airborne Division (Oct 56) and TT 6-18-2, Mortar Battery, Infantry Regiment (Feb 57). In March of this year, the School forwarded for approval the draft of FM 6-18, Mortar Battery, Battle Group, Divisional, which will supersede TT 6-18-2 when published.

ROTC STATISTICS

Of the 13,480 Army ROTC graduates to be commissioned during the 1 May 57 - 30 April 58 period, 3,441 (26 percent) will be commissioned in Artillery. Within the branch, 53 percent (1,824) will be assigned to Field Artillery and Missiles, 47 percent (1,617) to Antiaircraft Artillery and Missiles.

OFFICER CANDIDATE SCHOOL

COLONEL CHARLES A. SYMROSKI, ARTILLERY, COMMANDANT

CONSIDERATIONS FOR BATTERY COMMANDERS RECOMMENDING ENLISTED MEN FOR OCS

The U. S. Army Artillery and Guided Missile Officer Candidate School exists primarily for the purpose of training and educating selected enlisted men for a commission as second lieutenants of Artillery. The most important stage in the selection process is the battery commander's recommendation, because only the battery commander will have had the opportunity to observe the soldier's performance over a prolonged period in the face of varying challenges and problems.

Basically, the officer candidate course develops and measures the candidate in three areas: Professional knowledge, character, and leadership. The potential candidate must have positive qualities in each area. Army standard tests are used to determine the soldier's mental prowess and ability to gain knowledge. Character, as OCS emphasizes it, is the soldier's unwillingness to lie, cheat, steal, or evade the issue, and also his willingness to persevere in his mission in spite of physical, mental, and emotional strain. Leadership and followership are developed by actual performance within the candidate organization in every assignment from battery commander to cannoneer.

Often, candidates are relieved from the School because of inherent deficiencies which should have been detected early by the battery commander. It is the purpose of this article to emphasize certain qualities which are important to the soldier at OCS and which the battery commander should understand before making the first indorsement.

The prospective officer candidate should have a demonstrated and proven desire to work, study, and train in order to qualify himself for increased responsibility. This quality has a lot to do with his "attitude" at OCS where he will be subject to corrections by upperclassmen, to a full schedule of study and recitations, and to frequent, exacting inspections. If he assumes this as training and not as insult he will probably persevere. Those who do stick with the School are often the soldiers who conscientiously developed themselves into a better asset to the Army all through their Army careers. They are seldom the soldiers who are seeking a soft berth.

There should be something about the man which, strip him of all rank, makes him obviously more than his contemporaries. He cannot be less. If he were feeble of physique, as an example, not only may he fail the physical fitness requirements but he may never realize self confidence. Others will not follow him and so he is not a leader. He should be someone others look to for an example of a soldier.

It has been the experience of tactical officers that a candidate with a backgroud of failures will be inclined to quit at OCS when the going gets a little tough. The opposite is also true: those whose personal histories reflect perseverance will stay with the School.

Candidates are required to be on the go practically all of the time, from reveille to tattoo. Therefore, any serious family or financial troubles are hard to deal with at the School. Often, the candidate has no recourse but to resign to have an opportunity to attend to his personal affairs. These should be investigated and the potential candidate warned not to attend until he can devote his full abilities to the prescribed course.

Poor physical condition is a factor which contributes to early resignations. If the candidate cannot make an average score on the physical efficiency test when he first enters, he finds that the physical strain holds him back during his initial weeks, exhausts him, and makes the routine often too much to bear.

Insofar as leadership is concerned, the battery commander should not be content to estimate or guess that the applicant has leadership ability. The battery commander should positively establish the applicant's possession or lack of leadership traits by observing the applicant in some leader position.

The qualities mentioned here are by no means all that should be considered. They are qualities which are often overlooked because OCS is not understood to be as demanding as it is. We hope that battery commanders will consider these factors when encouraging their men to attend OCS or when considering the nature of a recommendation about a soldier who has applied. Such consideration will help the Army produce officers from the enlisted ranks, and will save the time and money expended on applicants who will not measure up at OCS.

DEPUTY ASSISTANT COMMANDANT

COLONEL C. H. WHITE, JR., ARTILLERY

REDESIGNATION OF U. S. ARMY ARTILLERY AND GUIDED MISSILE SCHOOL

Effective 1 July, the U. S. Army Artillery and Guided Missile School will be redesignated the U. S. Army Artillery and Missile School.

REVISION OF U. S. ARMY ARTILLERY AND GUIDED MISSILE SCHOOL PROGRAM

On completion of class number 2-57 of the Associate Field Artillery Missile Battery Officer Course on 31 July 57, there will no longer be a Missile Career Course, as such, in the school program of the U. S. Army Artillery and Guided Missile School. A new course, to be called "The Corporal Officer Course," will replace the Missile Basic, the Associate Missile Battery, and the Associate Missile Advanced Courses.

The new course will be approximately 10 weeks long and is designed to train officers assigned or to be assigned to duties requiring a knowledge of the Corporal system. The purpose and prerequisites of the course, as proposed to USCONARC, are as follows:

Purpose: To train selected commissioned officers in duties and responsibilities of officers in Corporal missile units. MOS for which trained, 1190.

Prerequisites: Commissioned officer on extended active duty whose actual or next immediate assignment is to a field artillery battalion (Corporal) or to other duties requiring a working knowledge of the Corporal missile system. Graduate of an Artillery Officer Candidate, Basic, Battery, or Advanced Course. Minimum of 2 years active duty remaining on completion of course. Security clearance to include SECRET.

A schedule of 6 classes in FY 58 has been proposed to USCONARC. Other major changes that have been approved in the school program for FY 58 are as follows:

Increase of Field Artillery Officer Basic Course from 13 to 17 weeks.

Increase of Artillery Officer Advanced Course from 37 to 39 weeks.

Suspension of the Corporal Mechanical Materiel Maintenance Course.

Addition of a Senior Field Artillery Officer Course of 5 weeks duration (see item in last issue).

Addition of the Field Artillery Radar Maintenance Course (14 weeks), to train field artillery radar crewman.

Plans for additional changes in FY 58 include:

a. Establishment of the following courses:

Corporal Ground Handling Equipment Maintenance

Redstone Officer

Redstone Electronic Materiel Maintenance

Redstone Mechanical Materiel Maintenance

b. Separation of the present Field Artillery Officer Refresher Course (Res Comp) into two courses: a battery officer refresher and an advanced refresher, each to be of 2 weeks duration, with 3 classes in each course during the fiscal year.

THE NEW LOOK

Course designations have taken on a new look at the School. Department of the Army, in an attempt to establish a common reference for course numbers at service schools, has directed a new numbering system. Briefly, this system is as follows:

The first element is a digit which indicates the agency responsible for conduct of the course; thus, course numbers here at the School start with the number 6.

The second element is a code letter which indicates personnel categories that will normally attend the course.

The third element distinguishes a given course from other courses in that grouping. Officer career course numbers have a "C" followed by a number which indicates the level or type of career course. Functional courses have the letter "F" in the third element followed by a number assigned arbitrarily. Courses which train for an MOS have the MOS as the third element.

Courses currently approved for conduct in FY 58, with old and new numbers indicated, are as follows:

Course	Old number	New number
Field Artillery Officer Basic	6-O-A	6-A-C1A
Field Artillery Battery Officer	6-O-1	6-A-C2
Associate Field Artillery Battery Officer	6-O-2A	6-A-C3A
Artillery Officer Advanced	6-O-3	6-A-C4
Associate Field Artillery Officer Advanced	6-O-4A	6-A-C5A
Senior Field Artillery Officer	6-O-8	6-A-F6
Artillery Communication Officer	6-O-6	6-B-0200
Corporal Officer	(Not yet numbered)	
Field Artillery Radar	6-O-10	6-A-0140
Artillery Survey Officer	6-O-11	6-A-1183
Artillery Observation	6-O-12	6-A-1154
Artillery Motor Transport	6-O-15	6-B-0600 6-B-0606
Honest John Officer	6-O-23	6-A-F3
Divison Artillery Staff Officer Refresher	6-O-26	6-A-F5
Field Artillery Battery Officer Refresher (Res Comp)	6-O-34	6-A-C10
Field Artillery Advanced Refresher (Res Comp)	6-O-34	6-A-C11

Corporal Maintenance Officer	6-O-41	6-A-1191
Corporal Fire Control System Maintenance	6-OE-31	6-N-1186 6-N-228.2
Corporal Electronic Materiel Maintenance	6-OE-33	6-N-1192 6-N-224.2
Artillery Ballistic Meteorology	6-OE-35	6-N-215.2
Weather Equipment Maintenance	6-OE-36	6-N-8219 6-N-215.3
Field Artillery Radar Maintenance Advanced	6-OE-37	6-N-1121 6-N-211.6
Atomic Projectile Assembly (8-inch How)	6-OE-38	(To be designated)
Atomic Projectile Assembly (280-mm Gun)	6-OE-39	6-D-F4
Honest John Atomic Warhead Assembly	6-OE-40	6-D-147.2
Corporal Atomic Warhead Assembly	6-OE-43	6-D-224.3 6-D-226.2
Field Artillery Officer Candidate	6-E-19	6-N-F1
Field Artillery Reserve Component Officer Candidate	6-E-34	6-N-F2
Artillery Communication Enlisted	6-E-1	6-R-313.7
Artillery Radio Maintenance	6-E-3	6-R-313.1
Artillery Vehicle Maintenance Supervision	6-E-10	6-R-631.6 6-R-632.6
Artillery Flash Ranging Advanced	6-E-11	6-R-101.1
Artillery Sound Ranging Advanced	6-E-12	6-R-102.1
Artillery Survey Advanced	6-E-16	6-R-145.2
Artillery Track Vehicle Maintenance	6-E-21	6-R-632.1
Field Artillery Radar Operation	6-E-22	6-R-211.1
Field Artillery Radar Maintenance	6-E-41	6-R-211.2

REMINDER

Submit your extension course enrollment, DA Form 145, in one copy only.

SECRETARY

COLONEL JOHN W. DEAN, JR., ARTILLERY

U. S. ARMY ARTILLERY AND GUIDED MISSILE SCHOOL LIBRARY

The Library of the U. S. Army Artillery and Guided Missile School is producing a series of special bibliographies of interest to artillerymen everywhere. Bibliographies now published include:

Special Bibliography Nr	1	Saint Barbara, Patron Saint of Artillery
Special Bibliography Nr	4	History of Fort Sill
Special Bibliography Nr	5	Military Uniforms
Special Bibliography Nr	6	Artillery Unit Histories
Special Bibliography Nr	7	Military Songs
Special Bibliography Nr	9	Noted American Military Leaders of Past Wars
Special Bibliography Nr	10	Gen. William T. Sherman

The Library is prepared to provide copies of these publications and also to answer specific questions on subjects pertaining to the artillery and its history. The Library also maintains a file of unit crests. Requests for bibliographies or assistance in connection with the preparation of unit histories and the location of unit crests should be directed to the Librarian, U. S. Army Artillery and Guided Missile School, Fort Sill, Oklahoma.

PRIOR PREPARATION FOR RESIDENT COURSES IS A MUST

The number of officers attending the associate officer courses of this School who experience academic difficulties in one or more of the subcourses of their course is a cause for concern. Most difficulties are due to a lack of the essential background knowledge rather than to any lack of application and desire to learn.

Many of those students who experience academic difficulties exhibit a serious lack of knowledge of the fundamentals of gunnery and tactics and either do not have the necessary math background or have lost touch with math through disuse. Many of those who successfully complete the course do so only at the expense of a great deal of extra study and after duty hours coaching on the part of instructors.

It is suggested that all officers scneduled to attend an associate course at this School prepare themselves by prior study and review, particularly in the fields in which they are deficient in background knowledge. The best and most convenient medium for this study is the Extension Course Program. The Special Extension Course, "FA Gunnery," provides an excellent review in the gunnery area. Complete details of the program are found in the Extension Course Catalog of this School and in Department of the Army Pamphlet 350-60, "Announcement of Army Extension Courses." The Special Extension Course, "FA Gunnery," is listed on page 10.

A thorough review of basic algebra and trigonometry will considerably increase the student's learning potential while in residence. For officers selected to attend the Associate Field Artillery Officer Advanced Course, the special weapons phase of the Tactics and Combined Arms subcourse requires a reasonable competence in basic mathematics and in the use of the log log duplex slide rule. The text, "Mathematics for Field Artillery," under preparation now, will be stocked by the Book Department in the near future. This text will be an excellent medium for math review. Announcement of the availability of this text and its cost will be published in the next issue of "Trends."

The Extension Course Division offers a good medium for math review--subcourse 15, Exercises in Mathematics. See page 7.

Since the music of "The Caissons Go Rolling Along" has been adopted as the Army song, the Artillery needs another distinctive song. It is suggested that "The Mountain Battery" be used in place of the caisson song where artillery music is appropriate.

CAREER MANAGEMENT DIVISION, ARTILLERY BRANCH

BRIGADIER GENERAL M. M. MAGEE, USA, CHIEF

THE CIVIL SCHOOLING PROGRAM

Each year a number of Artillery officers are sent to civilian universities for graduate work, normally for a master's degree, in fields in which the Army has continuing requirements. This is a splendid opportunity for Artillery officers, both Regular Army and Reserve officers on active duty, to improve their professional qualifications and equip themselves to handle a wider range of assignments.

Officers are sent to school for graduate work in both the physical and social sciences. The exact fields as well as eligibility criteria and possible assignments on graduation are outlined in AR 350-200 and AR 350-205. All selections are competitive and the officer's military record as well as his undergraduate record is considered in making these selections. In addition to the eligibility criteria as outlined in paragraph 4, AR 350-205, officers of the Reserve Components must have completed not less than 6 years and not more than 12 years active federal service and, further, it is desirable that all officers entering the program be graduates of an Advanced Course.

The requirements for officer graduates in the physical science courses tend to be increasing each year. Qualified officers who apply for schooling in the physical sciences have a much better chance of selection, and definitely earlier entrance into the program, than they would in the social sciences. The fields in which the Army has the greatest requirements at present are:

Aeronautical Engineering
Electronics
Guided Missiles
Nuclear Physics

When an application is received, it is retained on file and given yearly consideration until the officer is accepted into the program, withdraws his application, or is no longer eligible due to age. An active application may be subsequently amended by letter.

Graduates of this program have the same opportunity for branch material assignments, promotion, and selection for senior service schools as do their contemporaries. A utilization tour of 3 years is the normal assignment on completion of this graduate schooling. Duty assignments subsequent to the completion of the utilization tour will depend on military requirements. At the present, it is anticipated that most graduates of this program who do not enter an allied specialist field will serve one additional tour of duty utilizing this schooling. Interested officers should read AR 350-200 and AR 350-205.

REMINDER

Submit your extension course enrollment, DA Form 145, in one copy only.
