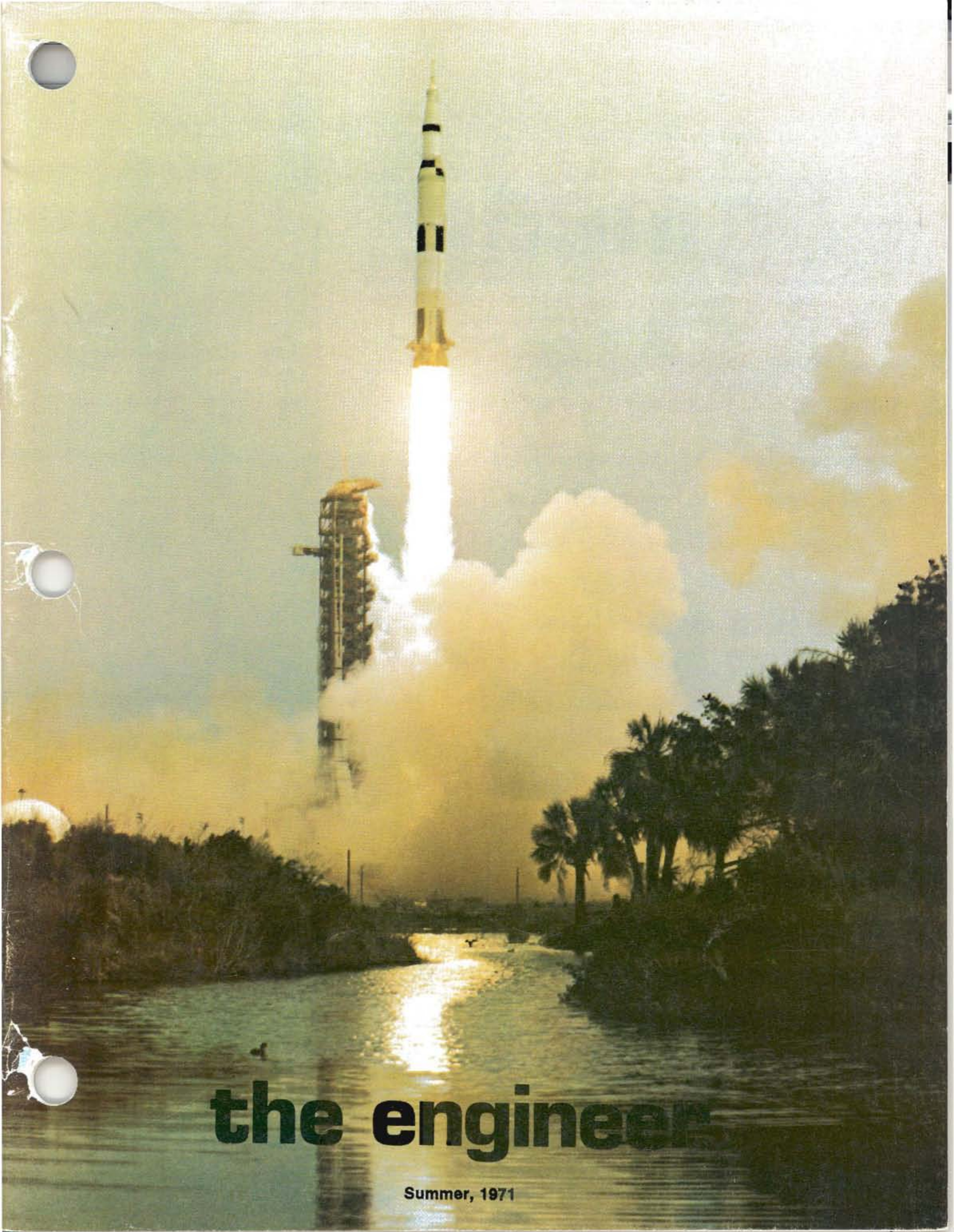


the engineer

Summer, 1971

the engineer

Summer, 1971

SUMMER 1971 VOLUME 1 NUMBER 2

designed for professionals

U.S. Army Engineer School
Fort Belvoir, Virginia

MG Robert R. Ploger
Commandant

BG Ira A. Hunt
Assistant Commandant

COL William F. Hart Jr.
Deputy Assistant Commandant

MAJ Tommy B. King
Officer-in-Charge

Robert G. McClintic
Editor

Michael J. Tercy
Associate Editor

CPT Tom Trivan
Circulation Manager

John W. Savage, Jr.
Art Director

The Engineer is an authorized quarterly publication of the U.S. Army Engineer School. It is published to provide factual and in-depth information of interest to all Engineer units. Articles, photographs and art work of general interest may be submitted for consideration to: Editor, The Engineer, USA Engineer School, Fort Belvoir, Virginia 22060. Views and opinions expressed herein are not necessarily those of the Department of the Army. Use of funds for printing of this publication has been approved by Headquarters, Department of the Army, July 11, 1969.

Subscriptions to THE ENGINEER magazine are available through the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. Annual rates are $1.50 for mailing to a domestic or APO address and $2.00 for mailing to a foreign address. Individual copies of the magazine are 50¢ each. Checks should be made payable to the Superintendent of Documents.

ABOUT THE COVER

Apollo 14 blasts off the launching pad at Cape Kennedy on another historic trip to the moon. Although no Engineer was aboard the space craft, the Corps made significant contributions to the success of the moon shot. It was the Corps that provided the maps which charted the astronauts path to the moon. It also was the Corps that supervised the construction of the Kennedy launch base.

engineer interview:

with lieutenant general Frederick J. Clarke

In fulfilling its never ending commitment to inform the Engineer Officer, **the engineer** *magazine went to the top of the Corps hierarchy to conduct a personal interview with the Army's Chief of Engineers, Lieutenant General Frederick J. Clarke.*

As Chief of Engineers, General Clarke is the project manager for Army engineering support and as such is responsible to the Secretary of the Army and the Chief of Staff for managing of a wide variety of engineering activities.

The General was appointed to the Corps highest position August. 1, 1969, following a three year assignment as Deputy of Engineers in Washington, D. C.

Commissioned in the Corps of Engineers in 1937 following graduation from West Point, General Clarke's career has been one of dedication to the Corps. In World War II he served as a battalion commander overseas and was later assigned to Washington for duty with Army Service Forces. In the post war period, the General had assignments in the field of atomic energy and at the Armed Forces Special Weapons Project at Sandia Base in Albuquerque, New Mexico. As District Engineer of the Trans-East District of the Corps in the late 1950's, General Clarke was responsible for military aid construction in Pakistan and Saudi Arabia and initiated transportation surveys in East Pakistan and Burma.

The General received his masters degree in civil engineering from Cornell University in 1940. He has also attended the Armed Forces Staff College, the National War College, and the Advanced Management Program of the Graduate School of Business at Harvard University.

In the early 1960's General Clarke served as the Engineer Commissioner for the District of Columbia, and from 1963 to 1965, as Director of Military construction in the Office of the Chief of Engineers. From 1965 to 1966, he served as the Commanding General of the US Army Engineer Center and Commandant of the Engineer School at Fort Belvoir, Virginia.

In carrying out his responsibilities as the Chief of Engineers, General Clarke heads the world's largest and most versatile construction agency. As manager of the Nation's comprehensive Water Resources Development Program, the Army Civil Works Program, the Chief of Engineers directs waterways planning, design, construction management and engineering service for the Army, and as assigned; designs and constructs for the Air Force, NASA, the US Post Office, and other U.S. Government agencies as well as governments from other countries.

The Chief of Engineers and his staff are actively engaged in providing general and specialized engineering support to the Army, which includes assistance in organizing, equipping, training, and force structuring of active and reserve Engineer units; the development of new and improved engineer techniques and materials; establishment of a worldwide geodetic datum for mapping through the use of satellites; as well as special studies with logistical and engineering implications for the joint and General Staffs.

In short, it can be said with great certainty that General Clarke, the Chief of Engineers, is a man with his finger on the pulse of the Army, as well as the Corps of Engineers.

ENGR: GENERAL CLARKE, PLEASE EXPLAIN YOUR ROLE AS CHIEF ADVISOR ON ENGINEER ACTIVITIES TO THE CHIEF OF STAFF.

CLARKE: This has been spelled out in Army Regulations in what I would call pretty formal language. However, I like the description that came out in some of the supporting papers that said the Chief of Engineers in essence is the systems manager for all engineering matters in the Army. Our job in this office is to make sure that all Engineer activities in the Army are moving together. This encompasses the development of doctrine, which is primarily the responsibility of CDC (Combat Development Command), the training, which is CONARC's (Continental Army Command) responsibility, development of equipment which is AMC's (Army Material Command) responsibility, and the field operations, which are under the respective field commanders.

We accomplish this task by looking into all aspects of Engineer operations in order to decide on areas which look as if they need special attention. Once this is done we can get those who are responsible to focus their attention to specific problem areas.

My office does this in many ways. Probably the best way is by discussion. By this means we reach agreements, sometimes on an informal basis, putting accent into areas where we think we are having trouble.

ENGR: WHAT IN YOUR WORDS IS THE REAL MISSION OF THE CORPS OF ENGINEERS?

CLARKE: Condensed down to a very few words, the mission of the Corps of Engineers is to enhance the capability of the Army to live and fight in the field. This, of course, includes the myriad activities involved in the host of combat engineering and construction tasks which we perform. All of our other missions, many of which are very significant and of great importance to the Nation, serve only to enhance the capability of the Corps of Engineers to provide this engineering support to the Army.

ENGR: WHAT ARE THE MAJOR ACCOMPLISHMENTS OF THE CORPS IN VIETNAM?

CLARKE: The war there has been called an engineer war and I would agree that we have been called upon to play a very important role in Vietnam. One of the biggest jobs the engineers were called upon to perform in Vietnam was the construction between 1965 and 1969 of 26 major base cantonments each housing from 1,000 to 40,000 men. Before 1965 the only major port in South Vietnam was in Saigon. We built or improved ports at DaNang, Qui Nhon, Vung Ro Bay, Cam Ranh Bay, Saigon and Vung Tau to handle all deep draft shipping. The Lines of Communications Restoration Program, better known as the LOC Program tasked Army engineers with the upgrading and hard surfacing of about 2,700 kilometers of highway. To date nearly 2,000 kilometers of this highway have been completed. Our engineers constructed 22 hospitals with more than a 6,000 bed capacity and built more than 15 million square feet of refrigerated, closed and open storage space to support the allied effort. Army engineers there have constructed 23 major airfields that can accommodate C-130 type aircraft. Eight of these airfields can handle jet aircraft. These are in addition to numerous other support strips which were built by Army engineers. Engineer efforts in Vietnam have been monumental and I think that we all can be proud of the accomplishments of the Corps in that country.

As in any large undertaking, we learned a great deal during our operations in Vietnam. As we learned and were faced with new conditions and requirements, we developed and introduced new equipment and concepts. During times of rapid buildup and deployment, there is always a tendency to reinvent the wheel. I believe we avoided that in Vietnam. One major innovation in Vietnam was the use of land clearing on a large scale with specialized equipment. Our Rome Plows have cleared over 700,000 acres of land. This has de nied concealment and refuge t the enemy, improved security and opened land for agricultural development by Vietnamese farmers. In order to do the large scale construction our battalions are engaged in with the LOC program, we purchased large commercial type construction equipment to augment our units' TOE equipment.

The commercial equipment increased production significantly and has worked so well that we are giving serious consideration to including certain items of off-the-shelf civilian construction equipment in the TOE of all our engineer units. Road construction in the Delta posed many problems due to the lack of aggregate in that area. Refinements in soil stabilization methods using lime-clay mixtures largely solved this problem fo us. With the advent of large sca use of helicopters in Vietnam, the control of dust became a major problem. The introduction of dust palliatives, chiefly peneprime, proved to be the answer to this particular problem.

We developed and introduced many new pieces of equipment in Vietnam to include: a light tactical aluminum bridge mounted on armored personnel carriers for rapid crossing of short gaps; sectionalized airmobile engineer equipment that could be transported by helicopter; a new lightweight, heavy-duty aluminum runway matting; pre-engineered and prefabricated DeLong Piers that were used to develop ports; and T-17 plastic membrane for airship and helipad surfacing. Of course this is just a partial listing, but I think that it is representative and can give you some idea of the magnitude of our work and development efforts in support of our role in Vietnam.

The major problem we have had in the past, and are still continuing to have, is trying to decide what areas really need the most attention. We have approached this problem in a variety of ways. The staff and I have been able to sense the most pertinent problem areas through our field visits. Through the visits we get reactions from people in the field and gain an insight into what areas need more attention and what should be done to make corrections. This method is probably the best in dealing with this problem.

We have within our military engineering directorate here, a group of people who are constantly analyzing all of the functions of the Army Engineers and evaluating on a subjective basis what areas need more activity. Additionally, we receive field reports that come in from such areas as mine and countermine warfare where there is a definite need for more activity. These are just some of the ways in which we determine where the force of the office should be directed.

ENGR: HYPOTHETICALLY, IF THE VIETNAM CONFLICT ENDED TOMORROW, WHAT WORTHWHILE TRAINING WOULD THE CORPS HAVE TO OFFER THE RETURNING ENGINEER OFFICER?

CLARKE: I think we are making some very definite progress in stateside training. The Army has wholeheartedly adopted the concept that our Engineer units that are in training will be used to meet general construction requirements at various posts, camps, and stations. However, I want to stress that these units would not be performing construction in competition with industry on projects approved by Congress in the Military Construction Army appropriation.

We are also in the process of setting up utility detachments which will perform basically the same function as conventional construction units. These detachments will be engaged in minor construction, and aid post Engineers in the States.

On the other hand, many Engineer units presently stationed in Europe have very heavy construction commitments which they carry out for the Air Force. These are often in addition to their "normal" commitments for the Army.

Similarly, as Vietnam draws down, we are going back to the posture that we had before the Southeast Asia conflict of assigning many more officers to our Engineer Districts. We are authorized to put 600 officers into this program and we are now utilizing about 400 of this number, many of which are lieutenants on the "Volunteer Indefinite Program." Of course, they are going to be disappearing soon and their places will be taken by captains and majors. I would anticipate that we are talking about two to three hundred additional captains and majors going into District assignments in both Civil Works and Military Engineering.

We also still have troops in many overseas locations such as Alaska, Hawaii and Panama. Also we have our Mediterranean Division, which is presently engaged in Saudi Arabia. Programs of these types will most certainly be continued. Likewise, we still have the Reserve assignments and ROTC instructors program and I am sure we will assign more officers in these areas in the future than we are currently.

This brings me to the point that I have been stressing. As the strength of the Regular Army goes down, we have got to make an all out effort to get the Reserves and National Guard up to the level to assume a readiness posture to back up the Regular Army.

ENGR: WHAT IS PRESENTLY BEING DONE TO REACH THIS

LEVEL OF READINESS TO WHICH YOU REFERRED?

CLARKE: Many things, such as assigning more and better qualified officers to Reserve and National Guard units, increasing equipment priorities and developing more realistic summer training programs.

The Army is also considering the "Sister Unit" approach, which I think is a good idea. Within this concept, a Reserve unit is allied with a unit in the Regular Army for training and administrative purposes. Some concepts would even make reserve battalions or brigades a formal part of a Regular Army unit. The only difference will be that the unit will not be on active duty.

I think this will bring up the esprit and morale of the Reserve and National Guard units, and will enable the Army to utilize all Engineer units to their fullest potential .

ENGR: WHAT IS BEING DONE TO IMPROVE THE MILITARY ABILITY OF THE CORPS?

CLARKE: We are continually trying to improve the equipment and materials that our engineer soldiers work with in the field. We are well along in the development of new and improved floating and fixed bridges that will materially improve our bridging capabilities. A great deal of effort is going into mine and countermine warfare. Our research and development work had produced some very promising new concepts in this area that we hope will solve some of our present short-comings. We have studied new organizations for the construction and combat battalions and will be field testing a new functionally-organized construction battalion Table of Organization and Equipment (TOE) next year. New and improved engineering design and rapid construction criteria for combat support facilities are being developed that are responsive to the needs of modern, highly mobile warfare. We are upgrading the instruction

and training of our engineer soldiers and officers. In capsule form, we are attempting to train and organize our engineers to obtain the maximum results from the best equipment in the world.

ENGR: WHAT MILITARY PERSONNEL SHORTAGES IS THE CORPS CURRENTLY FACING?

CLARKE: At this time, and for the immediate future, the only officer shortage of real concern occurs in the grade of major, where only slightly more than 50 percent of the authorized strength is available. Strengths of other commissioned grades are in relative balance. The major's situation should improve as future promotion boards meet and the Army approaches its lowered strength objectives. And we also have retention of our junior officers to help meet our needs. I have been very much impressed by many of our new junior officers in recent years. They are highly qualified and well motivated. The attractiveness of the Volunteer Indefinite program and continuing educational opportunities have provided significant incentives for many to stay in. I would encourage them to take advantage of the many opportunities available to them and consider a full service career. They are to be our majors of tomorrow who will contribute to the future successes of the Corps. Every field grade officer should keep this in mind, and counsel these young officers at every opportunity to insure they are aware of the future that is ahead.

As with the rest of the Army, shortages of enlisted skills and qualifications are being experienced. The Skills Enlistment Option Program, designed to attract personnel qualified in many of the construction skills, has contributed positively to gaining skilled enlisted personnel within the ranks.

ENGR: GENERAL WESTMORELAND HAS SAID THAT THE ARMY NEEDS BETTER LEADERSHIP. HOW DOES THIS APPLY TO THE CORPS OF ENGINEERS?

CLARKE: I think the demand for better leadership in all armies has been universal ever since the first army in history took to the field. Certainly, our Army today and the Corps need the very best leadership the country has available. Our troop leaders are faced with social problems that may not have been present in the past. Racial tensions, drug addiction and the public reactions to an unpopular war all create new problems for our leaders. There is a communications problem between some of our young enlisted men and some of the older officers and NCO's that needs to be solved and poses problems for our leaders. As we move toward a Volunteer Army and a major reduction in strength as the war in Vietnam winds down, the challenges to leadership will be even greater because we must continue to provide the kind of an Army the Nation deserves and needs We see little in the future which would indicate that we should lower our Nation's guard. The challenge to leadership in the Corps will be to do more with less—in terms of both money and personnel.

ENGR: HOW IS THE CORPS INVOLVED IN ENVIRONMENTAL CONTROL?

CLARKE: The most visible part of our activity in the environmental protection field is our permit program. This program establishes a nationwide Federal Permit Program to regulate discharges in the Nation's navigable waters and their tributaries. The Refuse Act—Section 13 of the Rivers and Harbors Act of 1899—prohibits discharges, except from public streets and sewers in liquid form, into any navigable waters of the United States or their tributaries without a permit issued by the Corps. This particular piece of legislation was designed and written to prohibit obstructions to navigation, but the Corps tested its application in non-navigation related matters after several levels of appeal. All applications for permits under the Refuse Act will be referred to the state water quality agency concerned and to the federal Environmental Protection Agency to insure compliance with both state and federal water quality standards before any permit will be approved.

We also have initiated pilot studies to develop regional waste water management systems for five major urban areas in the country; the Merrimack River Basin in New England, the greater Cleveland, Detroit and Chicago metropolitan areas on the Great Lakes and the San Francisco Bay area in California. With the inclusion of waste treatment and disposal plans in our studies of entire river basins, the Corps of Engineers experience in water

resource management can now have an equally important role in cleaning up the environment. This is a program that I believe has great promise for measurably improving our streams and one in which I believe that the Corps is uniquely qualified to assist.

Our efforts in the Civil Works Program are changing somewhat in emphasis to reflect the public's growing desire that the development of our natural resources for economic benefits no longer be the sole criteria for our work. Rather, people seem willing to forego, or to pay more for, their immediate needs so that the quality of their environment may be preserved and enhanced for the future. In that light, environmental values are now being given full consideration along with economic, technical, social and other factors when we study alternate means of meeting human demands. We are attempting to keep resource options open for future generations as far as it is possible to do so.

Our construction contacts now require that contractors comply with the applicable federal, state and municipal regulations to minimize environmental degradation on all of our projects. We have issued guide specifications requiring that a separate section of the technical provisions in our Civil Works and military construction contracts be devoted to environmental protection. These provisions cover such things as land defacement by improper or unnecessary bulldozing, erosion control and dust and smoke control.

ENGR: HOW CAN THE YOUNG ENGINEER OFFICER BECOME INVOLVED IN THIS ENVIRONMENTAL CONTROL ACTION WHILE HE IS ON ACTIVE DUTY?

CLARKE: He can become involved with our environmental protection program most directly by assignment to one of our Engineer District field offices where the work is actually performed. The great preponderance of our responsibility for environmental considerations is handled in the Districts. Certainly, post facilities engineers are going to be deeply involved with environmental considerations at their posts so assignments in the facilities engineering field will be another area where a young engineer officer could well become involved with all of the environmental protection activities.

FROM SOUTH OF THE BORDER ---down panama way

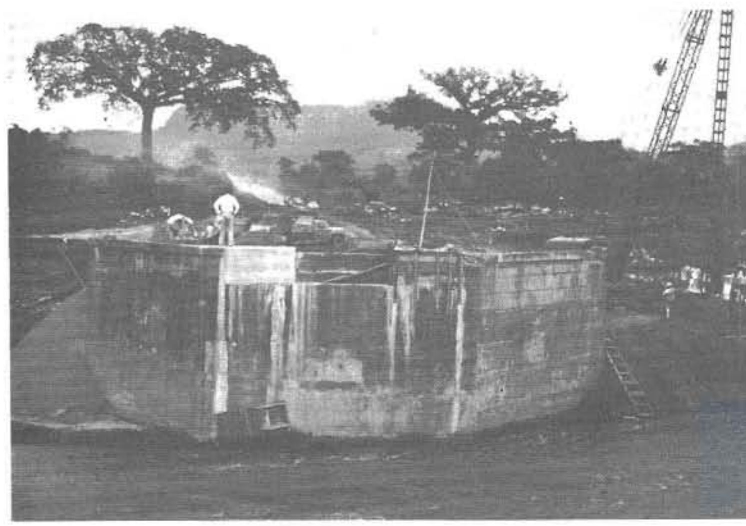
by Captain Dennis F. Pierman

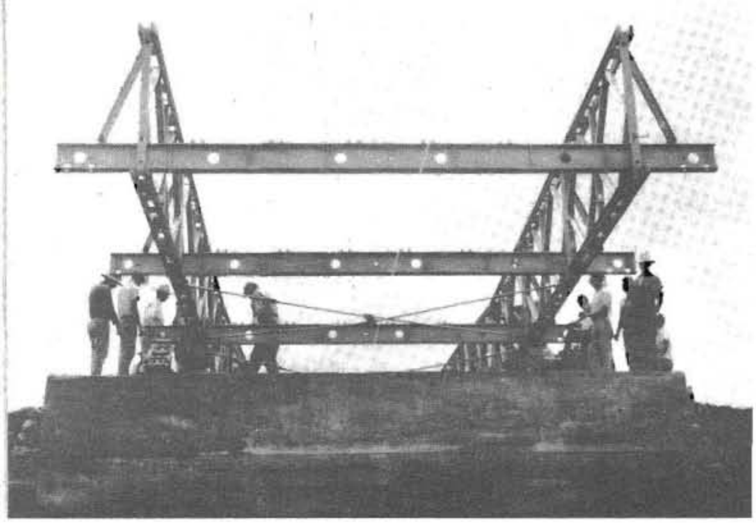
Tucked away in the timeless jungles of tropical Central America is an unusual engineer unit affectionately called an ECAD (Engineer Control Advisor Detachment) by Department of the Army. One of two in existence, the 146th Engineer Detachment (Control Advisor —Airborne) is attached to and provides specialized support for elements of the 8th Special Forces Group (Airborne) 1st Special Forces, the Special Force for Latin America.

The base of operations for the 8th Special Forces Group and the 146th ECAD is remote Fort Gulick, which, along with its nearby sister post of Fort William B. Davis, is nestled in the embrace of the Panama Canal on the Atlantic side of the isthmus. Both Gulick and Davis are on sites carved out of the steamy jungle during the construction of the Panama Canal and are surrounded wih mounds and debris of hundreds of abandoned bunkers constructed during World War II. Nearby is Coco Solo Naval Base, a World War II ghost town of empty hangers and windowless buildings which affords the Atlantic area installations the use of its airfield and storage space. All of these military installations are within the political confines of the Canal; one, a U.S. entity established within the Republic of Panama by treaty.

In support of the 8th Special Forces Group and as part of the Special Action Force for Latin America, the 146th ECAD provides specialized engineer-related support to U.S. nation-building activities in that area of the world. Utilizing Fort Gulick as its base of operations, the detachment additionally provides engineer support to the part of the Special Forces mission that deals with the application of the principles of unconventional warfare and internal defense and development of the host countries.

The mission of the 146th Engineer Detachment can be broken down into four discernible areas. The first requires that the detachment maintain the capability to deploy Mobile Training Teams to provide military instruction in engineer-related fields to personnel of the host country. Secondly, the 146th must be prepared to deploy Technical Assistance Teams capable of providing assistance to the military and paramilitary forces of Latin





America in the technical aspects of equipment maintenance and operation, logistics, construction projects and conduct of counterinsurgency operations. In the third area, the unit must be equipped to provide Civic Action Teams to assist the civilian population in nation building activities. Lastly, the 146th must provide physical support in setting up Special Forces Operational bases and furnish guidance to the 8th Special Forces Group command and staff.

Tailored to the advisory concept, the 146th ECAD is organized on three levels, consisting of a 10-man headquarters, two, seven-man control teams and six, six-man advisory teams. The Headquarters Team (KA Team) provides supervision and staff planning for the operation of engineer elements assigned or attached to the Special Action Force. In addition, the KA Team provides an engineer staff to the Special Forces Group and furnishes administrative support for subordinate teams in the detachment. The Combat Teams (KB Teams) provide engineer staff personnel for the Special Forces command and control element subordinate to the Special Action Force. Also the team provides supervision and staff planning, coordination and administrative support for subordinate engineer advisory teams prior to and during deployment on nation-building missions.

The Advisory Teams (KC Teams) are the points of contact who physically deploy to the host country as either Mobile Training or Technical Assistance Teams (MTT or TAT). They are geared to support their own tactical elements of the Special Action Force in counterinsurgency roles and assist and advise U.S. military forces when committed in support of host country forces. The KC Team also advises host country engineer forces on Civic Action type projects in support of nation-building activities. As members of Special Forces, they are authorized to wear the distinctive Green Beret and must be qualified parachutists. Additionally, because of frequent advisory assignments, at least one KC Team must have a Portuguese language-qualified member. Also, there must be at least two Portuguese language-qualified individuals assigned to the KB Team. The remainder of the detachment must all be Spanish language-qualified personnel.

Since its inception in 1963, the 146th Engineer Detachment has been deployed on 147 Mobile Training, Technical Assistance and Civic Action missions to Latin America. Host countries have included every Latin American nation except Mexico, Haiti, British Honduras, the Guianas, the British, French and Dutch protectorates in the Caribbean and of course Cuba.

Individual mission requirements have covered a broad spectrum of engineer-related activities. They include: engineer construction; surveying; maintenance of both wheeled and tracked equipment; equipment operation; road and airfield construction, ferry operation, electrical power generation, sanitation and a host of other important endeavors.

A Mobile Training Team (MTT) concerns itself with classroom and field instruction of selected members of the host country's military organizations. The program of instruction is oriented toward turning the students into instructors in their own right; tried and tested in the reality of their own local environment.

A recent MTT to Venezuela exemplifies the kind of mission with which similar teams have had to contend. A select three-man team was deployed to the Venezuelan Army Engineer School with the mission of training 25 host country counterparts in the operation of a new water purification units. These units were to be manned in conjunction with military units providing civic action and disaster relief. Actual training consisted of 200 hours of instruction and practical exercise conducted in Spanish. As a result of this training, the 25 instructor-qualified Venezuelan engineers learned enough in 45 days of accelerated study to effectively train contemporaries in their own unit.

These specialized teams are designed to provide on-the-spot assistance to host country personnel in the problems encountered in equipment maintenance and operation, logistics, construction projects and the conduct of counterinsurgency operations. Technical Assisance Teams aid immensely in furthering the present U.S. policy of helping developing nations to help themselves. It is perhaps one of the most effective means of providing economic assistance.

In October 1969, the 146th deployed an eight-man team to Guatemala to provide expert assistance in replacing hurricane-devastated bridges on a key road network. Because the time element was critical and economic loss to the Guatemalans was close to $50,000 per day, Baily Bridging was employed over the two, 200-foot spans involved. Aided by indigenous labor, the team replaced the demolished spans in three weeks. In addition to organizing and supervising the installation of the bridges, the team members trained a 200-man force to help in construction and for use in future disaster work.

The last of the three types of engineer missions to Latin America is best illustrated by a recent successful project in the town of Miguel de la Borda in the Republic of Panama. The project was ferry construction at a location selected by the local villagers. The problem was to make the villager's plan workable so the inhabitants of the area could gain access to the economy of the major port city of Colon, 50 kilometers to the north. When the project was completed, the 146th had made a significant contribution to both the economic well-being of the villagers and their pride in themselves at having seen their ideas become reality.

Through its many and varied activities, the 146th Engineer Detachment performs an invaluable service to the United States and our Latin American neighbors. Its MTT's, TAT's and Civic Action endeavors have contributed significantly to economic growth and political stabilization, engendering the hard-to-get respect and friendship of peoples normally too nationalistic to welcome a "gringo."

The 146th is prepared for its important role in a volatile Latin America and is justifiably proud of its accomplishments. Perhaps the future will find it elsewhere in the hemisphere, poised to deploy in support of the nation-building tasks of the Special Action Force.

Captain D. F. Pierman served with the 146th Engineer Detachment from November 1969 to April 1970 as a team leader and later as the adjutant. He is now assigned to the Engineer School as the Special Assistant to the Information Officer.

Gazing through the Crystal Ball

by Colonel Jack G. Becker

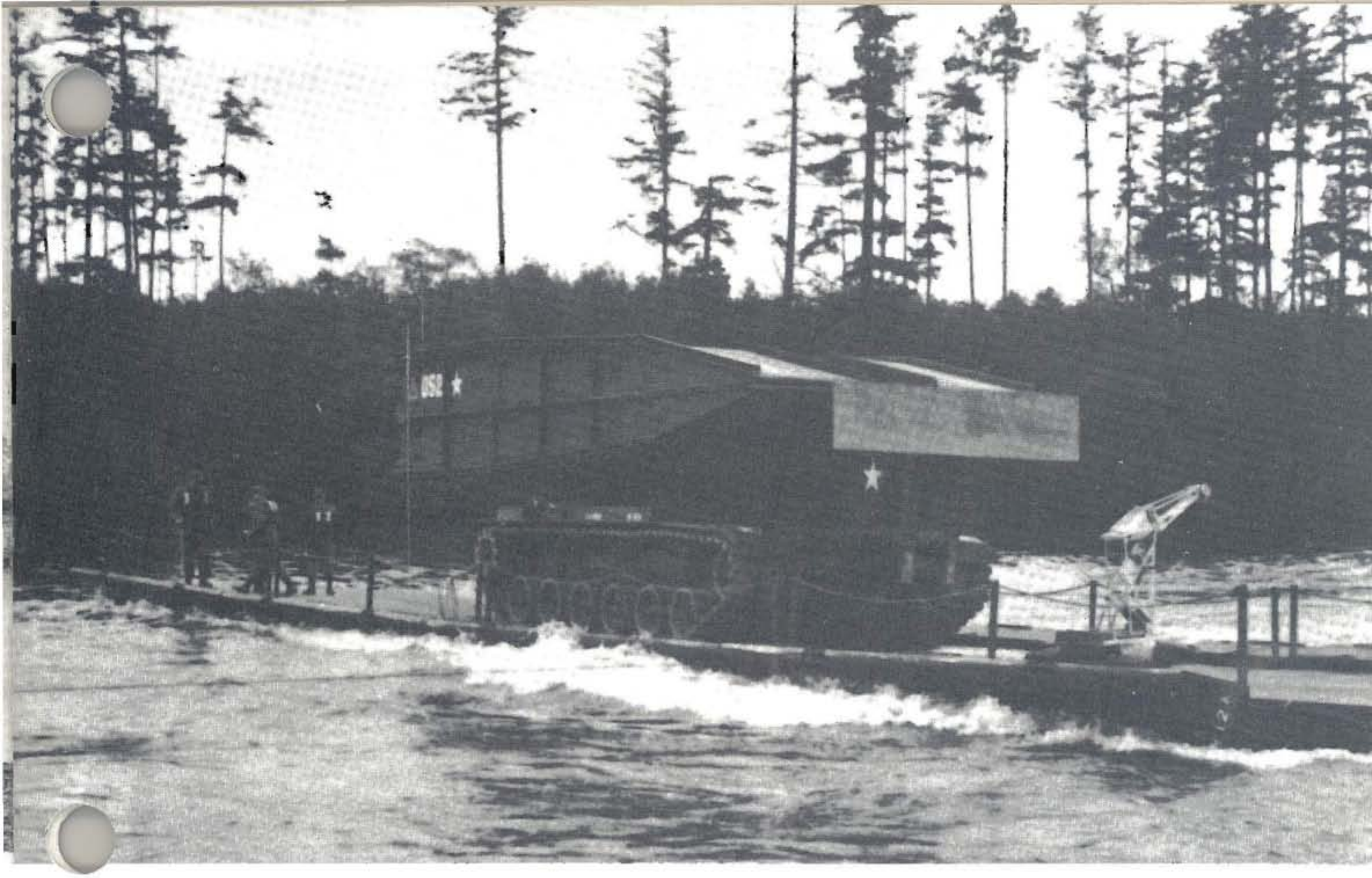
Have you ever considered the advantages of having a longer bridging capability for the Armored Vehicle Launched Bridge (AVLB)? Or, how about a skill-oriented, functionalized construction battalion? Or a mine detection capability from an helicopter? Or a controlled explosive device to increase earthmoving capability by 20 or 30 times?

Although this type of thinking may go on in the mind of the engineer in the field, it usually is only a passing thought. However, for he Combat Development Command Engineer Agency (CDCEA), ideas such as these are all in a day's work. Located at Fort Belvoir, Virginia, as a subordinate element of the U.S. Army Combat Developments Command (CDC), the Engineer Agency is eternally striving to meet the Engineer's present and future needs.

Though the Agency's mission has many facets, it is basically twofold. First, the Agency is the spearhead in organizing, informing and equipping the Engineers for efficient and effective operations today.

Secondly, the Engineer Agency functions as the prime catalyst in providing for Engineer organizations and equipment of tomorrow. This phase of activity is conducted in a two-step cycle.

The first step is to undertake studies which define future Engineer roles and capabilities. To do this successfully a certain amount of "crystal ball gazing" must be performed. This "gazing" attempts to identify future Engineer



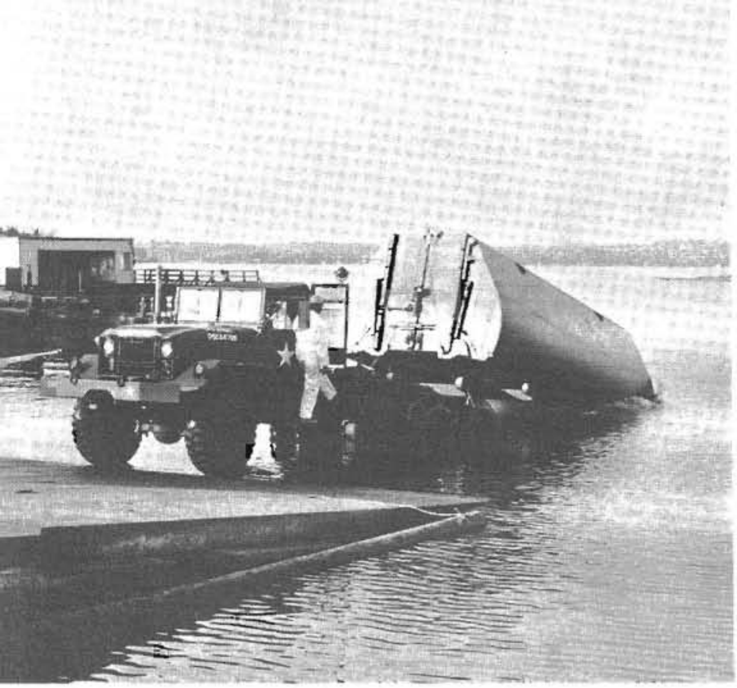
Sections of the Ribbon Bridge being used as a power raft to expedite the river crossing of an Armored Vehicle Launched Bridge (AVLB).

considerations and problem areas. Additional creative analysis must then be undertaken to devise various alternatives or solutions to the indentified problems. Evaluation of these alternatives is accomplished by considering cost, effectiveness and relationship to other Army Forces, to derive recommended solutions. Once this is accomplished, the studies are forwarded through command channels to the Department of the Army (DA) for final approval.

A description of new engineer material required to accomplished future Engineer support is the second step of this cycle. It is initiated during the early stages of the studies, and normally extends past their completion dates. The Agency pursues this task by drawing up the material requirements for new or improved engineer equipment and coordinates them with other elements of CDC, appropriate branch schools and material developers. After approval by DA, these requirements initiate the research and development cycle of new items. The Engineer Agency monitors the item's progress through the research, development, test and evaluation phase to insure that it will meet the needs of the user in the field.

Studies completed recently have dealt with tactical bridging requirements, mine/countermine operations, a Family of Military Construction Equipment (FAMECE), and maps and related terrain data requirements.

One of these studies, "Tactical Bridging for the Field Army in 1975," concentrated on three particular geographic areas where fu-



A section of the Ribbon Bridge during a launching operation.
After launching the bridge into the water, the section is unfolded. . . .

ture military activity might be expected. The frequency and nature of the tactical gaps in these areas were established from aerial photography and past terrain surveys. From this data broad requirements for new or improved bridging mehods were derived.

One of the recommendations of this study was that the armored vehicle launched bridge (AVLB) be increased from the present 60 feet to a length of 90 feet. The study also recommended a "ribbon" float bridge for crossing water obstacles. This new bridge provides for a construction rate of 22 feet per minute, at least three to five times the present construction rate.

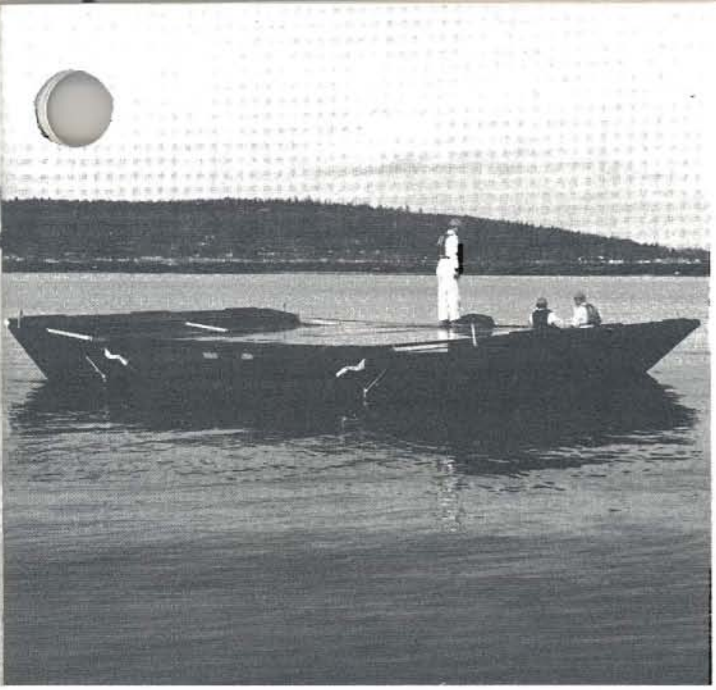
The ribbon bridge is also adaptable to a raft configuration and can be used to complement the mobile floating assault bridge for ferrying operations. A prototype of this bridge is now being tested on both still and fast water in the state of Washington.

Many Engineers have believed for some time that the construction capability of Engineer units could be increased through the adoption of selected commercial construction equipment currently being used by civilian contractors. Advantages foreseen included the use of the latest equipment, ready access to manufacturers' spare parts sources and the ability to tap the manufacturers' hot production lines in the event of national mo bilization. A significant saving was also vis ualized in research and development costs and in elimination of desirable, but unecessary, military design characteristics.

Impetus toward adoption of this plan was generated by the Vietnam buildup. Civilian contractors with their lates civilian equipment and techniques worked side-by-side in the Republic of Vietnam with Army construction units. On an item-by-item basis the contractor's increased capabilities became very apparent.

In response to the newly stated DA policy to adopt commercial construction equipment for use where such action is advantageous to the Army, the Engineer Agency has identified candidate items and prepared abbreviated performance characterisics for use in procurement of such equipment. The first pilot item being processed is a 25-ton hydraulic truck mounted crane as a replacement for the 20-ton truck mounted crane. Other items, including a 20-ton dump truck, are being worked on.

The Mine/Countermine Study (MICMIS was conducted by the Engineer Agency i 1970 to examine the organization, doctrine,



Once fully extended in the water, the sections are linked together as required.
Engineers preparing for retrieval of the Ribbon Bridge section.

and training aspects of mine and countermine operations. Among other things, the study analyzed operations in Southeast Asia to consider the application of lessons learned there to other areas of the world and various levels of conflict. Primary recommendations of this study included the provision of mine/countermine specialists in many units and staff sections. Also advocated was the adoption of an integrated countermine approach to include surveillance, inteligence, and area denial, as well as mine detection and neutralization.

A major portion of the Agency effort is devoted to the preparation of new TOE's (Table of Organizations and Equipment) and the updating of existing TOE's. The Engineer Agency develops the TOE for the Engineer Battalions organic to various divisions. In a recent revision of the TOE for the Airmobile Division, the Agency succeeded in adding a fourth long needed combat company.

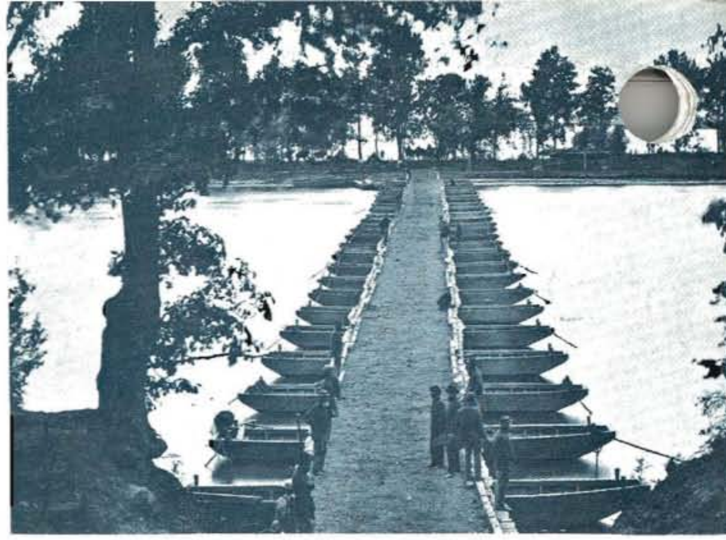
In eleven field manuals, the Engineer Agency is listed as the address to submit changes or corrections. The Agency revises these manuals as required to include the latest doctrine on Engineer field operations. In addition, the Agency offers a service to answer any questions from the field on interpretation of such doctrine.

The Engineer Agency is always on guard for new and unique ideas. To some Engineers, the idea of explosive earthmoving equipment is a "wild, new" idea. But the concept is feasible. Prototypes of the equipment are being tested and the Army may soon realize a tremendous improvement in capability through the application of this concept.

Engineers of bygone days can probably remember the Blast Driven Earth Rod, the Combat Engineer Vehicle, the Mobile Assault Bridge/Ferry or the Armored Vehicle Launched Bridge. These items were also considered "wild, new" ideas, but they grew to be useful items of engineer equipment.

CDCEA is tasked to review, evaluate and refine these types of "wild" and "new" ideas today in order to better prepare, organize and equip the Engineer of tomorrow. The Engineer Agency is proud of its past accomplishments and is constantly rededicating itself to the future of the Army and the Army Engineer.

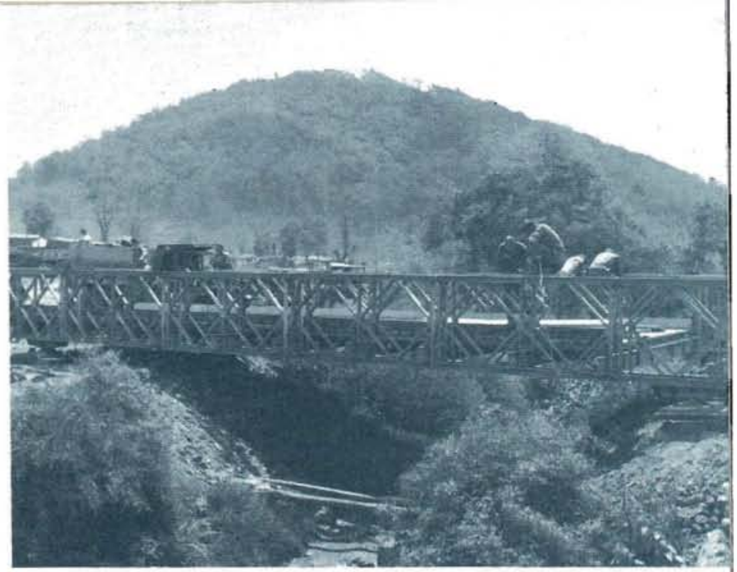
Colonel Jack G. Becker served as Commanding Officer of the Engineer Agency Combat Development Command, from 21 July 1968 to 7 June 1971.



A Salute to the Corps

by W. T. Spriegel

Engineers have provided combat support in every war and campaign in which the U. S. Army has been engaged. From the trenches of the Revolutionary War to the torrid jungles of Vietnam, Engineer soldiers have stood proudly—leading the way for others to follow.



The history of this country's progress can be traced by the phenomenal engineering feats accomplished by the United States Army Corps of Engineers over the past 196 years. Exploration and surveying of the West; surveying of the Northern Railroad; construction of the Panama Canal; the flood control programs; the planning and construction of our great dams and the Great Lakes Seaway are but a few of such major contributions to the development of the United States.

The Corps is one of our Nation's oldest and most respected military organizations—its history spanning a time frame dating from today back to June 16, 1775 and a resolution of the Continental Congress under which General George Washington named Colonel Richard Gridley as Chief Engineer of the Continental Army. Since that time, the history of the expansion and development of the Nation from the Atlantic States to the Pacific Ocean and beyond has been marked by engineer accomplishment.

Although Congress commissioned several engineers, Gridley alone retained the rank of Chief Engineer until the Chevalier Louis le Beque DuPortail from France was made Chief of all engineers in the Army, by resolution of Congress in July 1777 with the rank of colonel. He was commissioned brigadier general the following November.

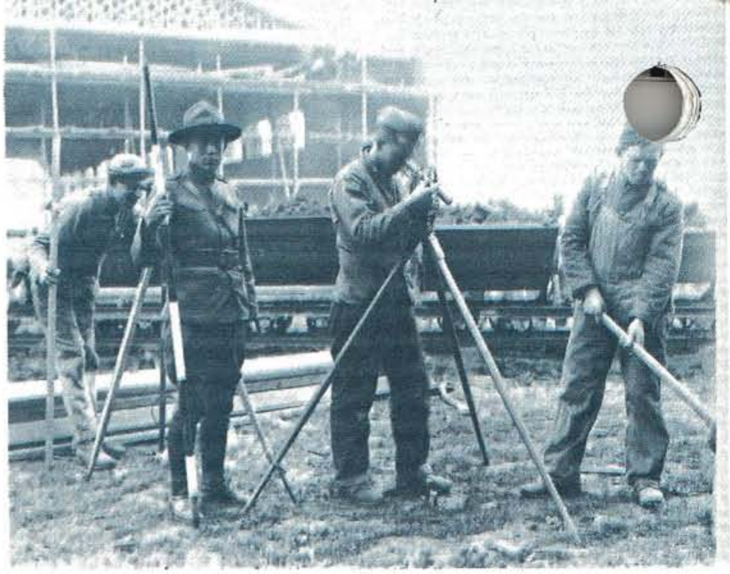
As Chief Engineer, and later as the first Commandant of the "Corps of Engineers," which Congress formally established in 1779, Chevalier DuPortail of France became one of General Washington's most trusted military advisors. He subsequently drew up the plan for a new Engineer Department, which later gave rise to the Corps of Engineers as we know it today, and the establishment of the US Military Academy at West Point in 1802. DuPortail has been called the Father of the Corps of Engineers. For 64 years, until it was placed under the Army-at-large in 1866, "West Point," the first—and for nearly a quarter of a century, the only—engineering school in the Nation was a Corps installation managed by the Chief of Engineers.

Since its inception, the Corps of Engineers' primary mission has been to provide combat support to our fighting Army. The Corp's success is readily evident by the distinguished battle record which engineer troops have racked up over the years. Engineers have been at the forefront in every war and campaign in which the United States Army has been engaged. From Bunker Hill, where Colonel Gridley, the first "pick and shovel" combat engineer, was wounded, after having taken spade in hand to help throw up the defenses which he himself had so painstakingly planned by lantern light the night before—to the steaming jungles of Vietnam, engineers have lent the weight of their considerable talents to speed the advance of friendly forces and to impede enemy movement.

The period from 1802 to 1866, which included the War of 1812 and the Mexican War, dramatized the importance of the United States Army in the development of the Nation as it expanded from the Atlantic to the Pacific Ocean. Leading the way were Army Engineers making early surveys for canals and railroads, extending the National Road, eliminating navigational hazards in the Ohio, Missouri and Mississippi Rivers, opening up harbors for steamships on the Great Lakes and building lighthouses for safe navigation. Others fought Indians while mapping their way across the continent.

During the Civil War winter of 1861-62, the "Battalion of Engineers," as part of the Army of the Potomac, constructed the defenses of Washington, D.C., and performed the many duties assigned to engineer troops as pontoniers, sappers, and miners. They pioneered construction and road repairing and trestle or crib bridges. At the sieges of Yorktown and Petersburg, the Battalion served as sappers and miners, and carried out a vital special assignment—responsibility for the bridge trains which accompanied the Army of the Potomac in all its movements from 1862 to 1865.

After the Civil War and up to the beginning of World War I, Army engineers were occupied mainly with peace-time work. They were managing America's water resources under a Civil Works program which had begun in 1824 with the passage of the first River and Harbors Act; they were directing surveys of the Nations riches in the vast underdeveloped territory of the West; and they were strengthening the seacoast defenses of the United States.



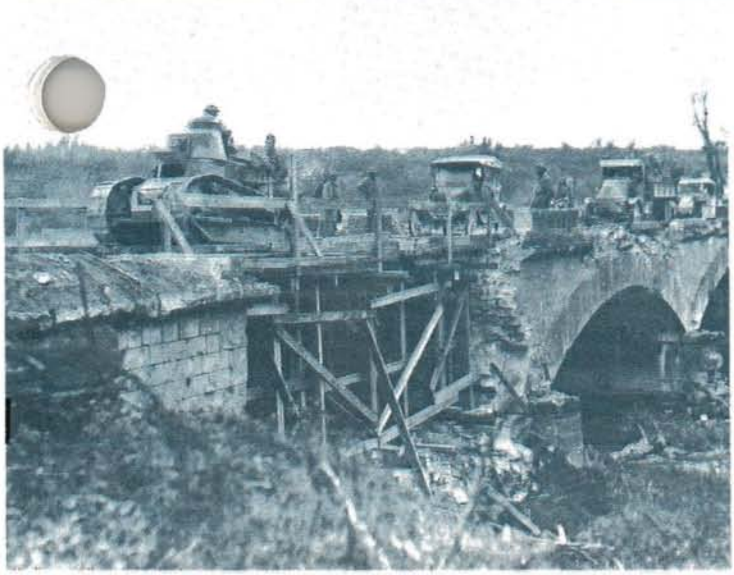
The Corps has been the principal developer of the Nation's water resources. From its initial task assigned by Congress in 1824 of clearing some snags and sandbars from the Ohio and Mississippi Rivers to facilitate navigation, until 1879 when the Mississippi River Commission was created, the Corps' activities in this aspect of civil works was limited to improvements for navigation. With the Commission's formation, flood control became a responsibility—at first in the alluvial valley of the Mississippi as a function incidental to improving the river from the mouth of the Ohio to the Gulf of Mexico, to provide safe passage for increasing numbers of commercial vessels. A few years later the Corps was charged with regulating hydraulic mining in California's Sacramento and San Joaquin Basins. It was also called upon to construct debris basins, and to institute other measures designed to prevent the creation of hazards to navigation resulting from such mining. All inventive minds were active during the post Civil War period. Inventions important to modern engineering were developed. Army Engineers built the great Panama Canal—a peacetime project considered the greatest engineering accomplishment of all time, and one which became vital to National Defense. It was a prologue to the extensive involvement of civilian and military engineers in World War I.

History records that engineer troops were first in action and the first to suffer casualties during that "war to end all wars." At the outset, the Corps was faced with problems of the first magnitude. Engineer supplies of all kinds had to be procured and transported. Timber had to be acquired through negotiations with the French, to construct training camps, supply depots, hospitals, barracks and housing. Engineer units built hundreds of bridges, repaired and constructed roads—and special engineer troops were designated to provide water supply. Searchlight units were trained and sent to France for defense against night bombing. Engineer schools for officers and enlisted men were established both in the United States and France to meet the demands placed on the Corps of Engineers. When the firing ceased, engineer troops remained to assist in the rehabilitation of France.

At Normandy in World War II, the first soggy GI boot was that of an engineer who, with his fellow trooper technicians, stormed ashore to clear the beaches for the Infantry. Combat engineers carried out three-fourths of all major landing operations during that global conflict. Following a long established pattern, engineers were in the advance element in every theater of operations, with newly developed engineer devices such as bulldozer blades mounted on medium tanks helping American armor slice through Brittany, across France and into Germany. In the Pacific, engineers created airfields in the jungles, built the Ledo and Burma Roads, and transformed wilderness into huge bases and ports. Immediately after Pearl Harbor, the Corps of Engineers was made responsible for military construction in the United States, previously a responsibility of the Quartermaster Corps. Army Engineers built more than 3,000 command installations, 500 camps, 765 airfields, 300 major industrial projects, 167 storage depots, and thousands of miscellaneous military facilities. They constructed the Alaska (Alcan) Highway reaching 1,523 miles from "head of steel" at Dawson Creek, British Columbia, through the Yukon Territory to Fairbanks, Alaska—and carried out the epic assignment of helping to develop an atomic bomb.

When, in June 1950, United States forces were again mobilized against communist aggression in Korea, engineers rallied to their motto of "Essayons" (Let Us Try) to pit their skills against engineering problems imposed by rugged country dominated by rocky, treeless mountains, narrow valleys, swift rivers swollen by summer rains, and would-be roads—little more than trails—winding through mountainous terrain or along dry river beds.

In the early stages of desperate, hard fighting in that land, engineers laid aside their tools and desire for enginering accomplishment, and as a necessity grabbed their weapons and assumed their secondary roles as infantry troops. The success with which they performed in that capacity is well documented. One of the most important accomplishments of Engineer troops during the Korean war, among many other combat situations which they faced, was the particularly brilliant



rear-guard action they fought to protect troop withdrawals from the Yalu River. For these men, no job was impossible in one of the most rugged areas of the world. And during the Korean period, Army engineers built strategic air bases at remote locations throughout the world, including Greenland and North Africa; constructed a complete line of supply and communications facilities across the breadth of France; and established air raid warning systems in Labrador and Greenland.

Today the Corps of Engineers continues in its military functions by providing engineer combat and construction support to all units of the Free World Forces now serving in the Republic of Vietnam. Courageous, energetic and resourceful, engineers face the steaming jungles, monsoon rains, dust, sand and mud to overcome the problems which only they, with their consumate skills, dare to attack. In Vietnam, Engineer battalions have succeeded in completing construction projects which constitute some of the most startling achievements of modern times, and a major boost to the program which we commonly refer to as Vietnamization. The three jet-capable airbases existing in that country in 1965 were increased by fifteen in four years.

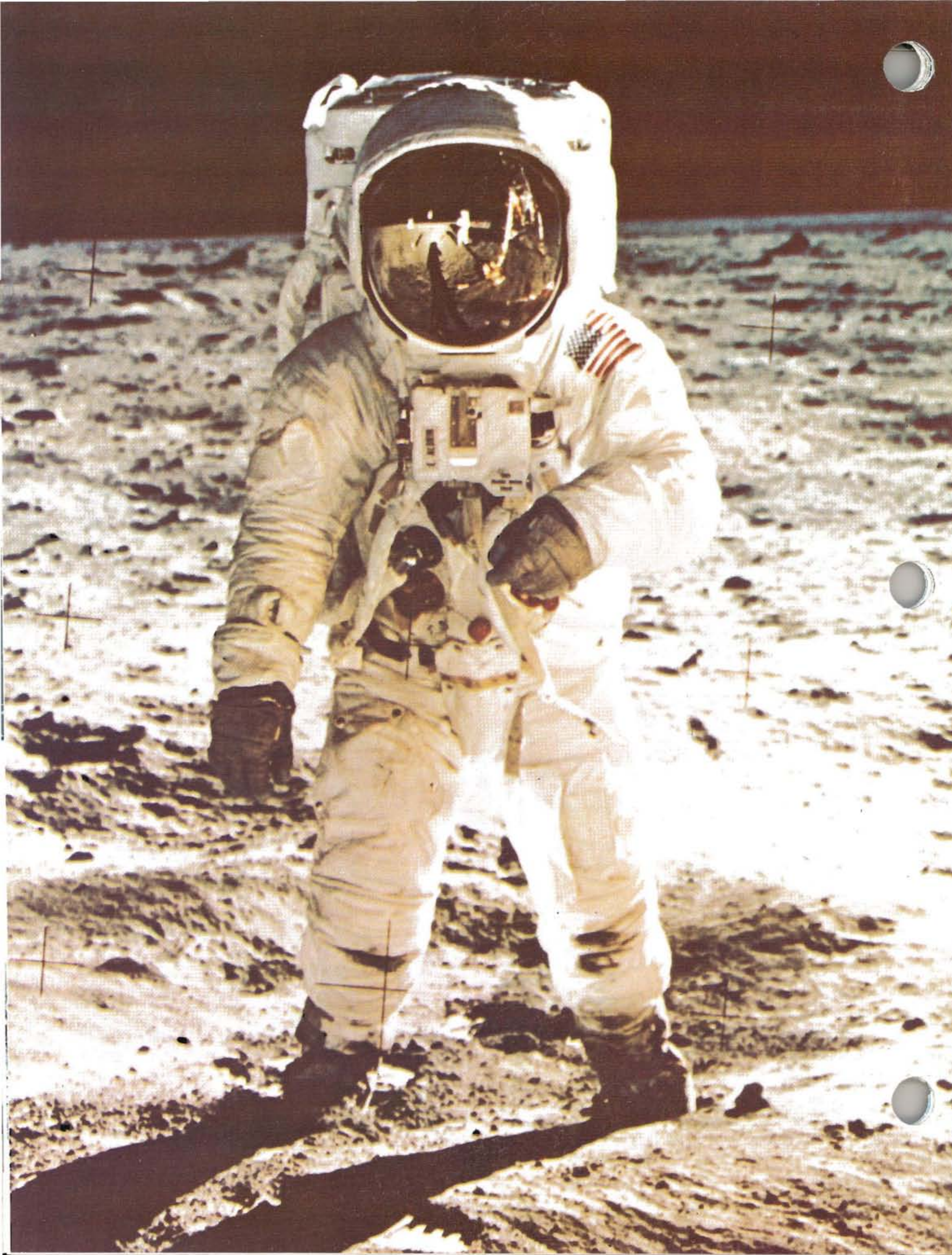
They increased by nine-fold the number of airstrips capable of accommodating the relatively large C-130 transport aircraft, while the two deep-water ports were increased to seven. In one year alone, troop construction forces built port structures with a capacity of more than 9,000 tons a day, storage facilities for more than a half million barrels of liquid fuels, hospital facilities totaling over 1,400 beds . . . a million square feet of closed storage . . . one half million cubic feet of refrigerated storage space . . . and housing for over 150,000 men. These were construction support projects. Meanwhile, combat support . . . road building, bridging, demolitions, airstrip and landing zone construction was on-going at the same time. Engineers have applied their skills to further the slow, tedious process of Vietnamization . . . rural development, repairing schools, providing potable water sources, drilling wells, improving sanitation systems, rehabilitating public institutions and erecting housing. Throughout this Nation's history the Corps of Engineers has both fought in the front lines and constructed the field military installations, roads, bridges and fortifications the Army has needed to do its job.

During the past 145 years, the Corps of Engineers has completed over 3,200 Civil Works projects. It has built over 19,000 miles of inland and intracoastal waterways now in commercial use, and 500 coastal Great Lakes, and waterway harbors, including almost all those through which the United States carries on its vital domestic and foreign trade and 250 small boat harbors, and harbors of refuge. It has constructed some 350 reservoirs and local flood control projects incorporating over 9,000 miles of levees and flood walls, and 7,500 miles of improved channels. Flood control projects built by the Corps have so far prevented more than $16 billion in flood losses, over three times the amount invested in flood protection. Corps hydropower plants in 50 projects have a total generating capacity of nearly 12 million kilowatts. Recreational attendance at Corps reservoirs during 1969 was in excess of 254 million. One hundred and fifty fish and wildlife management areas have been established around these lakes, as well as 400 state, county and municipal parks. In time of flood or hurricane, the Corps provides assistance in damage control, rescue work, and rehabilitation both under its own authorities and as engineering agent of the Office of Emergency Preparedness. Since 1863, it has been involved in more than 100 disaster operations, including more than 90 floods and hurricanes.

We pay tribute to the Corps and its members who celebrated yet another anniversary in June by paraphrasing a line from a song which is sung with gusto at one of our leading civilian engineering institutions—

IT'S A HELUVA, HELUVA, HELUVA CORPS OF ENGINEERS!

W. T. Spriegel joined the staff of the US Army Engineer School in September 1962 as Information Officer, and currently is assigned as Deputy Information Officer of the U.S. Army Enginer Center and Fort Belvoir.



Mapping the Future

by M. J. Tercy

Since the dawn of time, men have gazed into the heavens and observed the celestial wonders stretched endlessly before them. However, few men ever dreamed that the future would provide them with the means to reach out and explore these mysterious bodies of light.

It wasn't until almost four centuries ago, that Galileo first scanned the stars through his telescope. This new invented apparatus, although crude in design, gave him the tool to study in detail the mysteries which had puzzled men for so long. Through the use of his telescope, Galileo directed his attention to the moon, making sketches while he observed. In doing this, Galileo produced the first lunar maps.

With the efforts of Galileo, mankind embarked on a new adventure—the study of the moon. In our own time, we have witnessed astronauts leave the confines of our planet to actually land upon and explore the lunar surface. But the success of their mission has been the product of research by the successors of Galileo, who have stepped across the void of space to map the moon.

Early Moon Mapping

Without the use of modern techniques or equipment, the early moon mappers produced remarkable results. Perhaps one of the greatest obstacles to these observers, was the poor resolution power of the telescope or the inability to obtain a sharp clear image. This was compounded by the chromatic aberration or color distortion caused by the refraction of light through a lens.

Galileo had predicated that by simply increasing the focal length of a telescope, it would only serve to magnify the subject, but not clearify its image. As telescopes became larger, this theory was proven. The detail of the image became no greater due to the poor resolving power of the simple lens system. Because of this the accuracy of the early lunar maps relied heavily upon artistic interpretation. Even the best lunar representations of that period, although noteworthy in achievement, lacked accuracy in the positioning of detail.

In the latter half of the 17th Century, a French astronomer, Cassini, stretched the limit of lens resolution by producing a lunar map 21 inches in diameter. This was perhaps the best lunar map of that era. But it wasn't until a century later that the problem of lens resolution was to be solved. In 1758, John Dolland, an English optics maker, invented a system of correcting for refractory color distortion. He used different types of glass in composite system of lenses. Adapted to the telescope, it gave rise to a new era in astronomy and opened the way for precise plotting of lunar detail.

The first system of coordinates of the moon was developed in 1748, by Tobias Mayer, a German mathematician. His system enabled observers to determine actual position of lunar detail such as craters, mountain ranges, and "seas." Mayer led the way for new interest in lunar maps.

The 1800's produced dramatic studies in lunar map making. The reproductions made were larger and more precisely detailed than ever before. Positions on the lunar surface were defined by measuring the bearing and distance of craters. For greater accuracy, these measurements were made at various phases of the moon and took into consideration the swaying effect of the moon on its axis called "librations."

An example of an early moon map. This map done by Cassini in 1680, represents the best mapping efforts of that period.

A technician sketching the initial terrain relief with the use of a multiplexer. This instrument allows stereoscopic viewing of a given map area.

A technician tracing map relief with a "pantograph router" . . . The information received is transformed into 3 dimensional figures.

Observers could now create a basic geodetic control. A series of points could be measured and plotted, and a network of control points established. By establishing this series of interrelated points, secondary points of detail could be measured and plotted, then by simply linking and relating one point to another the entire visible surface of the moon could be accurately mapped. The maps compiled through use of these methods came close to the idea of a modern map. Refinement of the systems employed in their production, actually gave us the basis for present day techniques in lunar mapping.

Photographic Mapping

The idea of producing lunar maps from photographs was first conceived as far back as 1859. The factor which limited these efforts was the inability to measure the scale of photographic plates. As the state of the art advanced, methods of measurement were developed. Finally, in 1865 L. M. Rutherford made the first photographic maps of value to astronomers.

Further developments occurred during the turn of the century, as Julius Franz and S. A. Saunder set out to develop a new system of lunar coordinates. From the measurement of photographic plates, they established coordinates of longitude and height. They worked from a central point on the lunar surface, nearest the intersection of the moon's equator and the 0° degree meridian, calculating a network of 3500 control points. The degree of accuracy was so great, the "Franz-Saunder" system as it is called today, is the current reference for control and navigation on the lunar surface.

Compilation of modern moon maps, relies completely on photographs. The sources vary from advanced telescopic observations to pictures taken on the lunar surface by the astronauts. Methods are now so precise, that features as small as three feet in diameter can be accurately described and plotted. But with all the technical advances in present day moon mapping, one limitation still exists. Only 59 percent of the moon's surface is visible to the earthbound observer, and the techniques employed to record it are difficult and time consuming. Forty-one percent of the surface is always visible, but the remaining 18 percent can be viewed only at certain times during the moon's eighteen year orbital cycle.

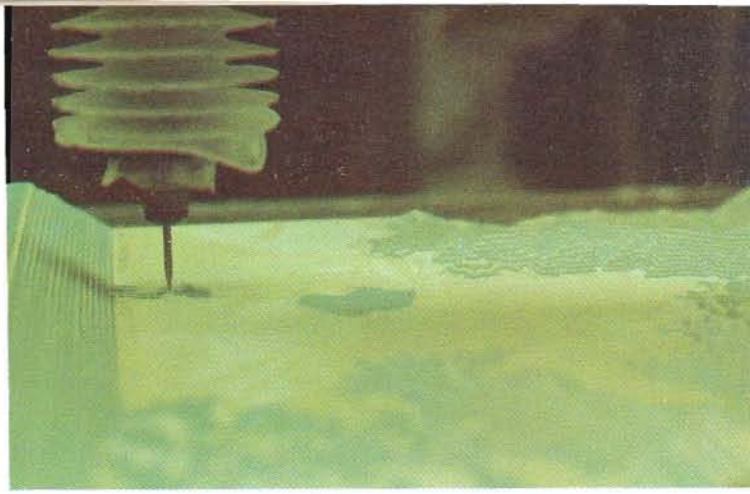
One technique employed in gathering these photographs is "time lapse" photography. This enables a larger number of photographs to be taken at short intervals, adding to the amount of different perspectives photographed. By viewing a given area at different angles, it then becomes possible to determine the height of the terrain and then plot the relief. The only drawback to this method is the inability to make direct measurement from the photographic plates. Mathematical computation must be used and the results at best are estimates, not actual linear measurements. To obtain these direct measurements the photographs must first be rectified to compensate for the curvature of the sphere.

To achieve this effect, the pictures taken were projected onto a curved screen with the use of specially designed projectors. This method removed the perspective view and displayed a flat image from which direct measurements could be taken. However, with the current demands for precise accuracy and short production time, computers took over the function of rectification through the use of electronic scanning devices. A further refinement of lunar photography, made use of stellar positions in the field of the picture. By relating these known points to positions on the lunar surface, a higher degree of accuracy of lunar coordinates was assured.

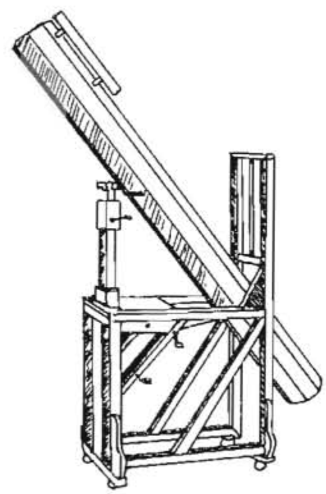
Mapping by Satellite

With plans to land a man on the moon, it was necessary to develop both new and more accurate sources of photographs and new techniques in map production. The material required was provided by satellite photography, utilizing the same basic principles used in aerial photography of the Earth.

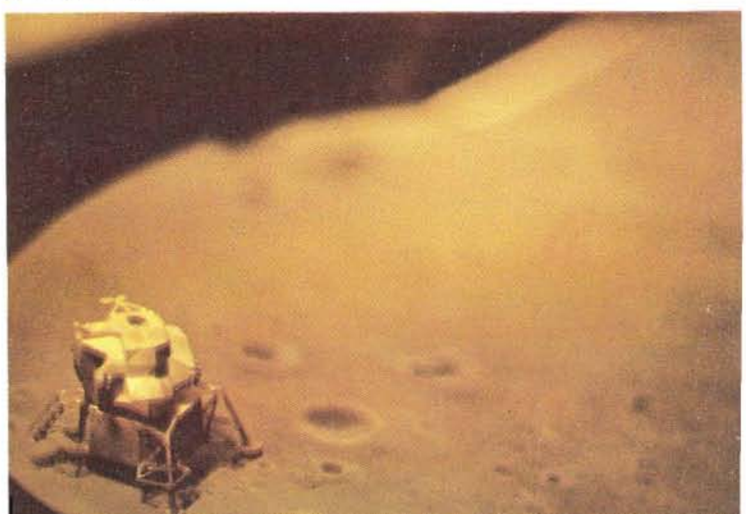
The first series of satellites launched, were the Ranger and Surveyor. These were designed to transmit back information of the nature of the surface terrain. Ranger was the first to be used. The plan was to take photos in sequence while the craft was descending to the surface. Even though the data received was limited to one area and one perspective of view, the photographs showed detail 1,000 times more accurate than the most powerful telescopes used on Earth. The second craft, Surveyor, "soft-landed", sending back photographs taken from the lunar surface. These pictures assisted the map makers in interpreting relief features from a horizontal or plane perspective. Although the Ranger and Surveyor satellites

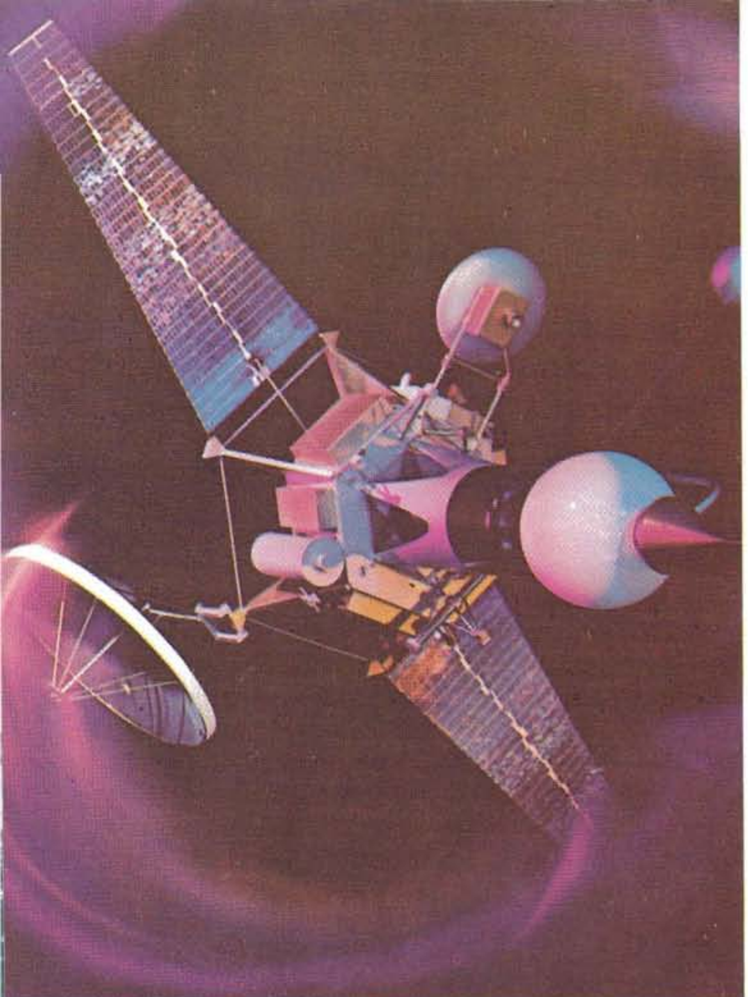


The 'pantograph router' carving 3 dimensional terrain relief on a map.



A model of the LEM on a three dimensional lunar terrain map.





A model of the Ranger III satellite. Its predecessor was the first satellite to transmit photographs of the moon back to earth.

provided interpretation of terrain features, they were not used for producing actual maps.

The next series of satellites to be launched were designed for mapping only. Appropriately, the name of the mission was Orbiter. The first three missions were sent up to photograph the equatorial belt of the moon, in order to map areas of possible landing sites for lunar exploration. The missions which followed gave further detailed information. While photographing the surface, they also relayed back flight data and recorded the positions of stars as reference points. All this information relating to the photographs gave highly accurate detail as well as precise measurements of positions. By the late 1960's the Orbiter mission had completely photographed almost the entire lunar surface. The maps produced from the Orbiter photography exemplified the most accurate and most advanced state of map production. The practical application and success of Orbiter missions is undisputed as the lunar landings have proven their value and accuracy.

Maps for the Astronauts

As the National Space and Aeronautics Administration (NASA) was preparing to launch its first manned lunar mission, Apollo, it required a great number of detailed maps for training, navigation, and exploration. The need was fulfilled by the Army's Topographic Command (TOPOCOM).

Probably the most important phase of preparation for the lunar expedition is the training. A Lunar Module Simulator (LMS) was produced to provide realistic training on the ground for the Astronauts. This device simulated every phase of lunar flight from the approach to the lift-off from the lunar surface. An important part of the "LMS" is a three dimensional relief map of enormous proportions. TOPOCOM produced this model meeting the most demanding requirements.

To date, TOPOCOM has produced five lunar models for use in the LMS. The most recent of these, and the one now in use is a model of "Hadley's Rille," the proposed landing site for Apollo 15. The actual size of the model is 16′ by 25′ and is scale to 1/2000 of an inch, representing approximately 40 square miles of lunar surface. The features are so exact that objects five meters actual size are detailed on the model. There are over 10,000 such features in all represented on the model of "Hadley's Rille."

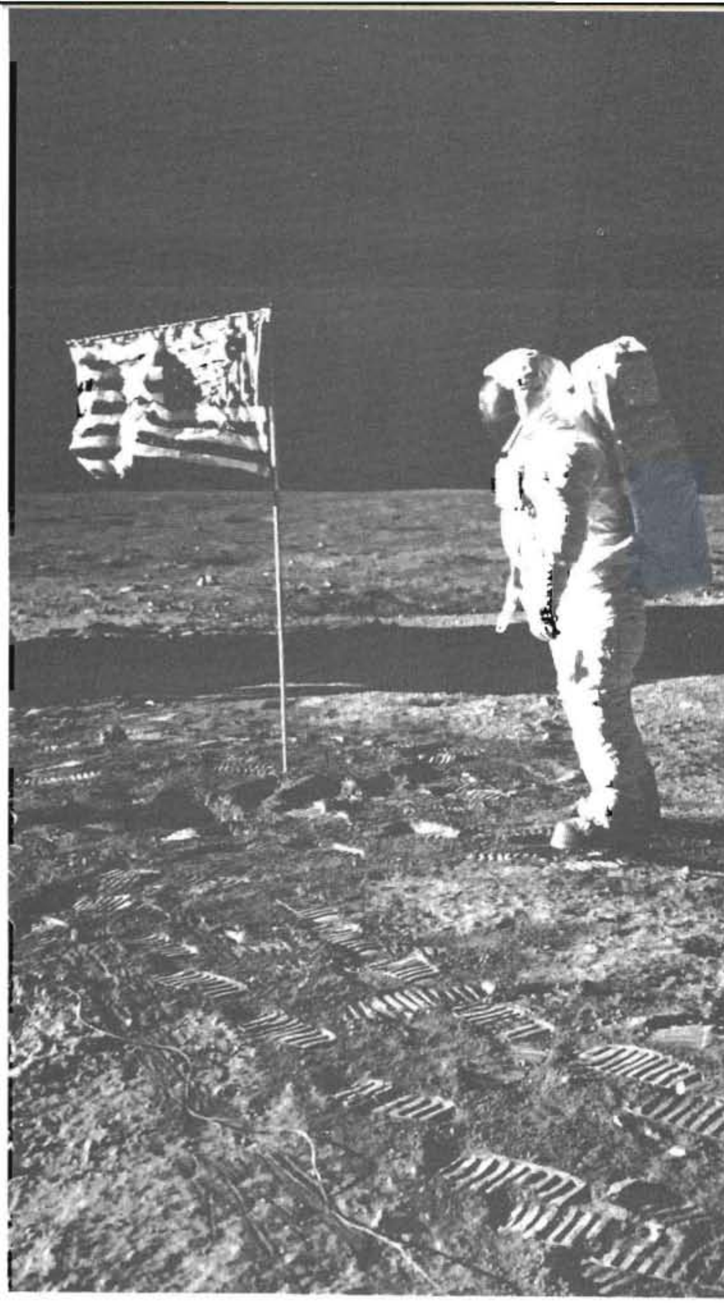
The time spent in construction of this map was approximately 18 weeks. This showed remarkable improvements in production time, since the first models took as long as nine months to build. The factor which accounted for the change was use of a urethane material (a type of styrofoam) as opposed to the use of standard plaster casts.

The first step in production is to cut topographic relief into blocks of urethane with the use of a pantograph router. This device enables the technician to trace the relief from a lunar map and have it directly transcribed three dimensionally on the urethane blocks. This forms a "negative" model. The sections, which are 24" by 24" by 4", are then finished by hand carving and sanding, progressively stacking the pieces and joining them into larger sections. This is continued until there are three major sections. These are then shipped from TOPOCOM to the John F. Kennedy Space Center where a final positive model is cast using an expoxy-resin material.

Once installed in the LMS, the astronauts view the lunar surface from their module through the use of a computerized mobile TV camera. The model area is magnified 2,000 times to produce an image which appears like the real thing. The astronauts confirmed its likeness by exclaiming from a descending lunar vehicle "There it is, right where it's suppose to be."

In addition to the LMS model TOPOCOM also provided NASA with additional technical data for navigation and exploration. The Apollo Landmark Maps, are used onboard the spacecrafts, mapping easily identifiable landmarks on the lunar surface. This combined with the use of star charts allows the astronauts to pinpoint positions and evaluate the accuracy of the ground data. Once on the ground, the astronauts make use of gridded terrain maps to establish their general location and to carry out their lunar walks. The planning for this is done at the Houston Space Center using smaller plastic models scaled to 1:12,500 of an inch.

TOPOCOM is already in the planning stages of their next production for the Apollo 16 mission. The proposed landing zone is near the crater Descartes, and photographs from the Orbiter satellites are again being compiled into maps. Once NASA finalizes the touchdown site, TOPOCOM will link past studies with modern technology to provide its invaluable assistance as mappers of the moon.



The end product of man's effort to map and explore the Lunar surface.

Lam Son 719

This moving account of U. S. Army Engineer activities in support of Army, Republic of Vietnam operations during the Laos incursion points up the magnitude of the Corps' diversified role in a combat situation.

The support mission carried out by the U. S. Army's Corps of Engineers has proven time and again to be diverse and always a challenge. One such challenge was met by the Engineers during the incursion into Laos. The events that occurred during the incursion which was called LAM SON 719, displayed what could be done under stress from an unseen enemy and in a short period of time.

Corps personnel carved roads out of mountainous jungle terrain and airfields were constructed to clear the way for the combat forces. The success or failure of the operation depended entirely on the ingenuity and flexibility of the officers and men of the Corps and once again they contributed invaluable aid. The following information constitutes the untold story of LAM SON 719.

In December of 1970, the premier of North Vietnam, Phan Van Dong, said "Our military, political and diplomatic strategy is a protracted war—a people's war"! Perhaps this statement best reflects the enemy effort in Southeast Asia throughout 1970. His commitment to a long-term war was characterized by mass population mobilization in the north. This action on the part of the enemy could be interpreted in many ways, but the most obvious was the increased need for men and materials in the south.

The need for logistics support has always been a problem which has confronted the enemy. In the past, three major lines of communications have been used. Each one has been systmatically cut to suffocate enemy activity and hopefully bring it to a grinding halt. Sampans and junks operated along the coastal areas feeding supplies to the interior regions. Also the port of Kompong Son (formerly Shihanoukville) in Cambodia was a major supply route supporting enemy combat activities in Cambodia and the southern portion of the Republic of Vietnam (RVN). The last of the three major logistical routes is the Ho Chi Minh Trail in Laos. This road network has more than 1,500 miles of motorable roads which encompass the entire panhandle area.

Allied operations have effectively cut the coastal supply traffic, and the disposition of Prince Shihanouk ended the enemy's access to the port of Kompong Son. Also last year's Cambodian sweep, denied the enemy the use of his sanctuaries along the Cambodian-RVN border. The consolidated result of this series of events seriously dampened enemy combat effectiveness. Because of this, the enemy was forced to expand his area of operation in Laos.

Traditionally, the major enemy logistics effort occurs during the dry season which extends from November through April. The buildup starts in North Vietnam's sector of the panhandle in late September and early October. And since the American bombings have ended in the north, the enemy has had little difficulty in moving men and materiel through this area from the north.

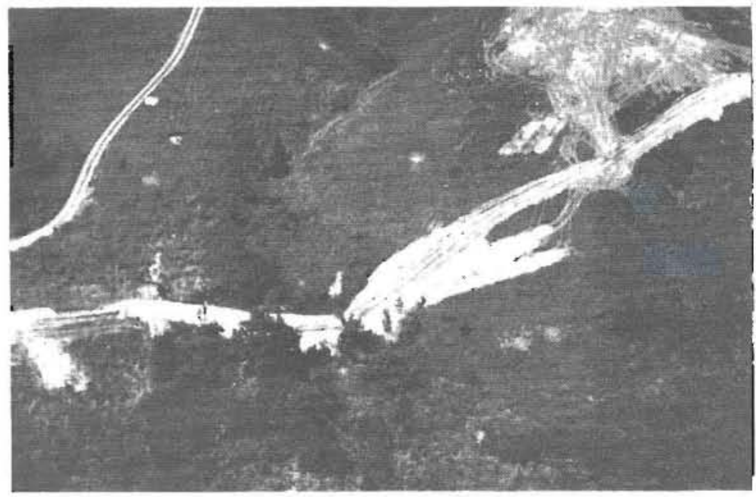
The supplies are brought to staging areas such as Vinh, Dong Hoi, and Quan Khe. They are then introduced into the Lao Panhandle where they eventually find ther way south. The supplies reach the areas in Laos from late October to early November. Then, as road conditions improve into the dry season, the infiltration increases achieving its highest levels during the months of February through April.

The supplies which move through this system are varied. They include food, weapons, ammunition, fuel, medical supplies, communications equipment and administrative supplies. The transportation of these supplies is as varied as the supplies themselves. Movement is carried out by porters, animals, bicycles, trucks and even boats. Even though the methods are known, the destinations of these goods are exceptionally difficult to estimate due to the thick jungle terrain of the area.

Cutting off this principle means of supply is equally difficult to accomplish. Not only is there difficulty in locating targets for destruction but the buildup of enemy anti-aircraft defenses has increased the threat to air assaults. The enemy has taken great measures in protecting his supply corridor in Laos. The use of the Ho Chi Minh Trail is now the only route of effective support left to the enemy.

The increased level of activity along the Ho Chi Minh Trail and the buildup in the panhandle area posed a definite threat to the security of Allied Forces in the northern part of RVN. To counter this activity and effective-

An aerial view of the Khe Sanh airstrip.



An aerial view of the "Red Devil" road.

Engineers span a tributary of the Quan Tri River with an AVLB.

Engineers begin cutting a road through the thick jungle.

The "Red Devil" Road to Khe Sanh.

The main airstrip at Khe Sanh overlayed with MX-19 matting.

ly stop it, a major operation was planned and carried out on January 30 of this year and lasted through April 8. The operations were designed to strike at supply and storage areas and to block infiltration routes leading into the western part of the region.

The American responsibility was limited to the initial phase of the operation. This involved the movement of the Army, Republic of Vietnam (ARVN) Airborne Division and a brigade of South Vietnamese Marines from Saigon to staging areas in the north around Dong Ha. Upon arrival of the troops, a massive enginering effort was launched by U.S. Engineering Units supported by U.S. Combat Troops. There were three major engineer elements involved in the operation, whose overall mission was to open road networks through the operational area. An additional responsibility was to open and repair the existing airstrip at Khe Sanh to accommodate large scale traffic.

The engineering phase of the operation was initiated by the 45th Engineer Group, which was given the specific mission of opening Route 9 to Khe Sanh and then on to the Laotian border. Additionally, they were to repair the Khe Sanh airstrip with the assistance of TF 326, an engineering element organic to the 101st Airborne Division (Airmobile). At the same time Company A of the 7th Engineer Battalion was to construct a new road from Route 9 to Khe Sanh. This would provide an alternate route to Khe Sanh for the upcoming ground forces.

The entire unpaved length of Route 9 extended a total of 39 kilometers. This operation required a major engineering effort which included the repair, replacement or bypassing of 33 bridges. The greatest obstacle occurred at Bridge 9/36, which crossed a major tributary of the Quang Tri River. The abutments of the original bridge which was bombed out, extended 184 feet above the river bed. This obstacle was breeched by the use of the Armored Vehicle Launched Bridge (AVLB).

The 45th Engineer Group opened Route 9 to Khe Sanh for wheeled vehicles the day after the operation began. It was then opened to the Laotian border for tracked vehicles on the third day of operation, and upgraded to handle wheeled vehicle traffic on the fourth day. Throughout the entire operation, Route 9 was continually upgraded and by the completion time, it was opened to two-way traffic for virtually its entire length.

The alternate road from Route 9 to Khe Sanh was begun on January 30. The total length of the road was 23 and a half kilometers. Within 10 days after the operation began, a rough pioneer road was completed. The road became known as the Red Devil Road and was subsequently upgraded to handle wheeled vehicle traffic. In all, Company A of the 7th Engineer Battalion completed a total of 80 kilometers of road network throughout the operational area.

Another phase of the Engineer activities was the repair of the airstrip at Khe Sanh. It took four weeks to repair due to extensive bomb damage. TF 326, which was to assist 45th Engineer Group in repairing the airstrip, was airlifted directly into Khe Sanh to begin work. They constructed a 3,200-foot by 60-foot assault airstrip parallel to the main runway. The first C-130 to land on the airstrip arrived on February 5th, but the Air Force had determined that the packed earth strip was unsatisfactory for prolonged use due to weather conditions. The runway was upgraded by the use of MX-19 Matting, and became an operational strip on February 15th.

According to all indications, Operation LAM SON 719 and Operation Toan Thang 01/71 which followed it, proved to be an overwhelming success. The ARVN ground forces effectively disrupted vital portions of the enemy's logistics system. They captured or destroyed significant quantities of enemy supplies, and inflicted considerable damage to enemy combat forces in the operational area.

Both operations have placed the enemy on the defensive, forcing him to divert his troop commitment to large defensive operations. In all, LAM SON 719 was more than just another successful operation. It was another challenge met, and job well done with a big assist through the support of the Corps of Engineers.

An Air Force C-130 lands on the completed Khe Sanh airstrip.

The abutment in the right foreground was all that remained of the bridge across the Quan Tri River.

Engineers "Clearing the Way".

THE HENRY LARCOM ABBOT AWARD

A Management Breakthrough

by Captain F. W. Bockman

WITH AN INCREASING NEED FOR FLEXIBILITY AND CONTROL IN CONSTRUCTION PLANNING, THE CRITICAL PATH METHOD HAS GIVEN THE ENGINEER A NECESSARY TOOL FOR MODERN EFFICIENT MANAGEMENT.

Until a few years ago, project managers and job superintendents had no formal procedure to aid them in the management of construction projects. Managers relied primarily on technical requirements, past experience and information derived from a bar chart.

Personal judgement and reliance on a bar chart had several disadvantages. The principal difficulty is demonstrating and explaining the interrelationships of work activities. The level of detail on a bar chart is also restrictive. Due to these restraints, if a manager became ill or had to be replaced, his replacement had great difficulty in continuing the job plan. Overhead cost and probability of mistakes on the job site were increased. Another restraint was the lack of a common plane of reference in progress reporting. These and other management problems caused the construction industry to try several approaches, none of which was quite successful, until the latter part of the 1950's.

In 1958 and 1959 a team of people at DuPont developed a networking system which overcame the disadvantages of the bar chart. They used this system, which they called the "Critical Path Method" (CPM), on maintenance and construction projects: At approximately the same time, a research team developed a similar system to be used on the Polaris missile project. This system was called the "Program Evaluation and Review Technique" (PERT).

The primary difference between the two systems is that CPM uses one time value for the activity durations and PERT uses, by statistical methods three time values. PERT is used principally on research or design projects where time values are very difficult to judge. CPM is used on construction projects in which time can be estimated with a higher assurance of accuracy.

CPM CHART

Showing initial portion of work activity

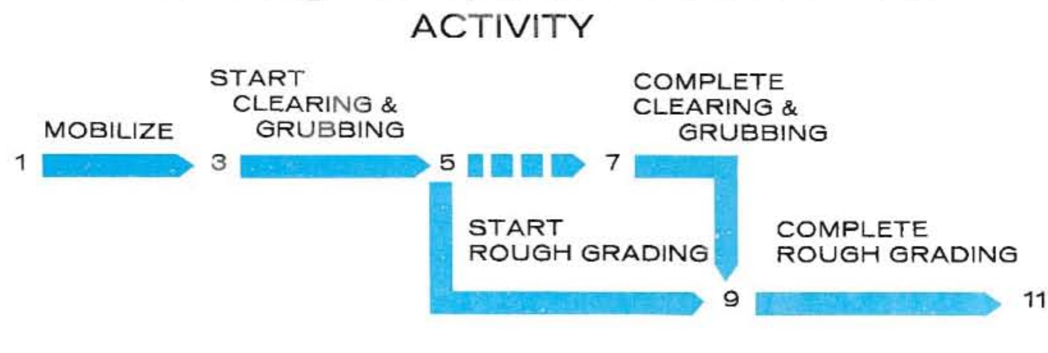


Figure I

The basis of both the CPM and PERT systems is the network diagram. With the network diagram two important additions have been added to the existing systems. They have added a visual relationship or interdependency of various activities, and a more detailed listing of activities. In figure 1, the example given shows three different activities. Even though the example displays a small portion of the overall operation, one can readily see how the CPM network allows the manager to graphically display how one activity affects the other.

The network not only shows proper relationships, but if a series of math computations are made, the results will give the expected start and finish dates of each activity as shown in Figure III.

Day one should be taken as the start of a job. By use of a calendar the various start and finish dates could be converted to calendar dates.

The main disadvantage to CPM and PERT has been the long and tedious hand calculations necessary in these systems.

With the growth and acceptance of CPM and PERT came a corresponding increase in Automatic Data Processing Systems (ADPS) to support these techniques. The newer computer programs that have been developed now allow the managers to process networks of thousands of activities in a matter of minutes.

These new programs have taken the basic CPM network of work activity and time and allowed the manager to add activity, cost, manpower, equipment, and skill codes. By use of these new programs a manager can incorporate this additional information in his CPM schedule and obtain the basic activity time schedule as well as the cumulative dollars, cumulative labor, manpower, cost outlook and equipment schedule reports. This information has made the rewards of using CPM

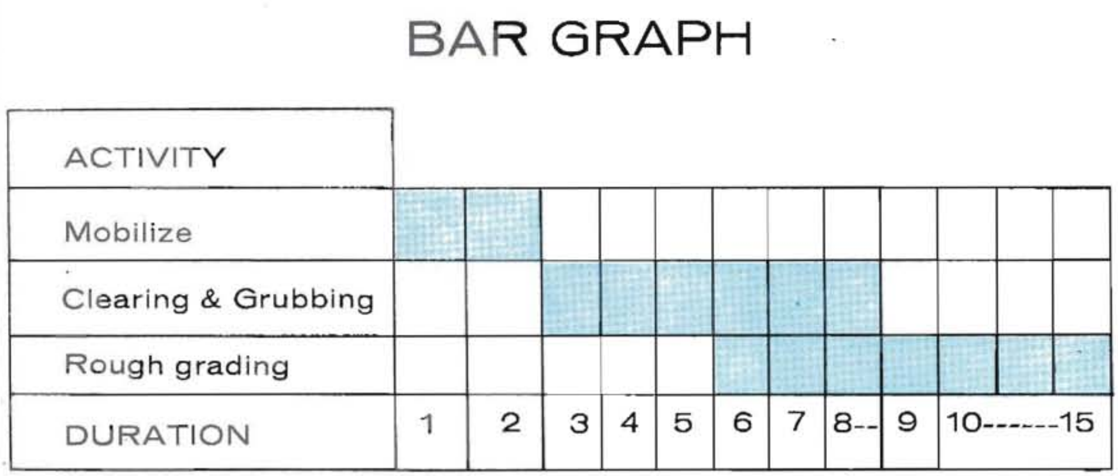


Figure II

and PERT much more beneficial to the manager who must perform the job.

The above mentioned print-outs are but a few of the options available when CPM and ADPS are combined as they are in the civilian world. But what about the good old Corps of Engineers?

In the majority of Engineer Districts in the United States there is a requirement that any job above a certain dollar size incorporate CPM. These requirements specify information that allows the district to better monitor the construction progress and job plan. An additional benefit of this schedule is that it permits the local representatives of the district and the contractor to have a plane of reference for further discussion of job progress and monthly job payments.

The development and use of CPM at the district level has given the contractor the freedom of building his own construction schedule. The district representative of the Corps and the contractor arrive at a true representation of progress, in respect to time remaining and monthly payments versus progress, by adding the construcion cost for each activity.

The use of ADPS and CPM has mechanized a large amount of paper work involving monthly payments and job progress. This mechanization frees the resident engineer from his office and allows him to add many hours to his primary job of guaranteeing the proper construction of Corps of Engineer projects.

On the military side of the Corps of Engineers, how much is known and used of CPM techniques? What capabilities exist at battalion and company level to make use of this superb management tool?

Every officer who attends the Engineer Advanced Course receives a basic understanding of CPM procedure and an introduction to PERT. He is familiarized with such terms as crash cost, equipment scheduling and other procedures developed in CPM. Facilities are

JOURNAL OF ACTIVITIES

Activity	Description	Duration	Early Start Day	Early Finish Day
1-3	mobilize	2	1	2
3-5	start clearing & grubbing	3	3	5
5-7	dummy	0	5	5
5-9	start rough grading	5	6	10
7-9	complete clearing & grubbing	3	6	8
9-11	complete rough grading	5	11	15

Figure III

made available to him to use a small computer program. There he can see the difference in the time required to hand calculate a CPM network and the computer calculation time in initialization of a network and updating of this network. The Advance Course Officer will leave with a sufficient background of knowledge that can be easily expanded by extra reading.

Once this officer returns to a company command or a battalion job he can develop an excellent CPM network with equipment and manpower estimates incorporated. However, if the network is of such size that it can not be hand calculated, his work is in vain. The battalion or group level has no data processing capability that will assist this man in his work. Regardless of his desires, the network must be developed so that it can be hand calculated, requiring many hours and allowing a much greater chance for error.

The civilian managers realized the profits of combining CPM and PERT networks with Automatic Data Processing Systems many years ago. Even the district level of the Corps of Engineers has combined the two processes to lighten the resident engineer's paper work load and allow him to spend this time more beneficially.

The military side of the Corps of Engineers pays lip service to this principle. It is imperative that proper scheduling techniques be used at battalion and company levels to insure that correct manpower and equipment is used to reach a realistic completion date. Until the Corps of Engineers makes available adequate CPM programs and Data Processing equipment to the people who must supervise the work at battalion and company level, it will never realize the full benefits of the Critical Path Method and Program Evaluation and Review Technique.

Captain F. W. Bockman is a graduate of the University of Alabama with a degree in Civil Engineering. He is currently a student attending the Engineer School's Officer Advanced Course.

Bridging

Efficiency Reports Can Make or Break An Officer's Career

"For want of an efficiency report, a promotion was lost, for want of a promotion a career was lost." This modern day adage aptly describes the significance which the Army places on the efficiency report. The report is the single most important document rendered by or about any officer. It is used in making virtually every decision regarding an officer's career. Promotions, schooling, assignments, appointments in the Regular Army all largely depend on the efficiency report. However, despite their importance, many reports arrive at Department of the Army long after the 45 day deadline required by AR 623-106. A punctual report could be the factor that tips the scales in favor of the officer concerned. If you have an efficiency report to write, start and complete it within the allocated time period. Remember someone's career is in your hands and maybe even your own.

Army To Name Next CGSC Selections Late This Fall

The Command and General Staff College selection process for the course beginning in August 1972 will take place this summer and early fall. Selection lists are normally published in late November or early December. The zone of consideration includes all officers with seven through 15 years of commissioned service as of August 31, 1971. Due to quota restrictions, only 46.6 percent of the Corps' lieutenant colonels and promotable majors have attended the CGSC resident course. Officers beyond their final year of consideration for the course are strongly encouraged to obtain credit through completion of the nonresident extension course. It will assist in assignment opportunities and promotion considerations. Application for nonresident training may be made in accordance with AR 350-60.

Earn Master's Degree Through ROTC Program

The Advanced Degree Program for ROTC Instructors Duty (ADPRID) is a relatively new program that offers Engineer officers an excellent opportunity to enhance their education. The first part of the two-part program gives the officer a maximum of two years of study under the Degree Completion Program to obtain a master's degree in a field related to Army requirements, excluding law. Upon receiving the degree, the officer remains at the same school as an ROTC instructor for a minimum two-year stabilized tour. Applicants who already possess a master's degree will be assigned a three-year stabilized tour as an ROTC instructor. Letter applications are accepted at any time. To learn more about the program read DA Circular 621-7 dated February 23, 1971.

the Gap

Advanced Courses Open to Qualified Engineer Officers

This year a limited number of Engineer Officers will be selected to attend Advanced Courses at the Infantry School (Fort Benning); Armor School (Fort Knox); and the Amphibious Warfare School (Quantico). Selection for attendance is on a competitive basis. Qualifying Officers must have a good Engineer background, which should include Company Command time, and have an outstanding performance record. Interested Officers should indicate their course preferences in the Remarks Section of DA Form 483 (Officer Assignment Preference Statement), or call the Captain's Assignment Officer in Washington, D.C. (OX3-0822). Volunteers for the Program are encouraged.

33 Engineers Win CGSC Credit For Vietnam Duty

A total of 33 Engineer officers, who served in qualifying positions in Vietnam, have been awarded constructive credit for the Command and General Staff College course under the provisions of Department of the Army Circular 351-16. All lieutenant colonels and majors on a promotion list serving in Vietnam are automatically considered for constructive credit by Branch. The basis for consideration is position held, efficiency ratings received while serving in that position, and one's total performance record. Final determination on award of constructive credit is made by a DA Board.

Plan Ahead For That Future Assignment

One of the most frustrating things for an Engineer soldier is to ask for a specific assignment and to be told that "the Engineer Branch presently has no requirements in this area"—then to learn that someone else received the same assignment a few weeks later. Unfortunately, this does happen. However, it is not that the assignment officer is trying to frustrate the soldier, but rather the nature of the personnel requisitioning system. The Engineer Branch receives requisitions to fill overseas slots approximately seven months prior to the desired reporting date, while continental United States requests are received five months prior to the report date. These requirements must be filled or canceled within a short period after the Branch receives them. An Engineer can best influence his next assignment by contacting his assignment officer early and filing a preference statement with him. Also, make sure to make an allowance for leave and travel time when computing the availability date. To receive the assignment of your choice, you should get your request in at least seven months before you are due to return from overseas and at least nine months ahead of time if you are leaving for overseas duty.

Total Professionalism

by Major Paul L. Theuer

has been the Engineer's standard for many years because his role demands it. Now, to meet the increasing challenges of the future, he must strive for an even greater degree of qualified competence in his exacting field.

The concept and value of "professionalism" is constantly before all of us both in military and civilian life. The normal interpretation includes performing the assigned task in the finest manner possible. No one will question that. It is a most creditable response, but is it "total professionalism"?

"Total professionalism" involves more than just doing a job, or maintaining one's status quo. Perhaps the best example of the absence of "total professionalism" is found in the dilemma facing space industry engineers and scientists. No one can dispute what they have accomplished since the days of Sputnik I (September 1957). They placed this country first in space. But why does the dilemma exist today? Why are technical personnel in many parts of the United States "out of employment," while some areas of engineering are actively seeking technical and engineering personnel to fill valid position vacancies?

Regardless of what we are now doing, it is considerably less than what we are trained to do, and what we are potentially capable of doing. It takes additional effort and at times a difficult effort, to keep ourselves primed to work outside of our present area of application when the need arises.

This article will attempt to analyze the current dilemma, by developing the concept of "total professionalism" and by showing that preventive measures are possible to preclude large

"Professionalism involves more than just doing a job, or maintaining one's status quo. . . ."

"The military engineer must never forget his responsibility to the engineering profession . . . it is not suspended while in uniform. . . ." "Skill maintenance? . . . both the employer and the employee must assume appropriate responsibility. . . ."

scale recurrence of the problem.

The traditional dual role of the Corps of Engineers and other technically-oriented branches of the Army dictates that a level of qualified competence be attained that is comparable to its civilian counterparts. This evidence of individual competence by professional registration is as vital an ingredient for acceptance and qualification among engineers and technical personnel as acceptance by state examination is for bona fide lawyers and physicians.

The National Society of Professional Engineers (NSPE) points out that registration provides the engineer with the authority to practice engineering before the public and establishes his professional standing on the basis of legal requirements. From a military view, the full development of the "total professionalism" concept will likewise have a tremendous public relations impact on the publicity of the "volunteer" Army. The young officer must be imbued early in his career with the importance of certification through successful completion of the Engineer in Training (E.I.T.) examination and on through the registration process. The corollary is that quality performance of a professional engineer is more easily achieved in a military environment if the personnel in charge at all levels are in fact "engineer-engineers."

The Chiefs of Engineers and Civil Engineering of the three services have viewed the importance of professional registration as one of standard policy for many years. Their roles demand it. The part each service shares in the total U.S. engineering effort, both at home and abroad, demands that the military component of each project be administered by personnel displaying competence and "total professionalism."

Regardless of the trade or profession that one enjoys, his expected useful life is a function of the maintenance effort expended to keep his knowledge current. How does one do this? Is formal refresher training necessary every few years? Can it be done at home? Let's examine the question.

Skill maintainance includes any action, which yields new and current knowledge in a particular field and an awareness of the present state-of-the-art in terms of technology, hardware, and application. Skill maintenance can be accomplished through a formal education process, nonresident instruction through government or private sources, reading of technical and trade journals, membership and participation in pertinent technical societies, and the study and review of applicable manufacturers' literature. The maintenance process must be broad-based rather than concentrated in a narrow area of current employment or practice. Continuous "saleability" checks must be made by the tradesman or professional to insure that he is negotiable in more than his present area of activity. The very question of "saleability" was brought to the forefront with the recent space and aeronautical industry layoffs. A subsequent problem arose of finding employment for professional personnel who were determined to be poorly maintained tradesmen and professionals.

Here lies the problem. What can be done now to preclude another dilemma, or an extension of the current problem. Both the employer (military and civilian) and the employee must assume appropriate responsibilities. The employer must provide the facilities and the incentives for his employees to continue their education and to seek new knowledge. By doing so, he makes employment with his firm more attractive from the view of professional recruitment, while building a degree of flexibility into his internal personnel structure. Similarly, the employee must commit himself to the sacrifice of time and effort to restore and retain his "saleability," making him a more viable part of his organization.

One might ask, how does professional registration and skill maintenance contribute toward "total professionalism"? The answer is stated simply that to be more than ordinary, we must do more than the minimum required. We may be in the Army or the Navy or with a civilian consulting firm, but more important, we are part of a larger group—our profession. For our profession to make its rightful contribution to mankind (engineers have contributed a large share during the past century), we must keep ourselves current or "saleable". We must be willing to sacrifice our time and our labors. If we have a new idea we must be willing to share it with our fellows through contribution to technical journals. We are like trees in the forest, and one is not able to exist without the mutual support of the rest of the forest.

Many options are available for personnel in uniform to obtain information and preparation for certification (E.I.T.) and registration (P.E.), or to merely provide for their continued education and development. A large selection of correspondence courses are available through the non-resident instruction departments of Service Schools, or directly from national professional societies. The state and national professional societies are becoming more aware of the requirement for continuing education in their respective fields. At an increasing rate, they are expanding their offerings in the form of book-reviews, short courses and seminars, and editorial comment on the value and importance of professional registration/licensing and skill maintenance.

The military engineer must never forget that his responsibility to the engineering profession and to mankind is not suspended while he is in uniform. Instead, his military career can be enriched through professional development. His involvement in military engineering is neither accomplished alone nor in a manner which is different from his civilian counterpart. Many times, he finds himself in remote parts of the world working side-by-side with a civilian contractor engaged in the same project, and faced with the same problems which demand the same competence. To meet the challenge of the task, he must know all the aspects of his assignment, both military and engineering, and by doing this he will reflect "total professionalism" in his person and performance as a military engineer.

"Quality performance of a professional engineer is more easily achieved if personnel in charge are in fact engineer-engineers" . . .

Major Paul J. Theuer is the Commandant of Cadets, Army ROTC, at Pennsylvania State University. He is a registered Professional Engineer in the District of Columbia, and is currently a candidate for a Master of Science degree in engineering.

☆ GPO 1971 437-459/1

Bye Bye Blackbirds

The birds are coming! The birds are coming!

This eerie warning of a well-known motion picture aptly describes the spark that ignited a conflict between elements of an engineer light equipment company and a host of obstinate blackbirds.

The setting of this epic struggle was the sleepy town of Paris, Texas, in late September 1969. Along with the community's 25,000 human inhabitants, thousands of blackbirds resided in Paris. Nesting in a large wooded area within the city, the feathered invaders were a nuisance and posed a health hazard due to the various diseases they carried.

City firemen and police, armed with shotguns, were assigned the task of eradicating the feathered pests. The tenacious birds, however, met the armed assault with aloof indifference and after a week of shooting they were as entrenched as ever. Experts then decided the only solution was to destroy the birds nesting environment. Underbrush would have to be cleared, and most of the trees would have to be removed.

The decision to destroy the bird's lair was reached while they were migrating and the clearing had to be completed prior to their return. However, to its dismay, the city had neither the equipment nor the finances to undertake such a project. The stage was now set for the entrance of the local Army Reserve unit into the conflict against the feathered intruders.

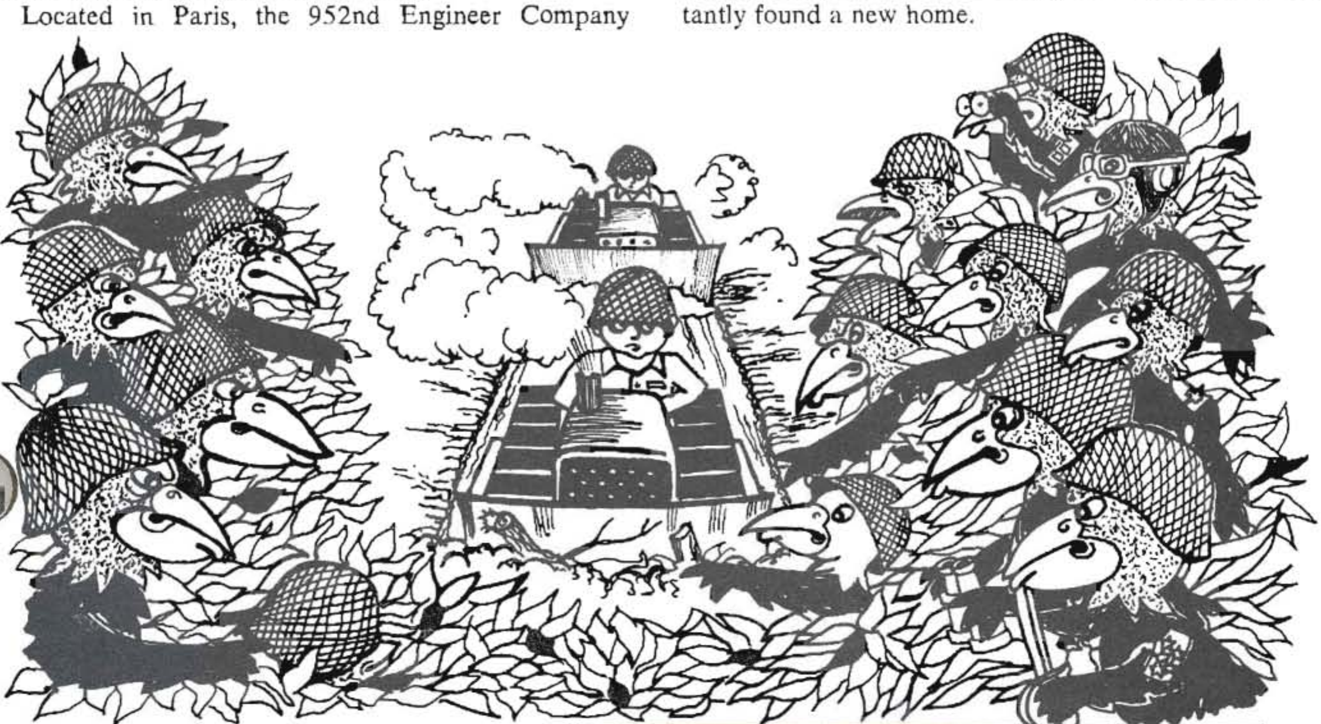
Located in Paris, the 952nd Engineer Company (light equipment) had troubles of its own. Recently reorganized as engineers, the company's men had received only limited training as engineers since its change from an ordnance unit. This problem of inexperience was magnified by the fact that the reserve unit's property provided barely enough space to park the vehicles, let alone sufficient area to operate them.

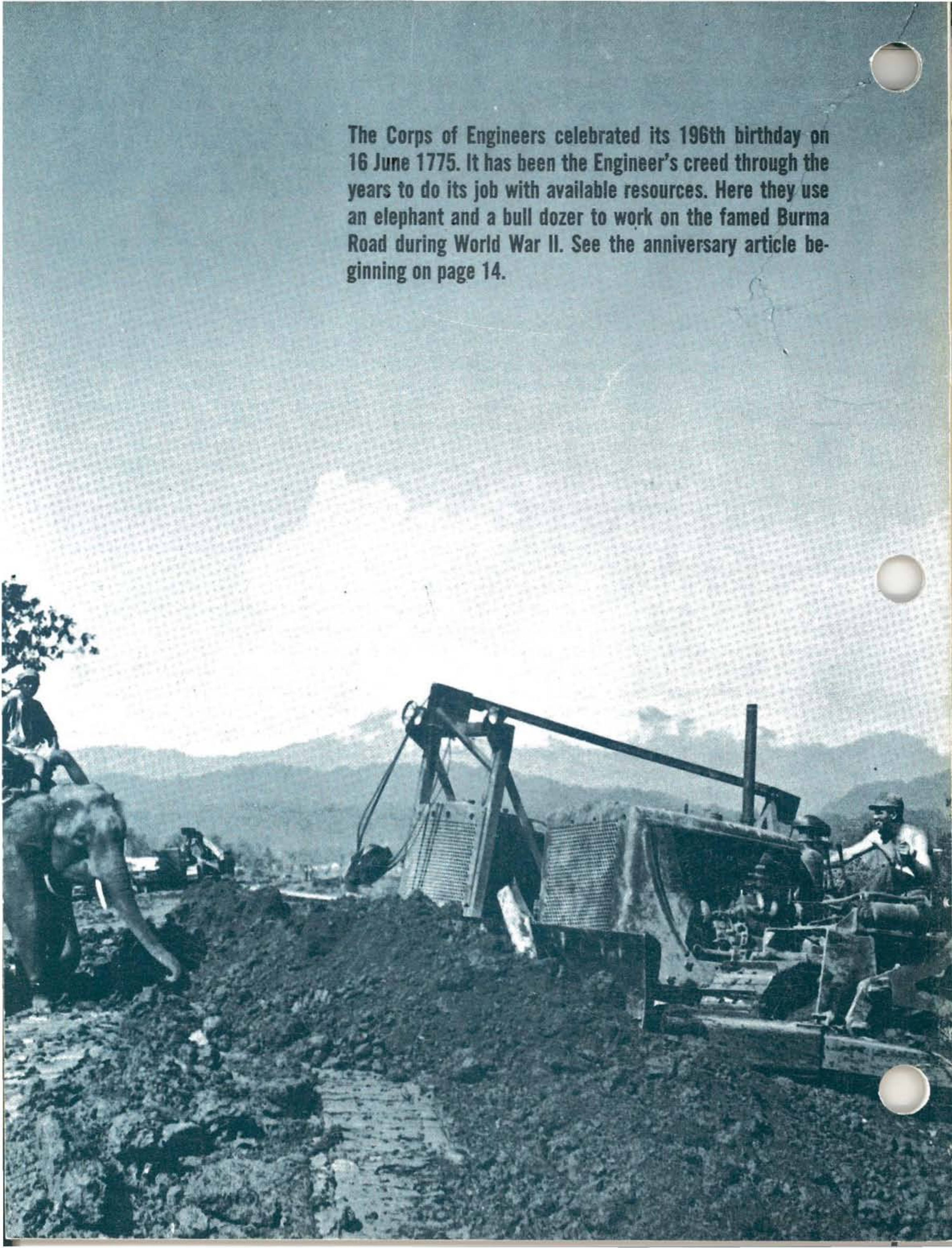
When approached by city officials, the 952nd immediately saw not only a chance to serve the community of which it was a part, but also a chance to provide its men with useful and much needed training.

Working with city officials, the company provided bulldozers, dump trucks and a bucket loader to accomplish the clearing operation. Debris was piled where the local fire department later burned it.

After four months and as many two-day training sessions, the 20 odd acres were cleared. When the blackbirds returned, they found that they had been evicted. Only charred stumps and a few larger trees remained in their once highly-wooded home.

The effort had tremendous results. The morale of the men of the 952nd soared to a new high, while they received worthwhile training. Residents of Paris who had been plagued with the pesty birds had only the highest praise for the effort expended by the unit. The city itself received a solution to what had appeared to be an unsolvable problem. And lastly, the blackbirds reluctantly found a new home.





The Corps of Engineers celebrated its 196th birthday on 16 June 1775. It has been the Engineer's creed through the years to do its job with available resources. Here they use an elephant and a bull dozer to work on the famed Burma Road during World War II. See the anniversary article beginning on page 14.