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How To Survive and Return To Duty

Making its air crews tough minded with precepts like "Food is where you find it" and "A thousand-mile journey home begins with the first step," with practice in signaling, hiking, shelter building, hunting and fishing, and pathfinding, the USAF schools its men in living off the land and getting home—Page 71.

USAF Pilot Training

Major General Warren R. Carter

WHEN we speak of any schooling or training program, we have a normal human tendency to think of that program as it was when we ourselves went through it. This, of course, is not true, particularly in our Twentieth Century. Any training program is worth its salt only if its graduates emerge with the most up-to-date knowledge in their field which it is possible to give them. This is particularly vital in training men for their role in the exacting science of air warfare. Few fields of human endeavor have changed as rapidly as has military aviation in the past 10 years. The Air Training Command, its curriculum, its teaching methods, and its equipment have changed with the times.

Until late 1950, the Air Training Command graduated a pilot who was basically "an airplane driver." This individual could take an aircraft off the ground, fly it to some predetermined destination, and land the aircraft safely. His was a generalized skill. He was not qualified to use any tactical aircraft for its specific mission. For this level of proficiency, he was sent to another major air command where he received further training which qualified him as a military pilot capable of using a specific tactical aircraft as a weapon. Not only did this scattering of a primary training mission subtract from the total manpower and physical resources of the other major commands from the pursuit of their own important primary missions, but such a system had little mobilization potential.

This unfortunate situation was ended by a major Air Staff decision in 1950 to centralize the medium bombardment combat crew training, both conventional and jet, and fighter-bomber escort training under the jurisdiction of the Air Training Command. With combat pilot training missions localized in one command, the USAF had achieved the ideal training situation. Now a combat-ready pilot could be produced in a series of integrated courses which followed a standard training philosophy.

Today's pilot training program is divided into two general phases—undergraduate pilot training and advanced training. The undergraduate phase consists of those courses which lead to a commission and rating as pilot, single-engine or twin-engine. The advanced training phase qualifies the officer for rating as pilot single-engine or multi-engine and ready for combat duty.

Beginning with the class entering training in November 1952 the first phase of the pilot training program is pre-flight. Each graduate of this phase will have proved that he possessed definite officer potentialities.

The first part of primary is a light plane screening phase with 25 hours of flight training. Like the flying program proposed for senior AFROTC students, it will eliminate students who demonstrate fear of flying, dislike for flying, chronic air sickness, or definite pilot training deficiencies. They can be accorded transfers to aircraft observer's school or officers candidate schools to complete their pre-commission training. The chief value of the extended pre-flight and light plane screening phase is that when students enter the primary flying phase, the quality of the individual and his training potential should be approximately the same as that of his fellow students. Attrition in the screening phase will vary inversely with the average stanine score of the students, but attrition in the primary, basic, and advanced phases should level off and remain fairly constant.

The second phase of primary provides intensive coverage of the basic fundamentals of flying for aviation cadets, rated observers, and all rated officers. Graduates of this primary course are channeled into one of the two basic courses by a carefully-monitored selection system. Each of the basic courses offers intensive application of the fundamentals learned in the primary program. In addition there is advanced training qualifying these students as a pilot in his field of specialization—basic multi-engine or basic single-engine jet. All graduates of basic courses are commissioned and rated.

PREFLIGHT

Objective: Officer training in customs, courtesies, administrative practices, military air leadership, and the moral responsibilities required of a USAF officer

Duration: approximately 12 weeks

Officer training: 72 hours

PREFLIGHT, INCLUDING LIGHT PLANE SCREENING (Piper Cub and T–6 aircraft)

Duration: Approximately 24 weeks

Flying Training: 145 hours

Academic training: 245 hours

Officer training: (cadets) 295 hours

BASIC PILOT TRAINING (T–6 or T–28, T–33 or F–80, or B–25 aircraft)

Objectives: Flying and academic training qualify a student as rated pilot of basic aircraft, continued officer training, or for student officers, upgrading training

Duration: approximately 24 weeks

Flying training: 135 hours

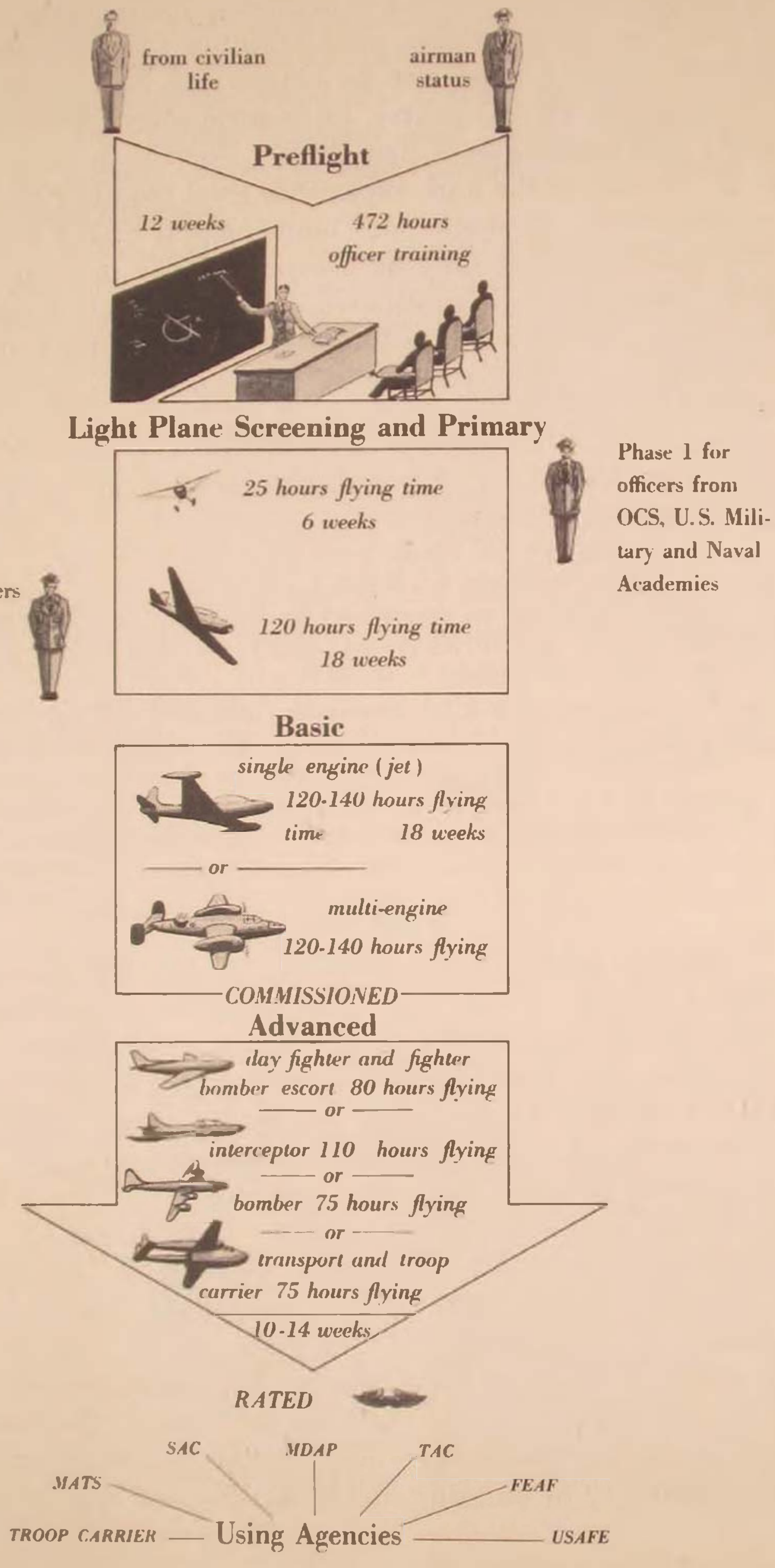
(1) Jet T–28—70 hours; T–33 or F–80—65 hours

(2) Multi-engine T–6 or T–28—70 hours; B–25—65 hours

Academic training: 97 hours

Officer training: 215 hours

Revitalized Pilot Training Program



Advanced Training

When the graduate of the basic single-engine pilot training programs enters into advanced training, he finds that he has completed all prerequisite training. The degree of qualification of the graduate of the basic multi-engine pilot training program varies with the aircrew training programs he enters. If he is entering the light bombardment (B–26) course, he is sufficiently grounded to enter directly into training as a first pilot. For the medium bombardment B–29, because of the high experience level required for airplane commanders by the Strategic Air Command and FEAF the new graduate must enter crew training as a copilot. The medium bombardment B–47 course must be considered a post-graduate course in a sense. Because of the advanced techniques and procedures required, students in this course must have extensive experience in four-engine bomber aircraft.

DAY FIGHTER OR FIGHTER BOMBER ESCORT (F–80 and F–86 aircraft).
Duration: 10 weeks.
Flying training: 80 hours.
Academic training: 95 hours.
Officer training: as prescribed by the local commander.

INTERCEPTOR TRAINING (F–94, and F–89, and F–86D aircraft).
Duration: 12 weeks.
Flying training (pilots): instrument phase T–33, 36 hours; application phase B–25K, 15 hours; F–94, F–89, or F–86D, 36 hours.
Academic training (pilots): instrument phase, 72 hours; application phase, 56 hours (supplemented by training in flight simulators).
Officer training: as prescribed by the local commander.

Training Aircraft

When the pilot training program was surveyed at the close of the Second World War, it was apparent that a tremendous gap had been opened between training aircraft and combat aircraft types which had been developed in the latter stages of the war. The Training Command had to find some way to produce proficient pilots capable of handling these new high performance aircraft, quite a challenge if the training program had to be conducted as much as possible with aircraft within the USAF inventory. During the war experimental programs had offered initial pilot training in high-horsepower and high-performance aircraft, but no definite conclusions had been reached on the results of these experiments. The PT–13 primary trainer obviously had to be replaced by another trainer of higher performance characteristics. But aside from the normal time lag in developing and procuring a new trainer, postwar austerity ruled out the possibility of building hundreds of a new type training aircraft.

so in the spring of 1947 the T–6 basic training aircraft was operationally tested at Randolph Air Force Base to see whether it could be used as a primary trainer.

These tests indicated that beginning students could master the T–6, and the more diversified training and techniques made possible by replacing the 225-horsepower PT–13 with the 550-horsepower T–6 meant that certain phases of the World War II training program could be consolidated. The former primary and basic courses were abridged and the curricula covered in those two phases were combined in the present primary course.

Not that all was smooth sailing. The T–6 created student problems, such as apprehension induced by the complexity and the high performance of the aircraft. Much of the pure enjoyment of flying was retarded by the higher concentration required to fly the T–6 in the initial stages of training. This meant that confidence was slow to develop in students. But for these very reasons the T–6 provided a more exacting training medium and thus provided a higher degree of transfer to the new basic training aircraft such as the T–33, F–80, and B–25.

The higher degree of pilot skill required of the primary student to fly the T–6 has several other effects. It sent the primary attrition rate above the expected level. In addition, it required a higher degree of instructional and pilot skill on the part of the instructor. These problems were overcome by perfecting more exacting instructional techniques, and the attrition rate returned to normal.

Ever since the inauguration of the T–6 as a primary trainer, the Training Command has constantly revised its techniques and procedures to provide the soundest foundation for subsequent training in tactical aircraft and the greatest possible transfer of knowledge and skills from basic training to advanced training. The results have proved very satisfactory. When primary pilot training was contracted to civilian flying schools in the spring of 1951, these Air Force techniques and procedures were adopted by the civilian flight instructors. The attrition rate has remained normal, and the quality of the graduate of the primary flying training has been maintained.

The step-up in performance of the basic trainer is as startling as is that in the primary trainer. As early as 1945 it was decided that the F–51 would be the standard basic single-engine trainer—although now single-engined conventional training is being phased out—and that the B–25 would be the standard basic multi-engine trainer. In 1947 the F–80 was added as the basic single-engine jet trainer. The acceleration and diversification of training made possible is considerable. Undergraduate pilot trainees now receive approximately 265 hours flying instruction as compared with approximately 230 hours during World War II. These 265 hours in high-performance trainers provide a higher level of proficiency, better preparation to enter crew training, and considerably more training in instruments, navigation, and cruise control than World War II training. With this foundation, the pilot trainee now finds that when he moves on to advanced training, aircraft such as the F–84, F–86, and B–29 are nothing more than other aircraft with a little higher performance. Even the relatively new interceptor program with its F–94 and F–86D aircraft has not presented a serious obstacle.

Officer Training

A significant but unnoticed improvement in the pilot training program is the increased emphasis on the development of officer qualities. Under the pressure of war, the training program had to be directed toward producing a pilot of the highest possible quality. Little time was left over for the development of officer and leadership qualities. But the peace-time Air Force must develop a smaller group of highly trained pilots who are also capable, responsible officers. The new program of officer training places considerable emphasis on oral and written communication skills, on leadership, military management, Air Force organization and administration, and other appropriate subjects. The course had also been made practical. A recurring part of the student's training takes place under simulated or actual conditions similar to those which he would face after graduation.

We are satisfied that a major improvement has been made in officer training and that the quality of the officer graduating is markedly improved. A further increase in quality could undoubtedly be achieved by expanding the officer training program, but the time limitations imposed by the existing flying and academic training load forbid it.

Major Developments in Curriculum

If a graduate of the war-time pilot training program were to look at an abbreviated outline of the present curriculum, he would find that the same general subjects presented in his day are still major divisions of the courses. The important new developments are internal, involving redirection of emphasis, new equipment, and new techniques. These internal changes were made necessary by the increased complexity of the training, aircraft, and equipment; high-speed and high-altitude jet flight; and the development of all-weather aircraft.

The increase in complexity of present-day training was inevitable. Student pilots who fly T–6, F–80, or F–86 aircraft must understand the operation of the various aircraft systems. High-performance aircraft do not excuse errors in system operation. Aircraft engineering and pilot's operating instructions have become more specific and exacting subjects. They must be to insure safe operation of these complex machines. Similarly innovations in navigation and flight instruments, specially in jet aircraft, require detailed familiarity.

Jet aircraft also demand a precise knowledge of cruise control and flight training. The relatively short time that they can remain airborne, coupled with their high speed, demands split-second decisions based on intimate knowledge of the capabilities of the aircraft and its equipment.

More than any other single factor, the all-weather program has had tremendous impact on curricula. Not only does proficiency in all-weather flying require more flying time in the aircraft, but it also involves more detailed and more refined instruction in the academic subjects of weather, navigation, instruments, and flight rules and regulations. Whereas the student pilot in 1943 received approximately 15 hours of hooded instrument flying time in undergraduate training, he now receives approximately 60 hours of hooded and actual instrument training plus the sizable block of time allotted in the advanced training schools.

Any flying training program must remain up to date in its methods. The Korean war is closely watched as a source for modifications in present training. Changes brought about so far have been refinements in tactics and techniques rather than major alterations. An active Far East Air Forces liaison program keeps the Training Command abreast with current operational trends and developments. In addition further liaison is being made with all major air commands using graduate pilots.

Instruction

The permanent value of any type of instruction is dependent upon the amount of course material which can be retained by the student and applied to his future problems. The Air Training Command has made considerable progress in vitalizing its pilot training program by increasing student participation, by employing a wide variety of training aids, and by improving the quality of instruction.

Each hour of ground instruction is being made as practical as possible. The student must apply his own thought processes to answer practical problems which he can recognize as being ones which he could well face in the future. Instead of the old lecture technique a flexible procedure has been adopted with the aim of drawing each student into as much of the classroom presentation as possible. Many types of learning activities are employed, and their pattern follows a step-by-step process—known-unknown-known. One of the most useful devices is the practical classroom, or the learning-by-doin method. For instance, the classroom may be a replica of some opera tional function, such as the weather forecaster's section, where th student is required to solve simulated operational problems unde instrument weather conditions.

Flying instruction is presented on an individual basis, with th individual student's abilities analyzed and taken into consideration Each course is flexible enough to give the instructors time to concen trate on the weaknesses of each student.

One of the most useful and realistic training methods is the em ployment of training aids, both the three-dimensional devices an publications. These training aids were hard hit by postwar austerity but the program has been revived and a number of new and ingeniou devices have been provided by training aids shops. The goal of th command is to staff and equip a first-rate training aid shop at eac air base. A publication system has been devised in which there ar now only five types of approved publications. All of these are spe cifically designed for the instructor, the supervisor, or the student This organization simplifies the task of instruction and administration yet is broad enough to insure comprehensive coverage of cours material.

Higher-performance training aircraft, more complex subject matter in the courses, the diversification in teaching methods, and the intensified use of training aids have all put an additional premium on the quality of instruction and instructional supervision. No training program will be any better than the ability of its instructors to demonstrate a comprehensive understanding of their subject matter and to communicate their knowledge clearly and fully to their students.

The Air Training Command has made every effort to improve its level of instruction by providing aggressive, formal, pre-service instructor training programs. Such courses as the ones for instrument instructors, primary and basic pilot instructors, and fighter gunnery instructors have done much to improve instruction. Pre-service training is further augmented by active in-service and upgrading programs. The Air University Command has cooperated in the instructor improvement by providing the Air Training Command with quotas to its Academic Instructors Course.

One major difficulty is in stabilizing the level of instruction. The constant turn-over of military personnel has necessitated a continuing program of training courses for both supervisors and instructors.

A degree of stabilization has been achieved. The new AFSC program has established an education career field for airmen and officers. This official Air Force recognition of the value of identifying and hannelizing United States Air Force personnel into the teaching ield has offered such personnel great encouragement. In certain fields ivilian instructors have been used to stabilize the training program. But in many areas of the training program we are still faced with the problem of turn-over. We need more assistance from other Air Force ommands in providing an orderly flow of qualified personnel into he Training command—personnel who have been instructors elsewhere or who possess aptitudes and experience which qualify them o be trained as instructors. In many cases the shortage of instructors has become so acute that we have had to resort to "inbreeding" practices within the command. There is a definite limit to this practice, and in only a few cases is it desirable. We feel there would be a definite improvement in the quality of our student product if provision were made for inter-command transfers of capable potential instructors. This should be supplemented by a definite tour of duty for both instructors and supervisors.

Such a system would also help to solve another problem—the one of finding more competent instructors for the classroom phase of flying training. Most of the instructors in the pilot training program, as well as most of the supervisors, have been pilots. Because flying is their primary interest, they have often tended to slight the classroom phase of the training program. This lack of interest, coupled in some cases with inadequate educational background, resulted in a prosaic classroom presentation and relative lack of progress on the part of the instructor. While a rated pilot who is also a good teacher is the ideal man for the pilot training classroom since he of all people is in the best position to hold the attention and respect of the student pilot, this type of individual has always been in short supply. A more even distribution of rated and non-rated instructors and supervisors, who can maintain a balance between the classroom and flying instruction, is a necessity in the pilot training program.

The Optimum Pilot Training Program

While the present pilot training program which I have summarized is a considerable improvement over the one which existed during the Second World War and produces a better rounded and more highly trained graduate, this does not mean that the Air Training Command is completely satisfied with the training program. There are always new methods, new training aids, and further improvements in the organization in a system as complex as the one which produces such a highly skilled technician as a rated pilot. Any pilot training program must also constantly battle against obsolescence. Training skills and training aircraft must always be related to projected first-line aircraft and re-evaluated. Our first-line combat aircraft and projected aircraft are extremely costly machines. They are fitted with expensive and complex equipment. Yet the striking power of these aircraft has increased in greater proportion than has the cost. Is it not logical then that we should also train a pilot to a proportionately higher level of skill so that we may safeguard our investment in equipment? I firmly believe that our program for the future will provide a highly skilled pilot on whom the Air Force can rely in combat situations which might arise within the next decade.

The first phase of this optimum program has been put into effect with the introduction of pre-flight officer training and the six-weeks light plane screening program.

With elementary pilot training offered in the light plane phase, the total flying hours in primary has been reduced from the 130 hours to approximately 120 hours. Academic training has been also reduced from the present 245 hours to 177 hours. Military training involves the solving of problems in relation to the subjects studied during pre-flight.

In the basic phase flying time will remain approximately the same, but training in T–6 or T–28 aircraft will be reduced from the present 70 hours to 55 hours and training in tactical aircraft (T–33 or F–80, B–25) will be increased from the present 65 hours to 80 hours. The military training will simulate duty assignments with local base activities in applying previously acquired knowledge. Commissions would be awarded to all graduates (i.e., aviation cadets) upon completion of this phase.

The advanced flight phase will offer the training which is now accomplished in the crew training schools. The basic purpose of this phase will be to teach the student pilot how to use his aircraft as a weapon. On completing it, the officer would be rated as a pilot.

Many of the underlying concepts for this revitalized training program have been explained in relation to the present program. Perhaps a few words are in order on the changes in proposed training aircraft, in the program of attrition, and in a brief discussion of problem areas which still remain.

A trainer to be used in the light plane training phase will be a Piper Cub with a 108-horsepower Lycoming Engine. Ultimately the light trainer should be a tricycle aircraft low in horsepower, low in maintenance and operating cost, and functioning both as a screening aircraft and as a training aircraft.

The proposed primary trainer would have slightly higher performance characteristics than the T–6, be tricycle geared, have side-by-side seating, and be lighter and less expensive to operate and maintain than the T–6. At present approximately 20 hours of training are required to master the flying technique for the T–6 with its conventional landing gear and high center of gravity. This technique has little transfer value to the tricycle-geared B–25, T–33, F–80, or any other projected combat aircraft. Side-by-side seating affords a better teaching position than does the tandem system in the T–6. The instructor can visually demonstrate procedures and more accurately determine the progress of his students. This would be especially valuable in the primary phase where the student actually begins to form definite techniques and air judgment.

From this primary trainer the student would progress to the T–28 and T–33 for basic single-engine jet training; and to the T–28 and a new trainer designed specifically for basic multi-engine pilot training. The T–28 is useful primarily as an instrument transition trainer. Control responses and cockpit instrument figuration are similar to the T–33 and to the proposed multi-engine trainer, with the added advantage of more economical operation. The tandem T–33 has already shown excellent results in the current program as the basic jet transition trainer. The proposed twin engine trainer would have a higher performance than the present B–25 and would provide techniques and performance more closely paralleling those of tactical multi-engine jet and conventional aircraft.

Tactical fighters and bombers would be used in the advanced pilot training. Since the complexity and peculiarities of these combat aircraft demand training in that specific aircraft type, a small percentage of all projected combat aircraft types should be tandem dual trainers for use by the Air Training Command to insure safe transition into these aircraft. The small number of modified aircraft should not glut USAF inventory; they would certainly pay for themselves many times in savings of aircraft which would otherwise be lost during transition. I know of no other way to achieve the final polishing of a combat pilot than by using the type of aircraft which he will have to use in combat.

Attrition would be handled more economically and more efficiently under the revised program. At present the majority of attrition is in the phase where the students are using the T–6. This aircraft is expensive to operate and relatively slow to master. The average student requires approximately two and one-half hours to assimilate the same amount of instruction which could be given in one hour in a low-horsepower aircraft. This means that attrition in the T–6 is concentrated in the pre-solo phases which take approximately six to ten weeks of training and between 15 to 30 hours flying time. Because of the slow rate of assimilation in the T–6, weak students are not singled out and eliminated quickly enough, yet pilot material is not so unlimited that the Air Force can afford to eliminate students prior to this amount of instruction. Earlier attrition made possible by an inexpensive, lower-performance trainer would reduce the amount of nonproductive effort expended on students who later were attrited, and yet would not compromise the quality of training. Research now underway is expected to provide more accurate methods for using the light screening aircraft as a yardstick to predict the individual's likely success or failure in pilot training.

There still remain certain broad problem areas facing the Air Training Command. Some of them can be overcome or remedied by constantly improving the quality of leadership and management. But the major element which the Air Training Command deals with is the human element, and this remains a field with so many variables that the planner and the manager must exercise extreme caution in setting up criteria by which to operate his program. Some of these areas require long-range research by human resources research scientists. In certain cases the research program has been underway for some time and has yielded valuable results, but at best we are still in an interim stage in finding the best answers to such problem areas as selection of student and instructor personnel, job analysis, proficiency measures, motivation and operational effectiveness, training devices and simulators, and skill retention.

The selection of students to enter the specialized phases of basic pilot training still remains a headache. Previous selection devices were mainly subjective and accomplished little more than division of pilot trainees into fighter pilots or bombardment pilots. We are not only dissatisfied with the subjectivity of this procedure, but we are now faced with the new and more complex problem of further subdividing our graduating classes from primary training into highly specialized basic and advanced training courses such as all-weather fighter, day fighters or fighter bomber escort training, B–26 training, or B–29 crew training.

Another problem in selection which urgently requires attention is that of isolating the characteristics of successful officer personnel and of developing the best possible selection devices for determining which applicants have the highest officer potential. While the pilot training program has been expanding in the last few months, qualified applicants for these courses have become fewer and fewer. Several months ago we could fill pilot classes with stanine 6 to 9 personnel having a minimum of two years of college. The supply of such personnel is nearly exhausted. We have been forced to drop the college education requirement and to lower the stanine to 5. Even at this level there remains a critical shortage of applicants. Yet we must expect more f our pilots than we have done in the past. With high performance nd highly specialized jet bombers, fighters, all-weather interceptors, ve must have men who as pilots and as officers can keep abreast of he developments of modern technology. The question is: can other riteria be devised which will give us the kind of men who can assimiate this wider variety of skills and knowledges without possessing he level of formal education previously thought desirable?

The selection problem is further complicated by the matching of personnel into combat crews for the F–94, F–89, B–29, and B–47. This s another area in which modern high-performance aircraft have inensified the need for closer cooperation and understanding between crew members than was necessary during the Second World War. An ll-weather interceptor pilot, for instance, must operate his aircraft ınder the direction of his radar observer and execute maneuvers immediately upon his command. At the same time he must construct the mental picture of the relative position of the target from the radar observer's running commentary. This mental picture must be accurate because the pilot will complete the final stage of interception through interpretation of his own radarscope. The weather in which these aircraft must operate produces natural apprehension in the pilot when flying in adverse weather, night weather, or flying a collision course to the target aircraft which is not visible. This apprehension can be materially reduced if the pilot has absolute confidence in his radar observer. Therefore it is imperative that personality differences be at a minimum. Psychological implications will of course increase if the aircraft is larger and the crew is expanded to the number necessary to operate such a complex jet bomber aircraft as the B–52.

In the problem area of job analysis, we must have more specific and scientific information on the particular jobs which have recently been established by the Air Force in its new career program. The Air Force had a tremendous job in setting up career programs for officers and airmen, and this job had to be accomplished on a best judgment basis without the benefit of thorough job analysis. The Training Command has inaugurated a command-wide program seeking job information directly from the using agencies. This information has been extremely helpful in revising the curricula of many of our courses. In an effort to make our training objectives more realistic, we have begun a program to prepare and distribute course training standards. Further research on job analysis is particularly needed in the skills peculiar to flying training. This need will become more critical as our aircrew personnel become more and more specialized and as the costs of developing these aircrew skills continue to mount.

The problem of trainee proficiency, again with particular emphasis on aircrew members demands further development of objective standards of measurement. Only through such standards can it be definitely determined which methods of instruction, training devices, curricular materials, and training organization are the most effective.

The problem of motivation and its reaction on operational effectiveness is another major concern of the Air Training Command. One way of improving motivation is the obvious one of improving the leadership qualities of our supervisors and instructors. There has been extensive investigation of the problem of motivation by business organizations and civilian research scientists in the last few years. The facts about motivation which they have ascertained should be translated to Air Force situations. But in addition to this phase, the Air Force faces a more unique problem when it must develop a "will for combat" in its flying personnel, especially in an international situation such as we now face as contrasted with conditions immediately after Pearl Harbor. We have been particularly concerned about the number of flying evaluation boards convened because of fear of flying in our B–29 crew schools. We must have proper motivation, first so that instructors will do an effective job, and second so that the student will apply himself in training and, later, in tackling the tasks assigned to him in an operational unit.

The problem area of training aids is one which has had considerable attention in the past. During the Second World War the Air Force spent a considerable amount of money on training devices and training aids. Much remains to be learned about their true value in the training program. With the tremendous initial cost and the high operating costs of our present-day aircraft, it is more important than ever that we use training aids, especially flight simulators, to the fullest possible extent. We need to know more about the exact nature of skills and knowledges of flying—which ones can be effectively taught on the ground and what kinds of ground training are the most realistic substitutes for air training. Answers to these questions involve basic research in the business of transfer of learning. What skills should be simulated? How close must the simulation be to the real product to yield the optimum transfer of training information to actual flying? We might consider the simulator projects which we already have underway for jet aircraft, fixed and flexible gunnery, aircraft interception, and control with a view to selecting students and possibly using simulators in measuring and maintaining proficiency.

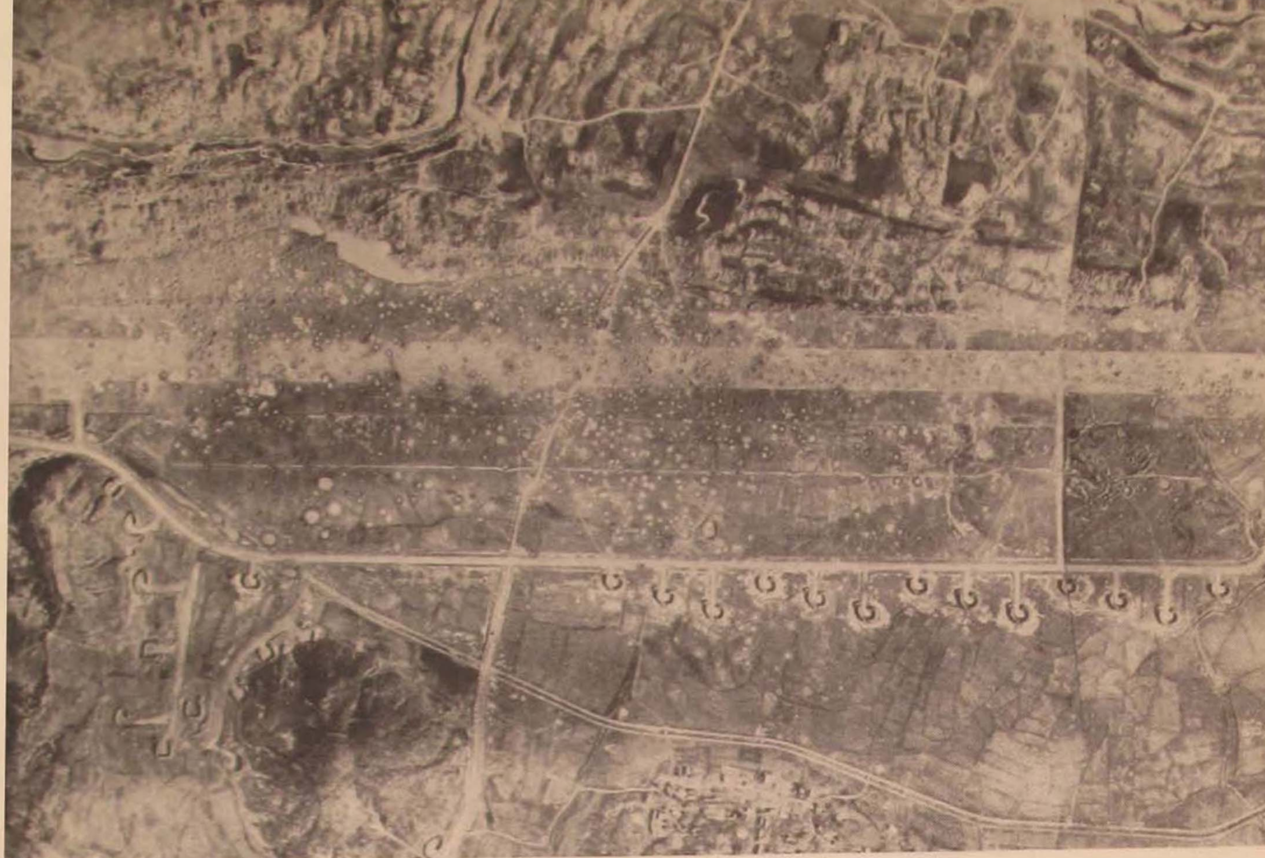
The final problem area of skill retention also requires much investigation. Our whole mobilization planning is predicated upon the assumption that the different types of learning and skills offered in a universal military training program and the reserve program will be sufficiently retained by the personnel to be of use in time of emergency. We should know more about the amount of retention which is possible for different types of learning and different skills.

Most of the problem areas which I have indicated are already being investigated and we are incorporating the results of the researches into our program as quickly as they can be evaluated. The revitalized pilot training program as visualized in this article is being put into effect step by step. It must be phased in gradually with our present program so as to not upset the balance of the training program. By the time this goal is achieved there will no doubt be other goals on the horizon, and this is as it should be. For the present, I can safely state that the present United States Air Force Pilot Training Program compares favorably to that of any other nation and, in its present form is the best we have ever had.

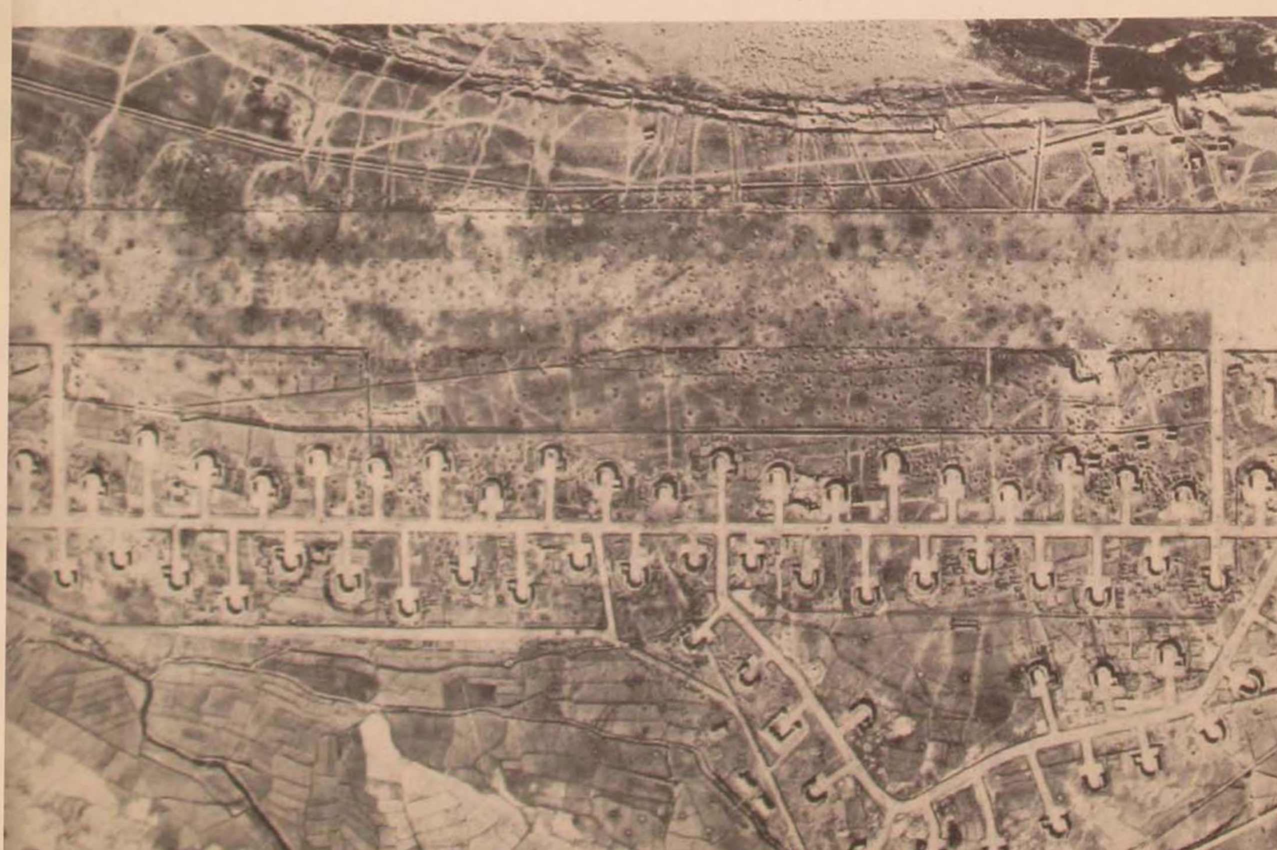
Hq., Flying Training Air Force

MIG Alley

The inability of any air force restricted in its operations to limited areas behind the enemy battle line to wage a completely effective interdiction campaign has been strikingly illustrated in Korea. When the war began in 1950, U.N. air forces struck swiftly and with deadly efficiency at the small North Korean air force, sweeping it from the skies and demolishing its ground facilities. By November 1950 there was no North Korean air force. When the Chinese Communists intervened, the air war began again, but under radically different circumstances. The Communists constructed 33 airfields in North Korea, but they were unable to operate from them in the face of the incessant U.N. bombings. Instead they have used airfields on the Manchurian bank of the Yalu River, where they are protected by the U.N.'s desire to limit the scope of hostilities. When U.N. interceptors tangled with flights of home-hugging MIGs from these Manchurian bases, they had only 10 to 15 minutes of fuel which they could expend in dogfighting. Yet if a MIG got into trouble, all he had to do was turn and streak across the border to safety. Although the kill ratio in these air battles has risen steadily in favor of U.N. pilots until it now stands at 9 to 1, air-to-air combat alone is not decisive. The other phase of the battle for control of the air—the destruction of the enemy's home bases and facilities and its aircraft industry—cannot be employed by U.N. air forces without risking expansion of hostilities. For two years F–86 pilots patrolling MIG Alley have stared across the Yalu at four major Communist airfields, Tapao, Antung, Tatungkou, and Takishan, where hundreds of gleaming MIG–15's present a magnificent target—but on the other side of the river.



South of the Yalu, the Communists have constructed 33 airfields in North Korea. All these airfields are regularly photographed by FEAF reconnaissance aircraft and are bombed as fast as the huge labor gangs pressed by Communists can repair the damage done by previous strikes. So closely are these airfields watched and so swiftly does bombing follow repair that all 33 airfields—from more elaborate ones such as Sunan (above) and Saamchan (below) with 6000- to 7000-foot concrete runways, hardstand taxi-strips, and rows of sturdy, dispersed revetments, to mere emergency landing fields—have been consistently non-operational. Not only have enemy aircraft never operated out of these airfields but MIG aircraft have never even been sighted on any of them except Sinuiju and Uiju, both of which are just across the river from Manchuria.



On the Manchurian banks of the Yalu lie four large Communist airfields. They are air bases in the true sense, for here are the hangars, the maintenance facilities, the supply dumps, and the administrative units not found on the Communist airstrips in North Korea. These oblique photographs, taken with a long-range aerial camera by a Fifth Air Force reconnaissance aircraft flying at high altitude on the Korean side of the Yalu, show two of these Manchurian bases from which MIGs rise to give battle over MIG Alley. This one is at Antung, just across the river from Sinuiju. MIGs are grouped at the ends and parked along the edges of the 7200-foot-long, 230-foot-wide concrete runway. More are lined up along the taxi strip and the revetment roads. Of 120 aircraft visible in this picture, only 5 are parked in revetments.

This picture taken from the Korean side of the Yalu shows the Communist airfield at Tatungkou on the Manchurian coast near the mouth of the Yalu. Some 58 MIGs are parked at the ends of the 6800-foot-long, 200-foot-wide runway, but not one of the 64 revetments is occupied. Tatungkou is not as complete as Antung, since it has no large buildings or hangars and no communications system. This does not mean that the airfield is not a very busy one. U. N. pilots have reported seeing as many as 400 aircraft there at one time. Antung and Tatungkou, together with Tapao and Takishan, are the backbone of the large enemy air build-up in MIG Alley.

Communist Lessons from the Korean Air War

MAJOR ROBERT B. GREENOUGH

IN the late thirties the average American viewed the growing tension in the Pacific with little or no concern. Victim of the most insidious form of propaganda—skillfully planted stories designed to induce apathy and indifferences—the "U.S.A." believed that our antagonists in the East could never approximate our weapons, our equipment, or our personnel. Tales were told of the ineptness of enemy intelligence; of how they slavishly copied false blue prints so that their new aircraft spun in on trial flights because we had cleverly drawn in fuel lines which would not feed during certain maneuvers. Then our pilots encountered the "Zeros," and the real story was told. When the first great test was over, the "U.S.A." was proved to be partially justified in its assumption—the American fighting man was the equal and superior of anyone thrown at him. For the rest—matériel—we had guessed wrong, and had sent our fighting force out to combat superior arms, which were overcome with the differential of courage and skill alone.

Today America is faced with the same situation, psychologically as well as militarily. Two USAF fighter wings, the 4th and 51st, have successfully challenged an enemy equipped with five times the number of an aircraft that is, in some respects, operationally superior. The score stands at about eight to one in favor of the F–86 against the MIG–15, and there is evidence some are content to say, "We've got them licked." It is a pleasant thought, but one that will bear examination because it assumes one false premise: that the Communists are standing still and are learning no lessons from the Korean Air War. This is palpably untrue, and the following discussion is an attempt to set forth only the salient precepts which have been placed within easy reach of the enemy.

Two fundamentals must be kept in mind. The first is that the air war has been fought over enemy-held territory, and hence any combat losses by either side, with few exceptions, have been recovered by the enemy. The second is that there are available to the Communists sufficient skilled technicians to take advantage of the recovery of both friendly and other crashed aircraft and to evaluate the evidence accumulated from them.

Technically, little USAF equipment that has been committed has not been compromised. The loss of various types of our aircraft to enemy action has resulted, doubtless, in the salvaging of sufficient matériel to permit enemy assessment of nearly all our armament and installed equipment, as well as armor. This discouraging fact is brought home by reports of enemy operation of U.S. type aircraft, notably F–80's, which have obviously been recovered and made operational. In this connection the U.S. had already given the Soviets a vital assist. During World War II almost every classified instrument and piece of equipment was delivered to the U.S.S.R. on "lend-lease." What was not delivered was impounded by our "allies," notably the B-29, to which the TU-4 bears a scarcely startling resemblance. In possession of our previous secret equipment, the Communists have had an unparalleled opportunity to compare the progress made in the newly captured equipment and to assess their own advantages. Any doubts of their ability to do so must be tempered by the knowledge that they possess captive German technicians, known to be on a par with the world's best. What the Communists have gained then since 25 June 1950 by the favorable position they have enjoyed is vastly greater than what we have gained. This is a natural consequence of the fact that they have carefully operated over only their own territory. For example, they should now have thoroughly evaluated the question of the relative merits of the high cyclic rate of fire of the F-86's, .50 caliber guns versus the rate of fire of the slower, heavier 37 mm and 23 mm of the MIG-15, as they have been able to recover the crashed interceptors of both sides. This problem goes farther than the relative probability of hits by either type armament under combat conditions. More important is the amount of structural damage caused by each type of projectile and what damage is necessary to produce a "kill." Based upon the findings of such investigations, changes in armor and modifications of aircraft can be planned. Vulnerability of fuel tanks, engines, and pilot's compartments, structural weaknesses, and performance characteristics have all been made apparent to the enemy, without a comparable acquisition of knowledge by the U.N. experts. This, in turn, vitally affects the angle and method of attack, the method of evasion, and all such related tactics.

The Communists, then, have had advantages in technological intelligence, coupled with a ringside and general hot seat for the observation of our operational procedures. It is inconceivable that these benefits have not caused a change in their organizational and operational concepts. Because of the nature of Communist air operations all such changes are not evident at the present time, but we do know that the Chinese Communist Air Force has demonstrated greater preoccupation with the concept of control of the air than could be expected unless its Soviet advisors had received the word to experiment.

During and after World War II, the classic concept of the mission of the Soviet Air Force was support of the ground forces, a concept which relegated the air units—under operational control of the ground commander—to the position of highly mobile, long-range artillery. Isolation of the battlefield and shock effect seemed to have been the primary aims. Korea must have caused a reevaluation of this concept, if it had not already taken place. The Soviet post-war emphasis on MIG production did not necessarily indicate a grasp of the concept of the necessity for control of the air for offensive operations or any other reassessment of the role of air units. This jet interceptor appears to have been first developed for the air defenses of the U.S.S.R. In any event, the evidence of the relative effectiveness of U.N. air-ground support and interdiction, achieved currently without serious enemy challenge, must have caused a Soviet re-appraisal of aerial warfare. The first and primary lesson has been that control of the air is a prerequisite, one which must be achieved before the committal of aircraft for other missions.

Since the beginning of the Korean Air War the U.N. has enjoyed relative air superiority, and the Communists have been on the defensive. Access to forward airfields has been denied them, and hence their ground-attack aircraft (the IL–10 has only a 165-nautical-mile combat radius) have been useless in that role. Further the continued U.N. interdiction of all North Korean airfields forward of the Yalu River area has limited the scope and type of operations of other Soviet type aircraft, placing primary emphasis on the role of the MIG–15. The last eighteen months, therefore, have seen almost the whole Communist air effort devoted to an attempt to wrest control of the air from the F–86's, so that the area of operations could be pushed south. The lessons learned from this endeavor fall primarily in the realm of tactics and maneuvers, with which this article is not concerned. But all indications point to the change in the over-all concept in the mission of Communist air power: it is now being devoted primarily to one end—control of the air.

With this change in concept, it is probable that the close control exercised by the ground commander over air units has lapsed. This statement is based principally on the absence of any pattern of Communist support and defense of military ground targets, even near the optimum operational area of the MIG–15. It would seem, rather, that the air commander has appropriated for himself a degree of autonomy under which he is attempting to devise his own concept of defense and attack, untrammelled by the dictates of a commanding ground officer.

The limited nature of the air battle area over North Korea, confined at present generally to the small air space north of the Chongchon River, has posed another organizational problem which the Communists seem to be in the process of solving. The integration and control of early warning and ground control intercept radar, together with their coordination with fighter-interceptor aircraft, have given the Communists valuable experience in interception operations. The tactical control of relatively large numbers of aircraft concentrated over a small area is still not entirely within their capability, especially at night and in weather. But the lessons learned in this type of operation are evidenced by the enemy's persistent, though largely ineffective, night intercept efforts.

The apparent change in the over-all mission, pointed out above, has perforce led to a change in planning concepts. Where, before, the principle of "mass" required the concentration of aircraft over a given land area in support of troops, the present defensive posture along the Yalu River is designed for the limited objective of defense of a relatively small, well-defined target area. Though the very number of aircraft of all types currently stationed in Manchuria poses a very real offensive threat, the majority of the aircraft are MIG–15's, primarily fighter-interceptors. All evidence points to the fact that this composition of the Communist air forces in Manchuria is designed principally for defense of the vital installations in this area.

It must be realized that all conclusions about Communist planning have been reached by the deductive process alone. Confirmatory evidence is totally lacking. Yet certain observable procedures, such as the rotation of air units out of combat after a comparatively short tour, indicate that the combined Communist command has in mind an accelerated combat training program intended to provide quantity rather than quality. This conclusion is borne out by the nature of Communist air operations over Korea during the period from November 1951 to April 1952, when an average of over 2000 MIG daytime sorties were flown monthly. Only a minor number engaged U.N. aircraft, the remainder seemingly being airborne for training through observation. The movement of jet fighter units from Communist air armies in the fall of 1951, the stepped-up conversion of piston to jet units in the satellite air armies this past spring, and the relative stand-down over Korea in MIG activity since mid-April 1952, in themselves are difficult to explain. Taken in conjunction, they present, at least, a not illogical indication that the conduct of the Korean air war is part of a Communist plan, strategic rather than tactical, to develop trained cadres for the purpose of bringing to combat readiness all of their far-flung air forces.

Another ramification of strategic planning must have been mastered when the Communist faced the logistical problem of supplying POL and parts, as well as aircraft, to support the Korean Air War. Aside from the inescapable factor of distance, which at one time certain segments of opinion fatuously believed to be insurmountable, the problem of developing indigenous sources of supply and maintenance had to be solved. To date there is no indication that this problem has not been overcome; rather, it would seem from the continued shifting of units, in addition to supplying the normal requirements of the Communist units in Siberia, that the current Korean logistic support has been adequately and efficiently planned.

The maintenance of an adequate level of supplies has presented no insurmountable problems. The primary result of two years' activity has been that the Communists have learned the requirements of stockpiling. That this lesson has been learned is evidenced by the continued operations over North Korea, simultaneous with increased training in Manchuria and the rest of China, and the recent eight days of sustained activity in August. Further proof is found in recent reports of an over-all increase in strength within the Chinese Communist Air Force.

On the other hand, in the area of tactical planning, the Communist efforts have been vague and without discernible pattern. Whether this results from restrictions placed on local commanders by higher headquarters or is brought about by the nature of the relationship between the Chinese and Koreans, with their Soviet "advisors," is not known. The best that can be said is that Communist reaction to U.N. air strikes has been unpredictable. A trend was noted during the spring of this year to intercept U.N. fighter-bombers north of the Chongchon River. And yet, the Suiho hydro-electric plant, less than 40 miles from the Antung complex, went by default. Ten minutes before the initial strike some 200 MIG–15's were observed on the border airfields, and no defensive sortie was made.

The areas of attack by the Communists were gradually restricted after the arrival of the F–86's in the theatre in December 1950. U.N. air superiority, including interdiction strikes against North Korean airfields, forced the enemy to base his aircraft across the Yalu River. However, the loss of advanced operational bases does not explain entirely the limitation of his defensive air effort to the area north of the Chongchon River. The combat radius of the MIG–15 permits operations as far south as the bomb-line, and at one time these aircraft successfully defended the area just north of Pyongyang. Thus the present areas of air activity are of the Communists' choosing, and as previously stated, the whole defensive effort is sporadic and pattern-less. In certain circumstances, however, results of U.N. daylight penetration are predictable: medium-bombers no longer attack northwest Korea in daylight, and fighter-bombers and reconnaissance aircraft require a substantial F–86 escort or screen when in the areas of MIG operations.

In general it can be said that the enemy has learned that, for the present, under his current operational concept his air missions must be limited during daylight to promising targets. In recent months his efforts have been primarily hit and run attacks on fighter-bombers and F–86's, when the chances of success were heavily weighted in his favor. In recent weeks this tactic has included end-run strikes at U.N. piston aircraft behind the F–86 screen. (This latest tactic is an indication of the effectiveness of the enemy early warning and ground control intercept radar nets.) The dire results to the enemy of a change in this generalized pattern, evidenced by losses during the first eight days in August, when 673 sorties were flown at a cost of 44 MIG's destroyed or damaged, were self-evident, and the Communists have returned to their former tactic of limited activity.

Enemy night activity has followed a different pattern—small numbers of aircraft, primarily piston types, roam over all of Korea as far south as the bomb-line. The night air effort has been, with one exception, extremely ineffective. Though the Communists have persistently vectored their aircraft into the vicinity of U.N. intruders, relatively few firing passes have been made, with little or no effect. The obvious explanation for this ineffectual effort is that to date the enemy appears to have failed to use such airborne intercept radar as he may possess. The one successful night intercept made against U.N. medium-bombers was made during bright moonlight, when visibility was good. This must have pointed up the need for night and all-weather intercept equipment. In the meantime the enemy has doubtless been making use of his opportunity to evaluate similar USAF equipment.

At the time of writing, the ratio of air-to-air combat losses is approximately eight to one in favor of the U.N. pilots. Disregarding for a moment the psychological factor of the "Freedom versus Slavery" struggle, it has become obvious that a factor in this disproportionate loss by the Communists is training. That U.N. pilots consistently out-maneuver and out-fly their counterparts must be abundantly clear even to the prejudiced eyes of the enemy leaders. That is not to say that every U.N. unit is measurably better than every Communist unit. Some MIG–15 units, for instance, have demonstrated high proficiency. On the other hand there have been numerous instances of MIG's spinning in without apparent cause, of enemy pilots over-shooting their targets, or firing out of range. This consistent disparity in pilot skill must be attributed to the fact that known Soviet training methods and criteria are inferior to the minimum prescribed by U.N. training standards.

That the Soviets, and their Satellite subordinates, have realized the inadequacy of their pre-combat schooling must be assumed. Less obvious are the steps being taken to ameliorate the situation. The thought was advanced before in this article that one explanation of the MIG combat pattern during the latter part of 1951 and early 1952 might be that the Communists were giving future training cadres a brief taste of combat. If this assumption is valid, it is evidence, if such is needed, that the enemy has profited from his two years' air conflict in Korea. In this connection, the air combat of the first eight days of August last may indicate that Communist judgment as to combat-readiness still leaves something to be desired. MIG's were unleashed in overwhelming numbers against F–86's with the dire results previously mentioned. This abrupt change in the air activity gives indications that the enemy had new pilots he thought were adequately trained. He could not have been more wrong.

One other factor in U.N. superiority should be mentioned briefly. Whether through training, or heritage, or confidence in their mission, the U.N. pilots have consistently out-fought their opponents, generally at great numerical odds. Whether facing superior numbers or superior-performance aircraft, U.N. pilots consistently bore in and "sweat it out," a characteristic conspicuously absent in the great majority of the enemy. The most prevalent tactic employed by the enemy to date has been the "hit and run" attack, in which the altitude capability of the MIG is used to position it for a single firing pass, followed by an accelerated get-away.

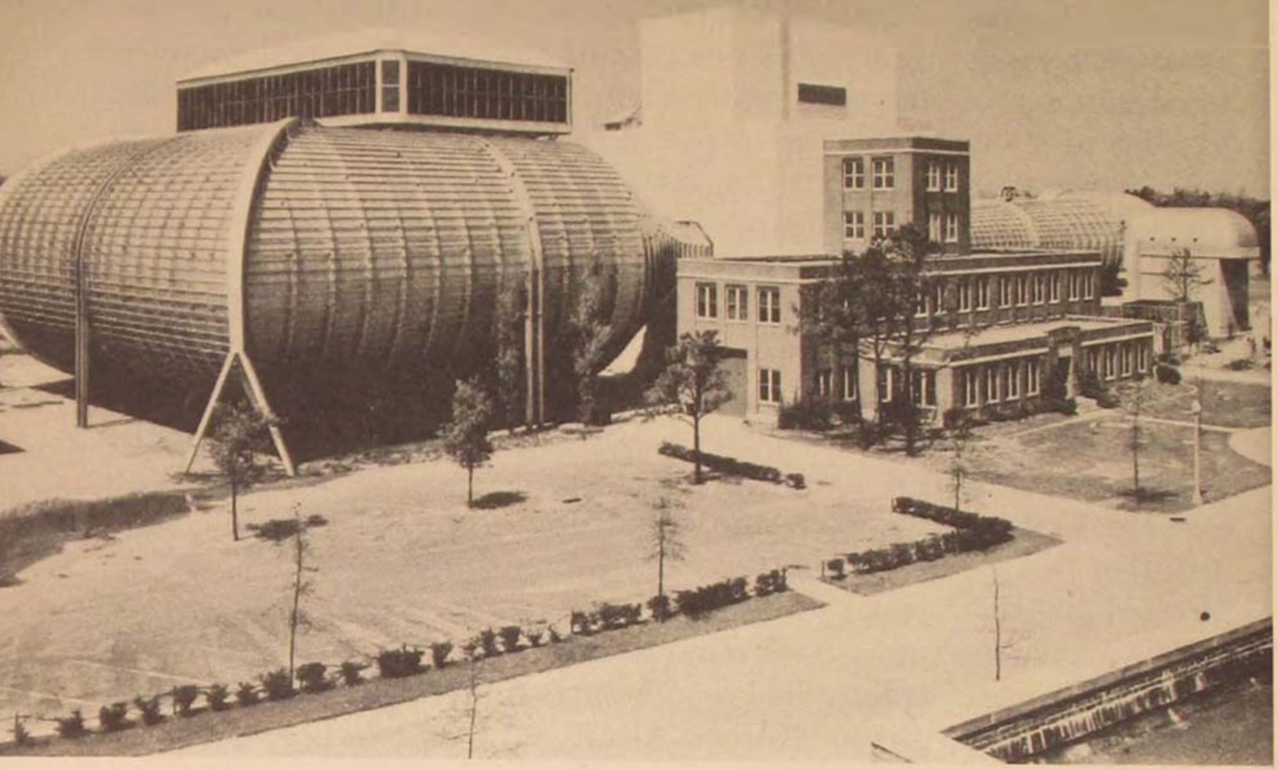
In the field of ground crew training, the Communists have given evidence of lessons at least partially learned. Again based on deduction, they appear to have some degree of know-how if they can maintain over a six month's period, an average of 2000 sorties per month with a peak of nearly 4000 during December 1951. When considered in light of the number of aircraft assigned, these figures do not indicate a sortie rate that even approximates U.S. utilization, but they do indicate a capability to match or exceed our total sorties. Assuming this maintenance to follow the pattern of other technical activities in the Korean War, we may believe that it was probably carried out in large part by indigenous crewmen, under Soviet supervision. This would be in keeping with the Soviet policy of training Satellite personnel to take over various technical functions as rapidly as possible. Here it should be noted that as a result of the last war the Soviets had learned one great lesson, which the Korean action has highlighted: by concentrating primarily on one type of aircraft, such as the MIG–15, training problems are greatly simplified. An indication of the increase in trained personnel is the fact that the majority of the jet aircraft appearing on the Antung complex are currently believed to be based there. For a time it appeared that these fields were used primarily as staging bases for operations over Korea, and before that, a fluctuating count at the border fields indicated that it was necessary to fly all aircraft to the interior bases for all except minor repairs. Both of these systems brought about an attendant reduction in operating efficiency and aircraft availability. This latest change tends to indicate the presence of a maintenance organization, and shows not only that the Communists have such units presently available, but also that they have learned the benefits of conducting such activity at forward airfields.

This article has perhaps served one useful purpose if it has shown that the Communists have had ample opportunity for learning valuable lessons in the present Korean Air War. The two phases of experience with which this article has dealt are the military, and very briefly, the psychological. Militarily the Communists have had time to assess, evaluate, and devise counter-measures against U.N., primarily USAF, tactics and use of air forces. Whether or not they have as yet demonstrated that they can successfully counter friendly procedures is immaterial. [Most U.N. air casualties have been due to ground antiaircraft fire—not to enemy fighters.—*Ed.*] No thinking USAF commander believes the enemy has made an all-out effort with his best equipment. The Communist "cat-and-mouse" technique is too well-known. In the meanwhile the mechanics—command, staff, logistics, maintenance, supply, and related problems—of a sizable air effort against the best of U.N. air power are being worked out and formulated.

In the realm of morale, or psychology, or pure purposefulness, the Communists have learned another lesson. Brief mention was made of the diving, "go-to-hell", boring-in tactics of U.N. pilots. This is true of the Australian, South African, British, and American pilots operating over North Korea. It is the one advantage which the Communists have not been able to overcome. No matter what their mission, or the type of aircraft flown, U.N. pilots have given the enemy abundant evidence that they can and will reach the target. Until the challenge of the ability, planning, and dauntles courage of U.N. air units is met, the Communists will continue to lack command of the air.

Headquarters, Far East Air Forces

NACA



This massive 16-foot transonic wind tunnel is located at NACA's Aeronautical Laboratory, Langley AFB. Powered by two 30,000-horsepower electric motors, it was remodeled early in 1951 to handle aerodynamic experiments in the sonic region (about 760 miles per hour at sea level). It is the largest transonic tunnel in the United States. The square, white structure in the center of the photograph is the test section.

With the trend of world events underscoring more than ever the importance of speed in the air, the National Advisory Committee for Aeronautics (NACA) is stepping up its exploration into the problems of supersonic flight. Many of these problems have been brought to its attention by the Air Force and the Navy Bureau of Aeronautics. Using all the means of aerial research from delicate measuring devices to massive wind tunnels, and following an airplane from the drawing board to the supersonic barrier and beyond, NACA studies "the problems of flight with a view to their practical solution," the purpose for which it was created by Congress in 1915. This basic research paves the way for improvement in American military, commercial, and private aircraft. In supersonic experimentation as well as most of its other projects, NACA does the ground work, leaving the developmental research and testing to the Air Force and the Navy. This gives the military forces more time for work on specialized equipment. Teamwork has produced a program of research, development, and testing which is dynamic and continuing.

Two of the half-dozen aircraft designed and built specifically for research purposes have attained supersonic speeds—the Bell X–1 and the Douglas D–558–II Skyrocket. The latter has flown 1238 miles per hour—20 miles a minute—at high altitude. Some NACA missile models have flown something like 3000 miles per hour. As a direct result of this research, American aircraft in Korea have been able repeatedly to engage enemy fighters in combat at supersonic speeds and at extraordinary altitudes.

While the NACA is vitally concerned with the supersonic zone, its research program is not confined to one area. Structural problems involved in build-

ing very thin wings, loss of strength due to aerodynamic heating, loss of stability at high speeds and altitudes, automatic controls, and excessive fuel consumption are a few of the matters under study in NACA laboratories, and in actual flight tests.

The bulk of NACA's work is conducted at three research centers. Its earliest and largest laboratory is at Langley Air Force Base, Virginia. There virtually every phase of aerodynamics, hydrodynamics, aircraft structures, and aircraft loads is researched. A flight station for pilotless craft is operated at Wallops Island off the Virginia coast.

The Lewis Flight Propulsion Research Laboratory, another NACA installation, is located at Cleveland Airport, Ohio. All phases of aircraft propulsion are covered, including problems peculiar to extremely high speed.

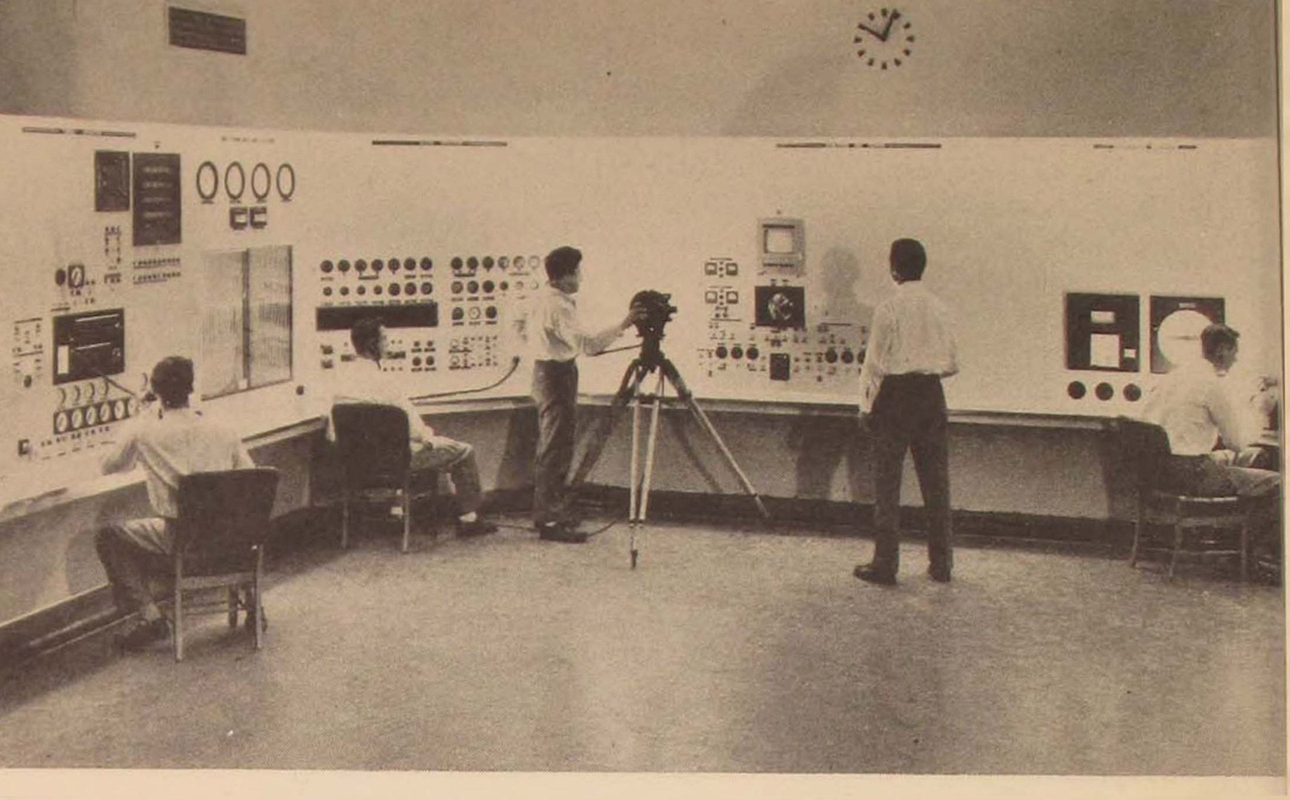
On the Navy's Moffett Field near San Francisco, NACA operates the Ames Aeronautical Laboratory. It is concerned chiefly with supersonic projects and has the largest and some of the fastest wind tunnels known. And much of NACA's flight testing is carried out in cooperation with the Air Force and the Navy at Edwards Air Force Base on the California desert.

The main NACA committee consists of 17 members appointed by the President. They include two officers each from the Air Force and the Navy, two representatives of the Civil Aeronautics Authority, and one each from the Smithsonian Institution, the U.S. Bureau of Standards, and the U.S. Weather Bureau, all of whom serve for indefinite terms. The remainder consists of seven individuals who are "acquainted with the needs of aeronautical engineering or its allied sciences." These seven serve for terms of five years.

Aerodynamics

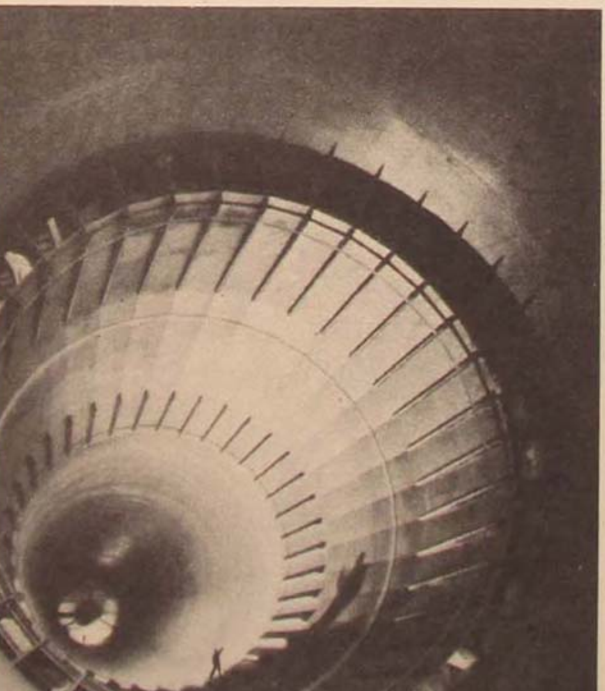
The NACA pioneered the design and use of full-scale wind tunnels and operates the largest ones in this country. This program of research systematically develops theory, progresses to experimental verification conducted in specialized tunnels, and is then extended to larger operations in full-scale and pressure tunnels. In the 40-by-80-foot tunnel at Ames Laboratory and in Langley's 30-by-60-foot tunnel, full-sized airplanes can be studied with engines operating, whether they are powered by reciprocating power plants or gas

Wind tunnel models must have miniature measuring devices wired to recording apparatus outside the tunnel. In this photograph a model is being instrumented in the instrument research division of Langley Aeronautical Laboratory. The model represents a fast swept-wing airplane (wings upside down, separated from fuselage). The technician is wiring the tiny instruments which will fit inside the fuselage when the wings are attached.

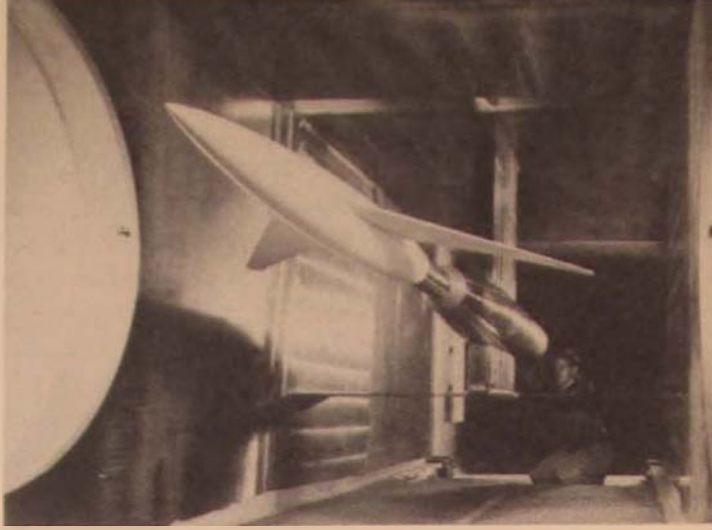


In this control room, data is recorded during the operation of world's largest supersonic wind tunnel at NACA's Lewis Flight Propulsion Laboratory, Cleveland, Ohio.

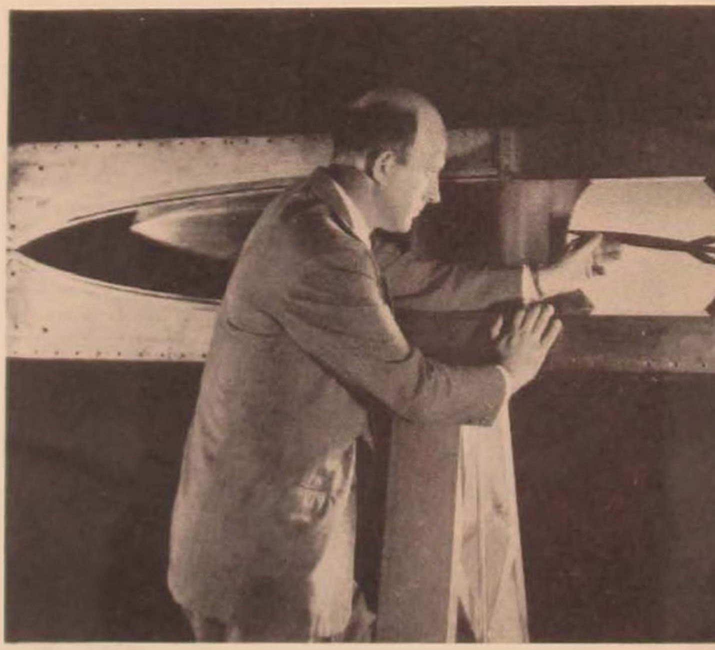
turbines. These tunnels are used for large-scale drag investigations and boundary-layer control studies. They are particularly valuable for testing wings and aerodynamic shapes designed for high speed and supersonic flight. Specialized tunnels have also been developed. Some are pressure tunnels in which the scale of models increases by whatever amount the air density is increased above normal pressure. Others are two-dimensional types of very low turbulence, and a combination of the two is a pressurized, two-dimensional, low-turbulence tunnel. The NACA spans the transonic speed region by the wind-tunnel technique, its 8-foot tunnel at Langley being the first large tunnel to enter this zone. These tunnels, in conjunction with rocket, free-falling body, and wing-flow techniques, enable the NACA to cover speed ranges from low subsonic up to 4.5 times the speed of sound, and beyond.



This supersonic wind tunnel at Ames Laboratory is one of the largest and most modern in existence. Its maximum air speed is twice the speed of sound, with a test section large enough (6 feet square) to accomodate a relatively large model containing more extensive instrumentation, with more pressure orifices and wire strain gauges at key points. This swept-wing model is mounted on a "sting" at its rear, so that shock waves formed by the struts will be behind the model. The sting transmits the slightest movement of the model to sensitive recording apparatuses. Schlieran photographs, depicting the characteristics of the air flow, are taken through the circular windows in the foreground. The giant compressor which moves the air through this supersonic tunnel is driven by two electric motors of 25,000 horsepower each.



The NACA's 11-inch hypersonic wind tunnel at Langley yields data explaining the fundamental nature of air flow at extremely high speeds. Flow conditions can be studied at from five to ten times the speed of sound. The immediate application of this scarce information is in the design of long-range guided missiles. This photo shows the nozzle and test section of the tunnel with the side plate removed. At left is a narrow slit through which the air is forced in at high speed and under great pressure. A partial vacuum created at the other end of the test section and the shape of the curved nozzle combine to cause the air to expand and accelerate rapidly, rushing past the model at hypersonic speeds. This tunnel, one of the fastest known, operates on the "blowdown" principle. Pressure tanks are "pumped up" between tests.

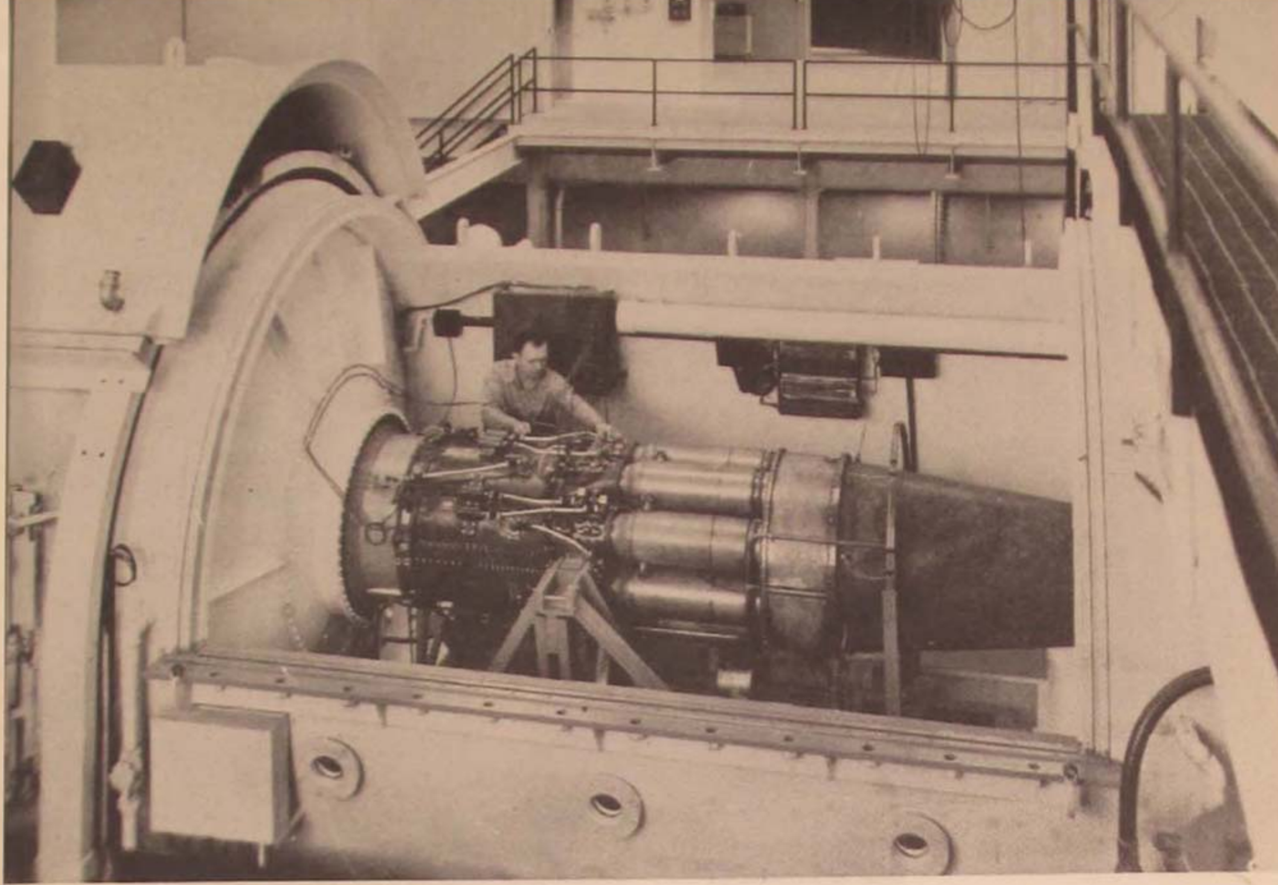


At the left is an inside view of the 58-foot-in-diameter return passage of Langley's 16-foot transonic wind tunnel. Air forced through the test section at the speed of sound moves through the tube shown here at slightly more than 100 m. p. h. The large air vents remove warm, "slow" air near the tunnel wall and substitute cool air from outside. At the right is the test section of Langley's 19-foot pressure wind tunnel, in which air speeds up to 200 m. p. h. are used for studies of maximum lift, stability, and control. Compressed air forced past the model at the usual operating pressure of two and one-third atmospheres affords test results equivalent to those obtained at atmospheric pressure with a model (or airplane) two and one-third times as large. Workers in the test section must enter and leave through a compression lock.

Propulsion

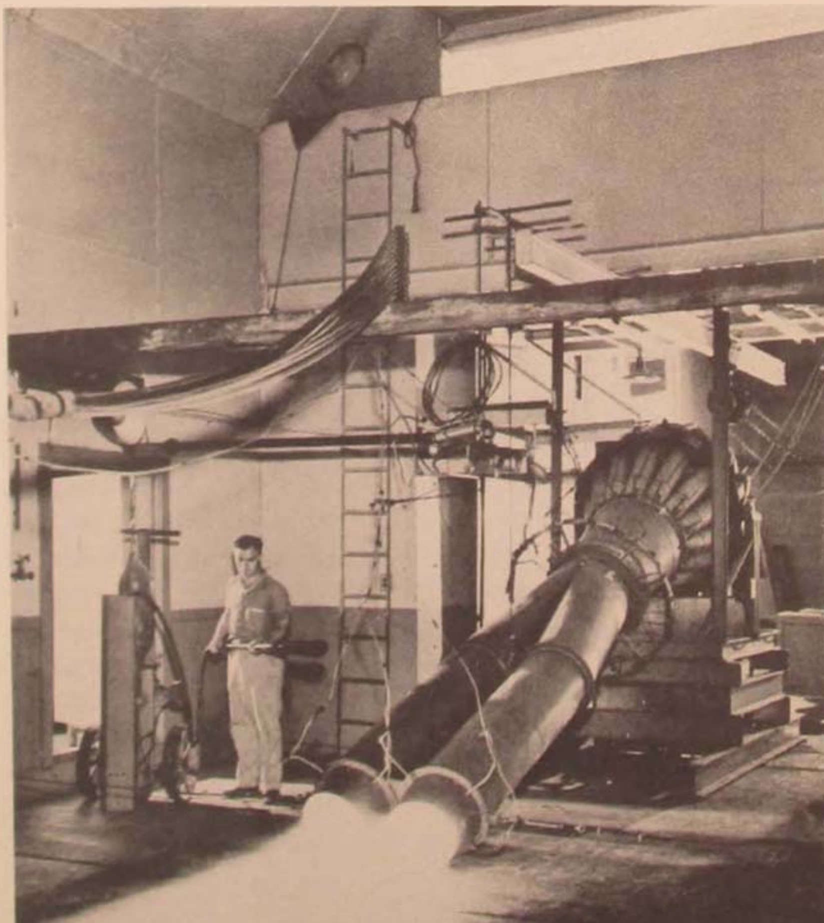
A majority of NACA's propulsion research is conducted at the Lewis Laboratory at Cleveland. With the exception of fundamental investigation of combustion and detonation, propulsion research is now entirely devoted to new types of jet propulsion, including rockets and turbine plants. Already new methods have been developed in compression, for example, which have permitted an advance from the reciprocating engine compressor of the 500-horsepower type to compressors for turbo-jet or turbo-propeller engines which absorb up to 10,000 horsepower. And recently huge compressors of nearly 15,000 horsepower have been built. Because fuel is an ever-present problem in jet aircraft design, NACA scientists are seeking to develop liquid fuels which will occupy less space for a given energy content than do conventional types. Metallic and other nonhydrocarbon fuels are being investigated in search of a fuel which can be used by ram-jets for long-range supersonic flight. An important instrument of combustion research is the NACA high-speed camera, which records combustion processes at 400,000 frames per second. Other aspects of propulsion constantly studied by NACA scientists are materials and stresses, lubrication and friction, and thermodynamics. These factors are examined as they operate under normal conditions and under simulated high altitude and extreme temperatures. Nearly a hundred NACA laboratories study phases of aircraft power plants.

A twin-engine ram-jet missile is shown in the 8- x 6-foot supersonic tunnel at NACA's Lewis Flight Propulsion Laboratory. Simultaneous research is conducted on engine and fuselage arrangement with stabilizing surfaces, and on the performance of the engine. The tunnel air stream operates at speeds as high as 1400 miles per hour.



At the Lewis Flight Propulsion Laboratory, a turbojet engine is installed in the altitude tank where starting and operating characteristics can be studied at simulated altitudes up to 70,000 feet and inlet temperatures up to 600 degrees Fahrenheit.

Many operational problems are under study at NACA's Lewis Laboratory. One of them, shown in this photograph, is the interaction of twin-jet exhausts inclined toward the ground in simulation of take-off conditions encountered in certain engine mountings.

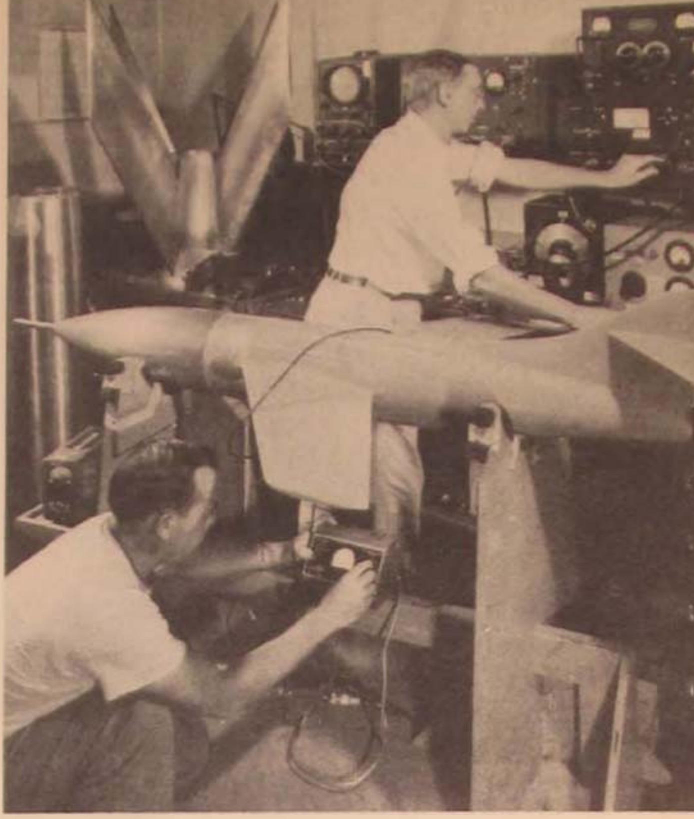


A delta-wing research model is prepared for firing at NACA's pilotless-aircraft test station on Wallops Island, Virginia. This large wooden model, designed to measure drag on a delta wing, is powered through transonic speeds by an internal rocket.

Research and Test Center

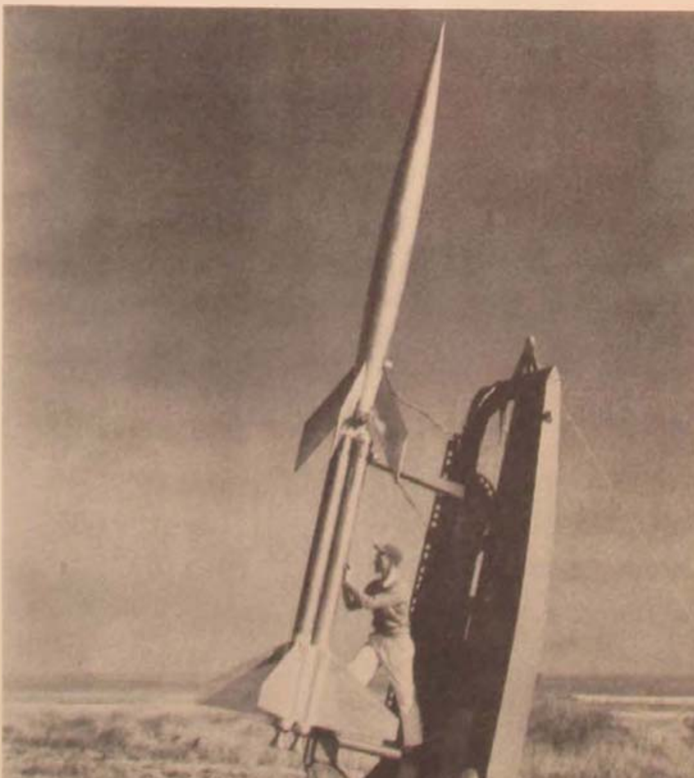
One of NACA's most valuable facilities for aerodynamic investigations in the transonic and supersonic ranges is its pilotless aircraft research station on Wallops Island, Virginia. There the research with models is brought out of the wind tunnel and flight tested. Rocket-propelled models are launched at incredible speeds. During their minute or two of flight, instruments note such things as wing lift, drag, dynamic stability, control effectiveness, buffeting, flutter, aeroelasticity, boundary layer, and heating. Models are tracked by movie cameras, and when the limits of sight are left behind, radar traces their course. Inside the model itself are tiny instruments which send a continuous record to the ground station by radio. Few models look like either an airplane or a missile—they are merely "aerodynamic shapes." Wallops is the intermediate point between the wind tunnels and Edwards Air Force Base, California, where NACA pilots and scientists explore the capabilities of prototypes—small and unusual aircraft which bear names like Bell X–1,

NACA technicians check the circuits of the miniature instruments and radio transmitter in a research model soon to be tested at Wallops Island. The small devices which obtain aerodynamic information from a model during flight are designed, constructed, and installed by the instrument research division of the Langley Aeronautical Laboratory. This is a flying scale model (minus the cockpit canopy) of the Douglas D–558–2 Skyrocket, which last August topped all speed and altitude records for piloted airplanes.

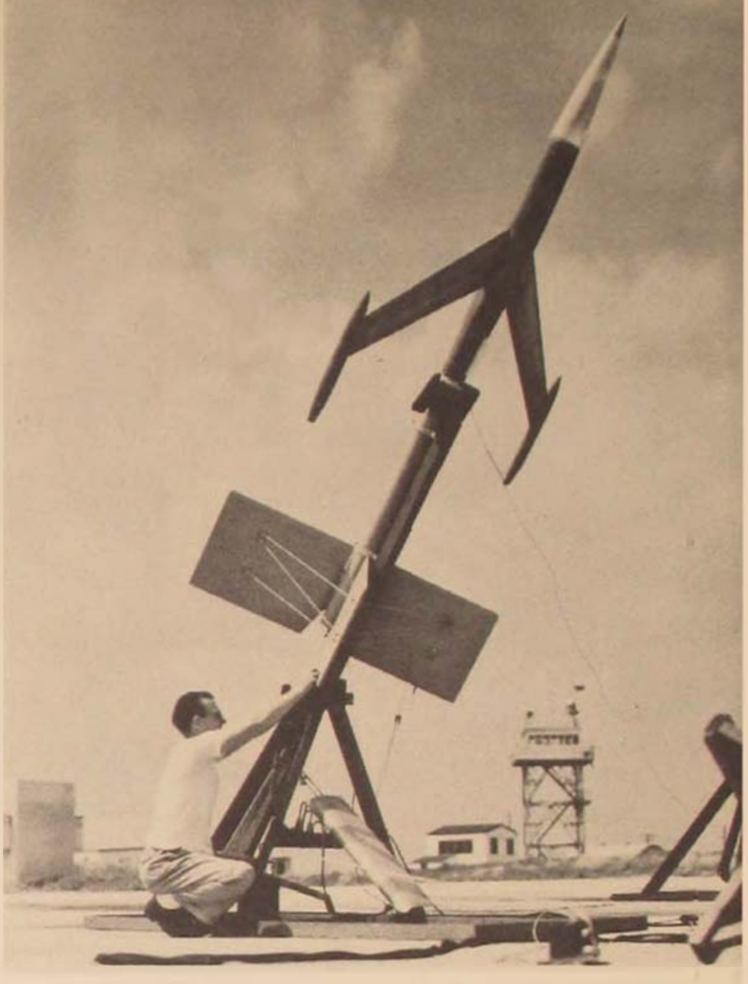


Douglas D–558–I, D–558–II, Northrop X–4, and Consolidated-Vultee XF–92A. Each of these planes carry into the higher altitudes and the supersonic speed zone hundreds of pounds of delicate measuring instruments, automatic optical recording devices, and miniature electronic equipment. Because these instruments are unique in their sensitivity and diminutive size, many of them must be designed and constructed by NACA laboratories.

A technician on Wallops Island prepares a drag-research model for launching. It is used to study skin heating caused by friction with the air, as well as pressure distribution, and the velocity of the boundary layer. This big model, 14 feet long and of magnesium construction, has twin booster rockets and a third rocket motor embedded in its shell. The boosters give the model a good start (about 1200 miles per hour). Then the internal rocket ignites, pushing the speed up to more than 2500 miles per hour.



This model is one of a series flown at Wallops Island to determine the most favorable shape, size, and location for extra fuel tanks on a fast swept-wing fighter plane. Tests were made with tanks at the wing tips and at other locations on the wings. Research results can also be applied to jet-engine nacelles on the wings and to aircraft rockets carried beneath the wings. Attached to the tail of the model is a booster rocket which accelerates the model to high speed. When its fuel is expended, the booster falls off and the model flies on, powered by its own internal rocket.



Rocket-propelled research models must be as light in weight as is consistent with the strength necessary for high-speed flight. The speeds at which they fly also demand extreme accuracy in design, shape, and dimensions. Most models are made of wood, others of light metals. This supersonic research model, used to study skin heating, boundary-layer velocity gradient, and pressure distribution, has a shell or fuselage of spun magnesium less than one-tenth of an inch thick. This 14-foot model weighs 90 pounds without instrumentation or rocket fuel and 275 pounds fully loaded.

The antennas on the left are at the NACA's rocket firing range on Wallops Island. They receive the radio signals transmitted from the flying model on several different telemeter channels. The helical antenna at left is stationary, while the turnable antenna is moved by remote control to track models. The right photograph shows a continuous-wave, Doppler velocity radar unit so sensitive it can track the flight of a caliber .22 bullet. It provides a running speed record for rocket-powered models.

NACA's importance to our military air power is underscored by Major General Donald L. Putt, a NACA Committee member and Vice Commander of the Air Research and Development Command: "To meet the threat of new weapons that the enemy is sure to have in his arsenal, the research budget for the U.S. services has been increased in order to speed up the development of aircraft and guided missiles. To do this we must draw upon our basic aeronautical knowledge and we must replenish and speed up the acquisition of new knowledge so as not to bankrupt the future. To provide the foundation for our development program, the services are almost wholly dependent upon the NACA."

Some of the NACA's research airplanes are shown at Edwards AFB. From the left: the Douglas D-558-2 Skyrocket, which broke all records for speed and altitude when it was clocked at 1320 m. p. h.; two Northrop X-4's, tailless planes for transonic studies; Bell X-1, first to pierce the sonic barrier; and two Douglas D-558-1 Skystreaks.

The Effects of Rank on Human Relations

DR. NATHAN MACCOBY
DR. B. HYMOVITCH

THE essence of administration is that certain key men are in a position to control situations and to influence other members of their organization. In other words, in order to administer the organization, members are ranked according to their authority. We call such an organization, where the members are placed in different ranks, a "hierarchy." The Air Force is a hierarchy. So are the Army, the Navy, large industries, universities, governments. Wherever there is a hierarchy certain problems of human relations are bound to arise. This review is concerned with these problems, and especially with the research that has been done on them. A list of some of the most important studies in the area is appended to this article.

This kind of research is still young and developing. The first important study was done at the Hawthorne plant of the Western Electric Company less than 30 years ago.[1] World War II gave a great boost to such research, and among its products was important work on military leadership, communication, and job satisfaction, done by the Research Branch of the Army's Information and Education Division, and published in part in the four volumes entitled *The American Soldier.*[2] The Air Surgeon's Office,[3] the Office of Strategic Services,[4] and the Office of War Information,[5] also contributed to this wartime research. Since 1945 there has been a steady growth of research in this area. The Office of Naval Research stimulated research in human relations and leadership at Michigan and Ohio State Universities, among others, and the Air Force led the way (the Human Resources Research Institute, the Human Resources Research Center) in establishing in-service research in human resources. The results of this activity are impressive, but there is still much to do.

What Makes a Good Leader?

Some of the earliest intensive scientific studies in this area attempted to throw light upon leadership. The early studies were heavily influenced by the then-current theoretical and practical developments in social science. On the academic side there were many theories which assumed that each man naturally belonged to one of various types, and that each type of man had relatively consistent psychological traits. That is, there were thought to be leader types and follower types. At the same time the practical world had become aware of the potential advantages in testing men before assigning them to jobs. The first question asked in the investigation of leadership was: "What makes a man a good leader?" Studies on that question or some modification of it date back to 1904. Many of these studies concluded that a specific list of traits in given quantities contribute to making one man a leader and another a follower. But reviews of these studies raised important problems. Studies of males yielded results different from those which used female subjects. Results in one age-group differed from those found in other age groups. Different situations—military, industrial, fraternal, and athletic—were shown to require different psychological characteristics in their leaders. Even when different groups in the same organization were studied, different traits were sometimes evident. More startling indeed are the observations that even within the same group different leadership qualities are sought at different stages in the group's development and in different situations in which the group may find itself. In fact a person might make a poor leader at one stage in a group's development and an excellent one at a different stage. Thus it became clear that the kind of personality that would make for a successful leader depended upon the structure of the group, the needs and goals of the group, and the larger cultural context in which the group existed. Also the term "leadership" meant different things to different investigators, and different standards of successful leadership were being employed, even when the theoretical meaning was kept constant.

It is not to be concluded that personality is an unimportant dimension of leadership. There are many occasions where group structure, group needs, and the larger culture are relatively constant. Under those conditions certain specific personality characteristics tend to make for better leadership. Of course the question arises: What are the criteria by which we measure better leadership? Considerable progress has been made on the problem of criteria testing.[6] Another important step in the investigation of leadership is the devising of reliable techniques for the description and observation of leadership in action.[7]

During the last decade, scientific interest has also centered on the effects of different types of leadership on group functioning. The study most responsible for this orientation[8] examined the effect of different kinds of adult leadership on groups of boys working together in a recreational setting. Three different types of leader behavior were employed—"democratic," "autocratic," and "laissez faire." The results of this experiment indicate that the kind of social atmosphere induced by these three types of leadership varied tremendously. Productivity, morale, inter-personal and inter-group relations, varied accordingly. The unfortunate use of the terms "democracy" and "autocracy" have been responsible for some hasty generalizations. It would be well to refer to the exact descriptions of the behavior employed in this experiment, since what the investigators considered "democratic" may not at all correspond to the meaning that others give to the term. Nevertheless, it is a most stimulating study when viewed against the problems of military leadership.

Considerable exploration has also been made of leadership functions. One study [9] has shown that, in the absence of an assigned leader of a group, the various leadership functions tend to be carried out by different members of the working group. Thus, if a group is to accomplish its purpose, certain leadership jobs must be done whether by an assigned leader or by temporary informal leaders.

How Does Rank Fit Our Social Values?

It is clear that certain conflicts in values exist in our society because of the hierarchies which exist in most of our organized activities. It is safe to assume that many people in our culture consider hierarchial organizations as authoritarian in nature and basically in conflict with the American ideals of equality and freedom. This view oversimplifies both the nature of hierarchies and the meaning and intent of equality and freedom. Yet the behavior of many a "boss" reveals his feeling of guilt because he wields power over others. He is thus revealing a conflict between the oversimplified values of our culture and the demands that are placed upon us to organize our activities.

We all know that people in superior positions in our society are subject to strong pressures when acting as superiors. The oft-repeated cry of a boss—"Just call me Ted!"—may be interpreted as a demonstration that he really does not want to be considered as occupying a superior position. The fact that he may not want an underling to call him Ted prior to his request to do so merely demonstrates the two-sidedness of his feelings.

Another illustration is seen in the fact that the boss may continually repeat that his door is open to anyone at any time, yet he may be quite upset if subordinates come to see him without appointments. There are many other symbols of the existence and importance of a hierarchy, even in organizations where the administration is proud of the equal treatment accorded to all. The difference in the sizes of desks, maneuverability and upholstery of chairs, plushness of the carpeting on the floors, presence or absence of a water carafe, and numerous real or fancied inequities in the distribution of these items, often indicate the underlying problems.

It is interesting to note how often the boss may want to lay down the law and yet how embarrassed he may be in so doing. The subordinate is puzzled by the boss's variations in behavior toward him. This is another sign of the ambivalence of our feelings toward hierarchy. The result is that values dominant at a particular time are subordinate at another, and this affects the behavior of both superior and subordinate.

How Can We Best Communicate Between Ranks?

The communication process has received increasing attention during the last few years. Frequently one of the administrator's prime concerns is how best to communicate downward so as to encourage a feeling of participation among all members of an organization. While the administrator's primary conscious concern is with the downward process, it is reasonable to assume that the people most important to each individual in a hierarchy are those above him, for these are the people who have power over him and who can determine what happens to him. These observations have led to the hypothesis that the major impulse is to communicate upward. If this is true, not enough communication downward will occur unless special efforts are made. The major will report to the colonel, but he may neglect to inform fully the junior officers and the noncoms unless he works at it.

Some interesting research relates to this point. One study [10] demonstrated that groups of youngsters who are experimentally placed in an underprivileged position tended to communicate increasingly to the over-privileged groups. A study of rumor transmission [11] indicated that rumors tended more often to be transmitted in an upward direction in a hierarchy. This did not hold true, however, for material which was critical of the upper levels. Another study [12] found that individuals who were low in a hierarchy and had no chance to move upward tended to communicate more irrelevant information upward than "lows" who potentially could be promoted. The author suggested a theory of substitute locomotion to account for these results. According to this theory, if an individual wants to move upward, but has no opportunity to do so, then his communication upward may psychologically serve as a substitute for actual locomotion. He also found that persons in high positions do not criticize their own positions to persons in lower positions, and that persons in low positions tend to communicate less hostility upward than to people on their own level. Presumably the defensiveness of the "highs" prevents them from revealing the less attractive features of their position. A further study of what kinds of information get communicated upward and downward in a hierarchy is now being completed. The fact that the boss so seldom knows of the many interpersonal difficulties present in his organization suggests that the "lows" carefully select what gets communicated to the "highs".

It is fascinating to note the effects of a hierarchy on the perceptual processes of its members. Social scientists have become increasingly aware of the important role that one's needs, desires, and hopes have on what and how one perceives his environment. It is obvious that not all that registers on our eyes is actually noticed by us. We pay attention to what is important to us. Every whim, remark, and gesture of the boss is perceived and analyzed by his subordinates. The employee may speculate at length and become perturbed about the way the boss said "hello," not knowing that he had indigestion. The boss, on the other hand, will probably not notice the fact that the employee went out of his way to avoid saying hello to him. The superior's attitude may be so important to the employee that he pays excessive attention to the superior's behavior, whereas the converse is hardly likely. The superior may be quite surprised when he is informed of the tensions that exist within the employees in relation to him—"How was I supposed to know? He never complained to me!" In one study,[13] high school students had to face a board of three adults who were to determine whether each student would obtain a specific reward. Some of the youngsters were told that certain members of the panel had more power to make the decision than did other panel members. Under these circumstances, the youngsters tended to perceive the more powerful individuals as more friendly to them despite the fact that all panel members behaved in the same way. And when the members of the board showed different degrees of friendliness toward the subjects, the subjects perceived the more friendly ones to be more powerful.

How Do Group Codes Develop?

Considerable evidence has been gathered during the last decade supporting the notion that group standards or codes—implicit or explicit—develop in most social organizations. These group standards can be a difficult problem for the higher level administrator. Unless he knows of these standards, their origins, and the way in which they operate, he may fail as a leader. The more cohesive the group, the more likely is it to develop strong group standards.[14] Administrators are often puzzled when a group of workers functions together in a slipshod manner, although each employee may have a record as being a conscientious worker. The reason is usually the existence of a group standard of which the leader is not aware.

Or, a group of workers, whose individual productivity should vary tremendously, may produce approximately the same amount on a given job. Here again a group standard is controlling individual action. There is good evidence that nonconformity to group standards often results in bad consequences for the nonconformer in highly cohesive groups. We know, for example, how unions treat "scabs." It has been demonstrated that the tendency to reject individuals from groups for disagreeing with other members of the group increases in proportion to the cohesiveness of the group, and is also stronger when the source of disagreement is particularly important to the group.[15] In other words, a bomber crew is more likely to accept someone who is not their pal in his recreation habits than one who is not a good team man in his work habits. In many cases the group has the power to determine what is relevant to the group. Members of the upper echelons of an administrative structure, for example, may insist that members behave in specified ways even off the job. These are but a few examples of how group standards operate to determine the behavior of its members when the forces keeping the group together are fairly strong. They are a major factor in the "resistance to a change in procedure" common in most administrative organizations. Recognizing this fact, investigators[16] have shown that changing the opinion of the group as a whole has better results than attempting to change the members individually. This has implications for commanders faced by informal behavior codes among their troops—for example, a commander who finds that the informal code of his troops overseas condones black marketing.

It is, of course, also true that under many conditions the supervisors may play an important role in determining group standards and group norms. This may very well be true of military organizations. The leader is particularly capable of influencing groups when they have a strong desire to please him because of his personality or his power, or both. His influence may transcend the official working relationship. An interesting illustration of this point occurred in an organization in which a large number of professional people were employed. A new director had been hired but had not yet arrived. Knowing that the new director smoked a certain brand of cigarettes, a social scientist predicted that most of the members of the staff who were not then smoking that brand would change their preference soon after the new leader's arrival. This prediction proved to be correct.

Effects of Group Membership

A brief review of the foregoing remarks will uncover the existence of other social problems in administrative situations. An employee of a large organization may identify himself with and be a member of a sub-group of co-workers who exert pressure on him to subscribe to their codes and norms. He may also be a member of a departmental group which includes persons both superior and subordinate to him, and this second group also exerts its pressure on him. The same employee is also a member of a larger organization and may be expected to behave according to the needs of the larger organization. The pressures on him, stemming from his group of equals, from his subordinates, from his superiors, and from the organization itself, may come into conflict. His overlapping membership in these groups can expose him to a cross-fire of demands. His co-workers may look down on conscientiousness, while his superiors reward it. His department may urge him to sabotage the efforts of another department, while top management urges cooperation. The problem may be further complicated by membership in outside groups—union, ethnic, socio-economic, or racial. In one experiment in this area [17] a group showed in their student role a very different attitude from that of a comparable group of students who had been gathered as members of a religious organization. Overlapping membership in a company and union has also been studied.[18]

The problem of overlapping membership may lead to other difficulties. The boss is often quite surprised to find his subordinate, who had wholeheartedly agreed with him, do an about-face in his absence; or what is more frequent, the boss agrees with the subordinate, only later to reverse his stand after conferring with others. Members of one occupational group may get along very well with members of another occupational group in their inter-personal and inter-professional relations; yet they are amazed to find that these others, when attending conventions of their own professional group, behave in relatively hostile ways. Conflicting membership in different groups may result in a person's saying one thing in the presence of members of one group while thinking otherwise in accordance with his membership in another group. A study [19] has demonstrated that students of one religious faith voted more often for members of their own faith when the voting was anonymous then when the voting was public.

The effects of public commitment are fascinating. We have already noted that one of the better ways to change a group's behavior is through winning over the group as a whole. The process has on most occasions included public commitment by the members of the group to participate in the change. Administrators of fund-raising activities or other voluntary assignments have for a long time accepted the effectiveness of public commitment.

Factors in Group Productivity

Some of the most important problems of human factors in administration relate to the productivity of organizations. We have already noted the effects of different types of leadership behavior on the productivity of groups. Interesting research in this area has been carried on by members of the Survey Research Center of the University of Michigan. The initial studies [20] explored psychological factors involved in group productivity. Matched work groups were studied in the home office of a large insurance company and among section gangs on a railroad. Factors such as production methods, skills, and capacities of groups of workers were comparable. Differences in group productivity could only be functions of morale, leadership, and related psychological variables. Components of morale were separately measured and analyzed, and only one of the morale dimensions was found to be positively related to group productivity. This is the oft-cited military concept of morale: pride in group. The satisfaction a worker derives from performing the content of his job was found to be *negatively* related to group productivity. The reasons for this finding are not fully known, and it may be that this relationship is limited to employees performing routine work and in a position low in the hierarchy. A number of supervisory attitudes and behaviors were found to distinguish supervisors of relatively high producing work units from those of directing comparable units with relatively low production. Supervision among the high producing units was more general, less detailed, less close, more "democratic." Time spent on supervisory tasks, as contrasted with straight production tasks, was higher for the leaders of high producing sections. Supervisors of high producing groups recommended their people for promotion less often but more often succeeded in obtaining the promotions which they did recommend. Further work in this area is in process.[21]

Growing awareness of the importance of social factors in administration has given impetus to the development of human relations techniques. One of the first scientific studies in this area [22] showed that training in human relations can result in superior performance by leaders. Training programs have since been approved by many industries. The National Training Laboratory in Human Relations Skills represents another such development. Many techniques have been developed with the aim of improving group functioning. It is important to note, however, that very little research has been reported on the relative effectiveness of these techniques and on the nature of the conditions under which they are likely to prove most effective. Observations suggest that there are great potentialities in this area, but it is apparent that considerable research is required.

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Air War in Korea: VI

ENEMY BRIDGING TECHNIQUES IN KOREA

Major Felx Kozaczka

An intensive U.N. aerial interdiction campaign against the Communist forces in Korea has been waged since the beginning of the war. The controversial Operation Strangle has only been one phase of this continuing decimation of the enemy's transportation and supply system. The Air Force has frequently pointed out two salient peculiarities of the Korean war which have limited interdiction and thereby hampered its effectiveness: (1) the unusual limitation of the striking depth of air power imposed by our desire to confine the fighting to the area south of the Yalu River has greatly constricted the area of the interdiction campaign. The relatively short distance from the front lines to the Yalu makes it difficult to locate and attack every truck convoy and supply train moving south from Manchuria, especially now that almost all movement is at night. This restriction of course makes it impossible to strike at the sources of enemy supplies. (2) The lull in ground-fighting for the last year has meant that the Communists were expending only a fraction of the supplies which they would normally require for full-scale fighting. If the enemy under these conditions expended 5 per cent of his normal supply requirement in limited engagements, he could still stockpile 5 per cent even if the interdiction campaign succeeded in destroying as much as 90 per cent of his logistical support. Even so, the Air Force asks, is that any reason to abandon interdiction as unsuccessful and thereby allow the enemy to stockpile not 5 but 95 per cent of his supplies?

In addition to these fairly well-known considerations, there is another factor of equal importance which has received little attention in the past. This is the amazing recuperative power which the Communists have demonstrated in their effort to keep their supply system in operation. The rate of construction and repair of rail and highway bridges by enemy forces in Korea has been little short of phenomenal. This is not the result of any secret equipment or new radical techniques, but must rather be attributed to the ingenious and effective use of crude materials and equipment by hordes of apparently well-directed, hard-working laborers.

Enemy bridging techniques encountered in the Korean conflict are not original. Every repair and construction method used in Korea seems to be a throwback to methods used by both the Chinese and Japanese in World War II, the chief difference being an increased effectiveness. This effectiveness stems from a number of factors, the major ones being the stability of the ground situation (allowing repair crews to be stationed at major bridges on a semi-permanent status), and the ready availability of large quantities of lumber and laborers, the two primary ingredients necessary for the Communists' type of repair and construction.

Although a considerable number of attacks against highway bridges were made during the early months of the war, it became apparent that vehicular traffic could not be stopped by destruction of highway bridges, as the great number of roads in North Korea, together with the lack of water depth in the rivers, enabled the enemy either to go around by another road or ford the stream under the destroyed bridge. All but a few of the Korean rivers are fordable except during short periods in the rainy season. On those rivers which are not fordable, such as the Yalu, and the lower reaches of the Taedong and Chongchon, the same techniques used to repair and construct rail bridges have been used for highway crossings. Highway by-pass crossings normally have been built out from the river banks on fill as far as the depth of the water and strength of the current would allow. Then cribbing or pile piers have been used in bridging the over-water portion of the stream or river. The only known instances of the use of pontoon bridges during the Korean war were at two locations on the Yalu. These bridges were temporary expedients in use shortly after the Red Chinese "volunteers" intervened, and have since been replaced by more permanent installations.

As with all modern armies, the enemy forces in Korea are dependent to a great extent on rail transportation for the bulk of their logistic support. This is especially true of the Communists in North Korea because virtually all war industry in the country has been destroyed, making it necessary to transport the enemy's entire logistic requirement from beyond Korea's northern border. This situation was recognized by FEAF, and, as a result, a considerable portion of FEAF effort has been employed in attacks against the rail system. These attacks have destroyed at least two-thirds of the permanent rail bridges over 300 feet in length, and damaged almost every other major bridge in North Korea.

The North Korean Railroad Recovery Bureau, responsible for keeping the rail lines serviceable and salvaging damaged equipment, has organized a highly ef-

This low oblique photograph shows a scene of great activity as the lower and less severely damaged of twin railroad bridges is being rebuilt to do the work of both bridges. The rails stripped from the higher bridge have been laid down on the mud flat between the two bridges to form a makeshift work-train track (1). Some three dozen workmen standing in the foreground (2) and working on the lower bridge (3) are constructing wooden piers (3) to reinforce the two damaged concrete ones. As usual, everything is being done by hand labor. The steel span on the ground at the left (4) has probably been taken from the higher bridge to replace a damaged span on the lower bridge. When the wooden piers now under construction (3) have been completed, other steel spans from the higher bridge will be laid across them to close the gap.

Above is shown one of the shortcuts used by the Communists in North Korea in constructing temporary bridges. Fill material is extended out as far as possible from each bank. The span of the bridge then is built only over the main channel of the river or stream. This device reduces the number of piers necessary for each bridge, minimizing engineering problems and construction time. Such a bridge is safe at normal water levels for moderate tonnage loads, although the fill approaches are subject to undercutting when the river rises during the rainy season. Below, a small marshalling yard in North Korea contains trains loaded with bridge repair materials. The train at left has cars loaded with railroad crossties. The one at right is loaded with steel rails (foreground) and rough lengths of wooden pole to be used in shoring up damaged bridge sections. Note the absence of steel construction materials.

This bridge complex is typical of the elaborate precautions taken by the Communists to keep traffic moving on their main supply lines. With 8 spans down and several others damaged on the permanent railroad bridge (2), it would be very difficult for the enemy to reestablish rail traffic across such a broad stream channel with no first-class repair materials. The small service bridge (5) built out to the gap in the railroad bridge is probably used only for salvage purposes. With rail traffic interrupted, highway traffic has become of such vital importance that the enemy has constructed two by-passes (3 and 4) though the main bridge (1) is as yet undamaged.

fective force capable of rapid repair and reconstruction. With a reported strength of thousands of men, plus an almost unlimited reserve of civilians who can be pressed as laborers to meet emergencies, this Bureau appears very able to perform its mission. Numerous agent reports indicate that it is further aided by Soviet and Chinese Communist technical advisers.

The outstanding feature of enemy railroad—and highway bridge—construction and repair is its simplicity. If their repairs are inadequate by normal standards and repaired bridges cannot support normal traffic tonnages, the main point to the Communists is that the rail line is reopened with a minimum of delay. Repair materials consist primarily of locally procured materials such as lumber and rock. No evidence of the use of steel—except for rails—has been noted in rail repairs in North Korea. This year prefabricated bridge sections made of wood have been noted in considerable number in northwest Korea.

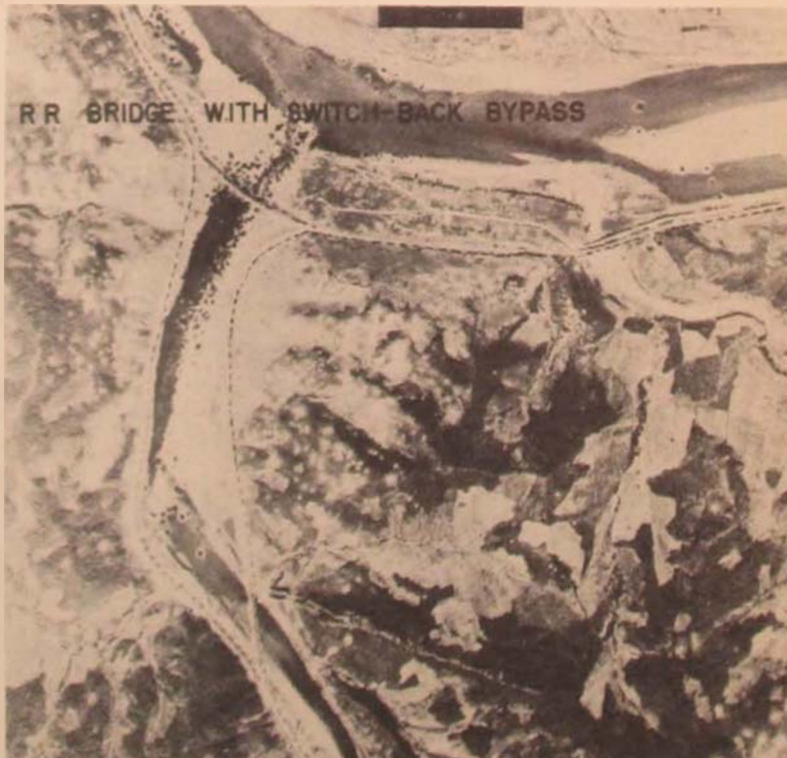
By-passes have been constructed at almost every major bridge crossing. In some instances, as many as three or four by-pass bridges are constructed at one crossing in an attempt to keep one through line serviceable. At some locations by-pass bridges have even been constructed prior to attacks against the permanent bridge.

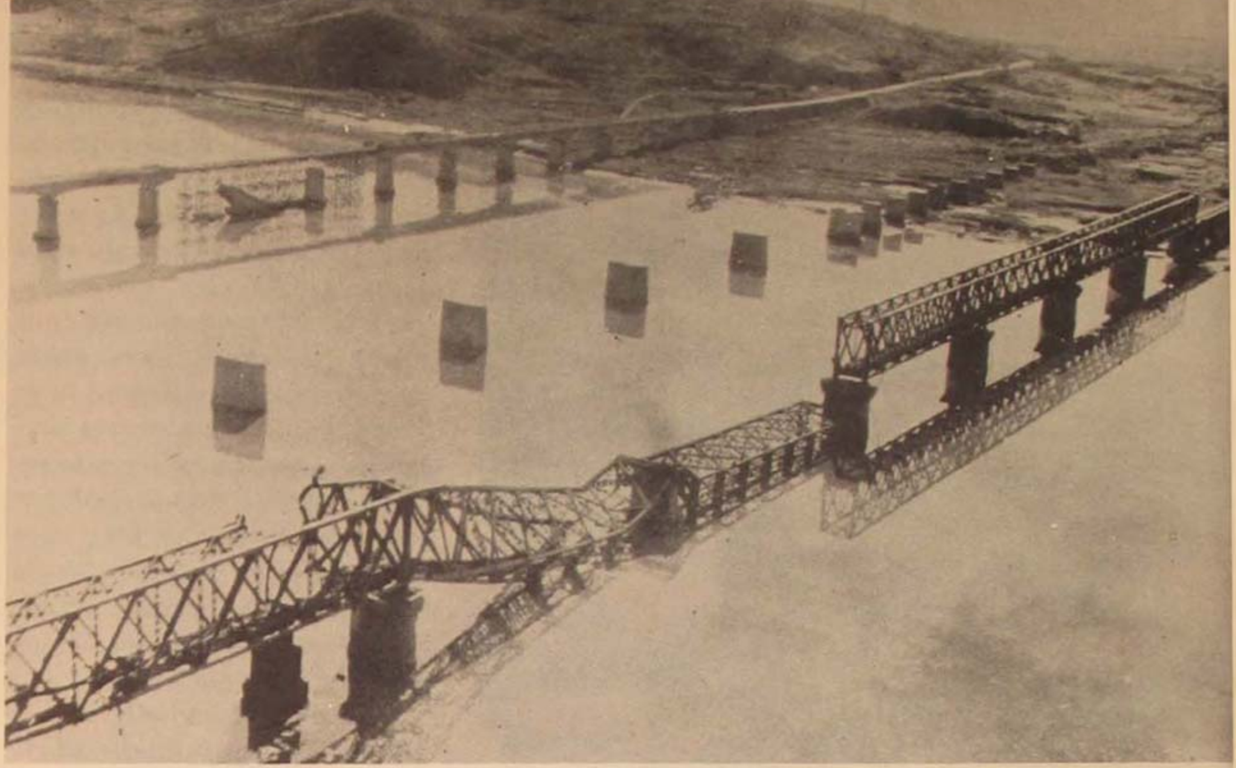
No set formula or pattern has been used by the enemy in repairing damaged permanent bridges. The type of repair has been predicated on the amount and type of damage and the availability of repair materials. Where damaged is restricted only to the displacement of spans, these same spans are replaced on their original piers. About 95 per cent of all North Korean bridges employ a deck-girder span, most of them uniform in size. This makes the replacement of such spans comparatively easy. In locations where a double-track line formerly employed two separate identical bridges, serviceable spans have been removed entirely from one bridge to replace damaged spans on the other bridge. All bridges damaged beyond economical repair have been stripped of usable deck-girder spans for possible use at locations where by-pass is impossible or unfeasible. Where spans are damaged to the extent they cannot be replaced, supplementary piers are built to support shorter spans of wood construction. These supplementary piers are generally of wooden pile, wooden cribbing, or sandbag construction.

Repeated successful attacks against the permanent rail bridges in North Korea have made it impossible in many cases for the enemy to repair these bridges be-

Because they must withstand much heavier traffic tonnages than highway bridges, railroad bridges are much more difficult to repair. This is especially true when the only steel available for use in repair work is the small amount that can be salvaged from other bridges which are beyond hope of repair. Even concrete necessary to build new piers to replace those demolished or weakened by bomb hits does not appear to be available to the Communist repair crews. This damaged railroad bridge has been repaired with the materials most commonly in use in North Korean repair work. Supplemental piers are built up from the river bed to the bottom of the steel span which supports the track. These piers consist of railroad ties laid upon each other to form a hollow square, with the center being filled with sandbags. Sandbags also are placed outside of the pier at its base. In this photograph, the crib piers in the center of the bridge are built flush against the old concrete piers to strengthen them. The temporary piers at the left are double the usual thickness to replace a concrete pier and support the track where one steel span has been knocked out.

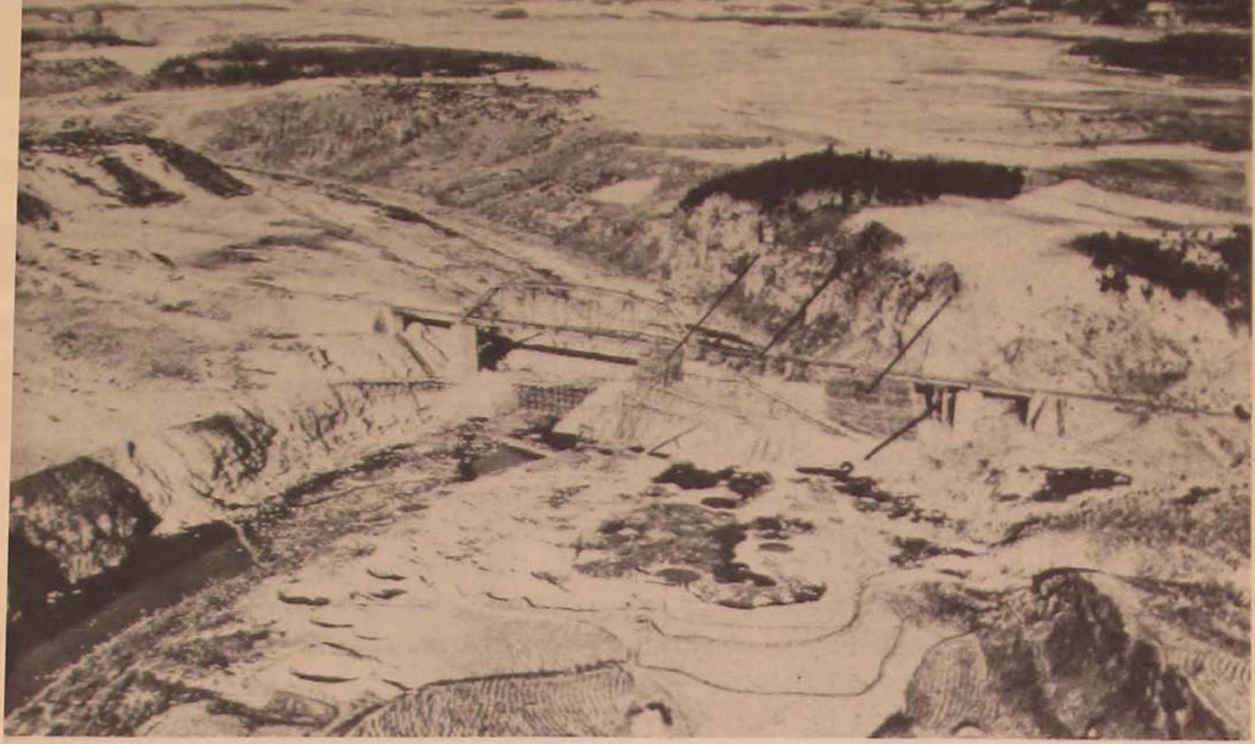
Since the North Korean railroad system is so underdeveloped and the rugged terrain offers a limited choice of by-pass routes, the Communists are much more sensitive to air attacks on railroad bridges than on highway bridges. In addition to building by-pass bridges at some crossings even before the permanent bridge is knocked out, the enemy has also constructed switch-back by-passes to certain railroad bridges in an effort to make sure that through traffic continues to roll. These are usually resorted to in regions where the stream valley is so narrow as to preclude a normal by-pass bridge with a sweeping curve at each approach. In the one shown in this picture, a train approaching the damaged bridge from the right could turn down the by-pass track, cross the stream over the secondary bridge, into the dead-end switch-back track, and back down the left bank of the stream, regaining the main line on the far side of the damaged bridge. In order to interrupt rail traffic on this main line, FEAF aircraft must destroy both widely-spaced bridges.





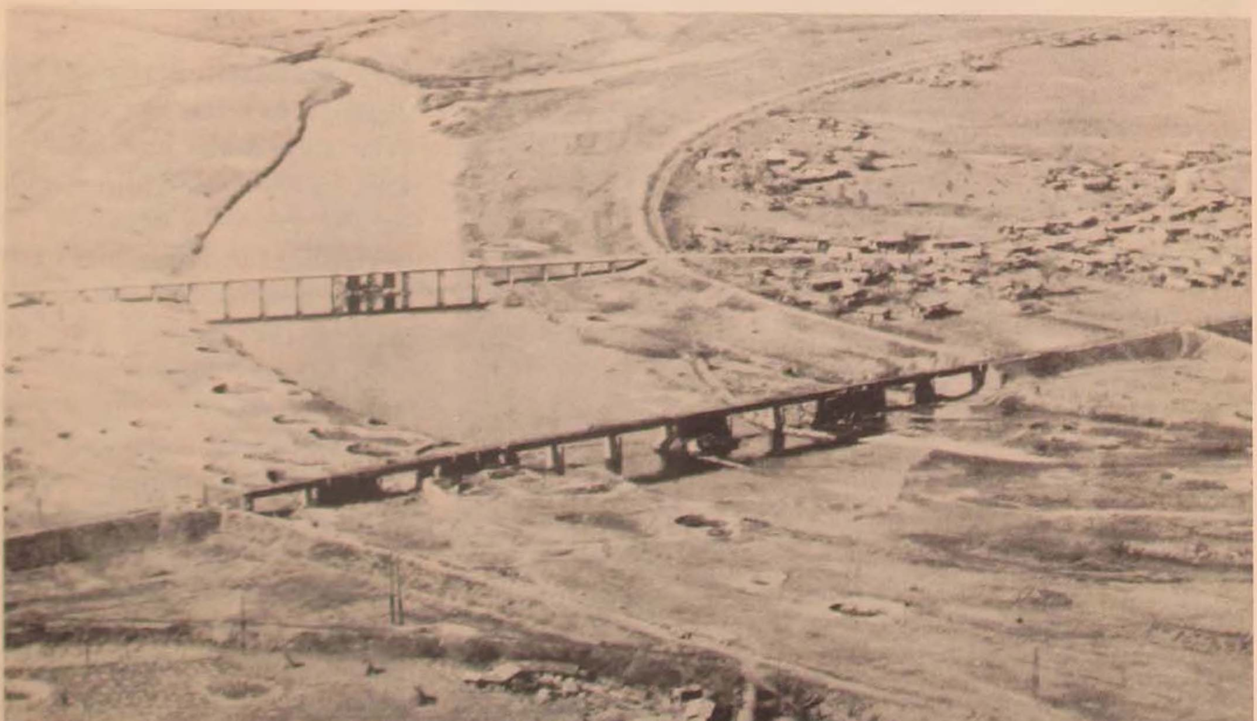
Although the truss-type railroad bridge in the foreground seems to be permanently destroyed, the more easily repaired highway bridge in the background has been patched up. With three spans knocked out and two concrete piers damaged, the bridge was yet worth repairing because it spanned the Chongchon River on the main highway entering Sinanju from Sinuiju. Hundreds of wooden piles have been sunk in the river bed or raised on top of the damaged concrete piers, then lashed together with many wooden stringers. Regular crossties and steel rails have been laid across them.

Here five tall cribs have been constructed to support the new makeshift deck for bombed-out portions of this highway bridge. At the water's edge on the right bank, where a portion of the old bridge deck remained standing on three shaky piers, concrete piers now have railroad-tie, Y-shaped extensions to give support to the roadbed.



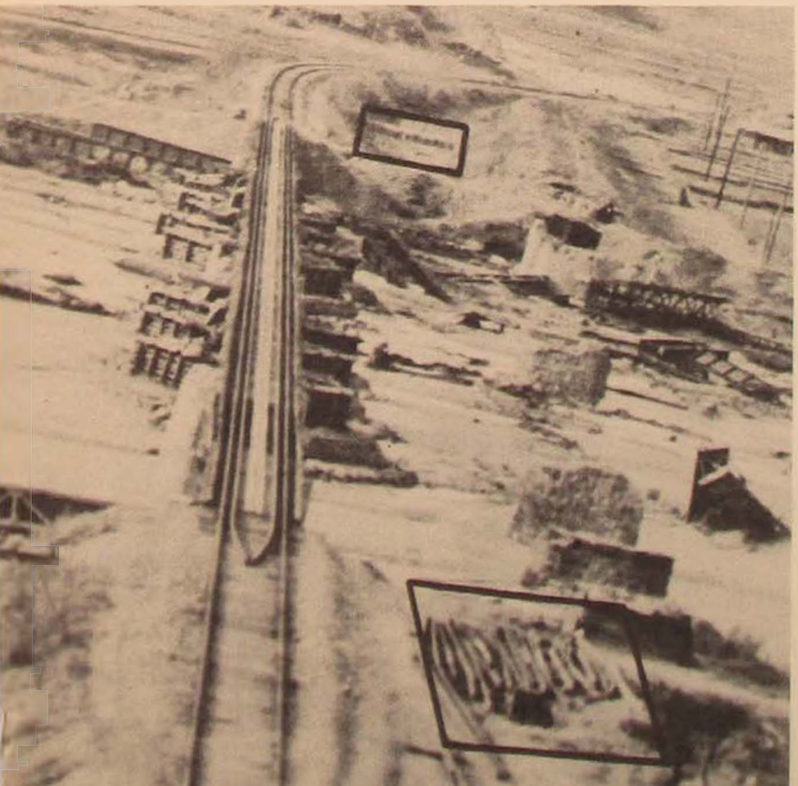
This massive repair job on a through-truss type railroad bridge and its approach bridge was made necessary by bomb hits which knocked out two spans of the approach bridge and damaged several of the concrete piers. The right-end pier of the truss bridge and the left-end pier of the bridge over the unfilled part of the river valley have been reinforced with extensive cribbing. The two knocked-out spans to the right of the truss bridge have been replaced, buttressed by seven small supporting cribs. A supplementary wooden pier (2) supports a weakened span over the unfilled area.

In their extensive repairs on the railroad bridge in the foreground, the Communists have used timber cribbing filled with sandbags to fill in completely under four spans of the bridge. Smaller cribs reinforce concrete piers near each end of the bridge. The highway bridge in the background now has two big timber cribs on sandbag foundations. They have been built up to support the center of the two damaged spans.

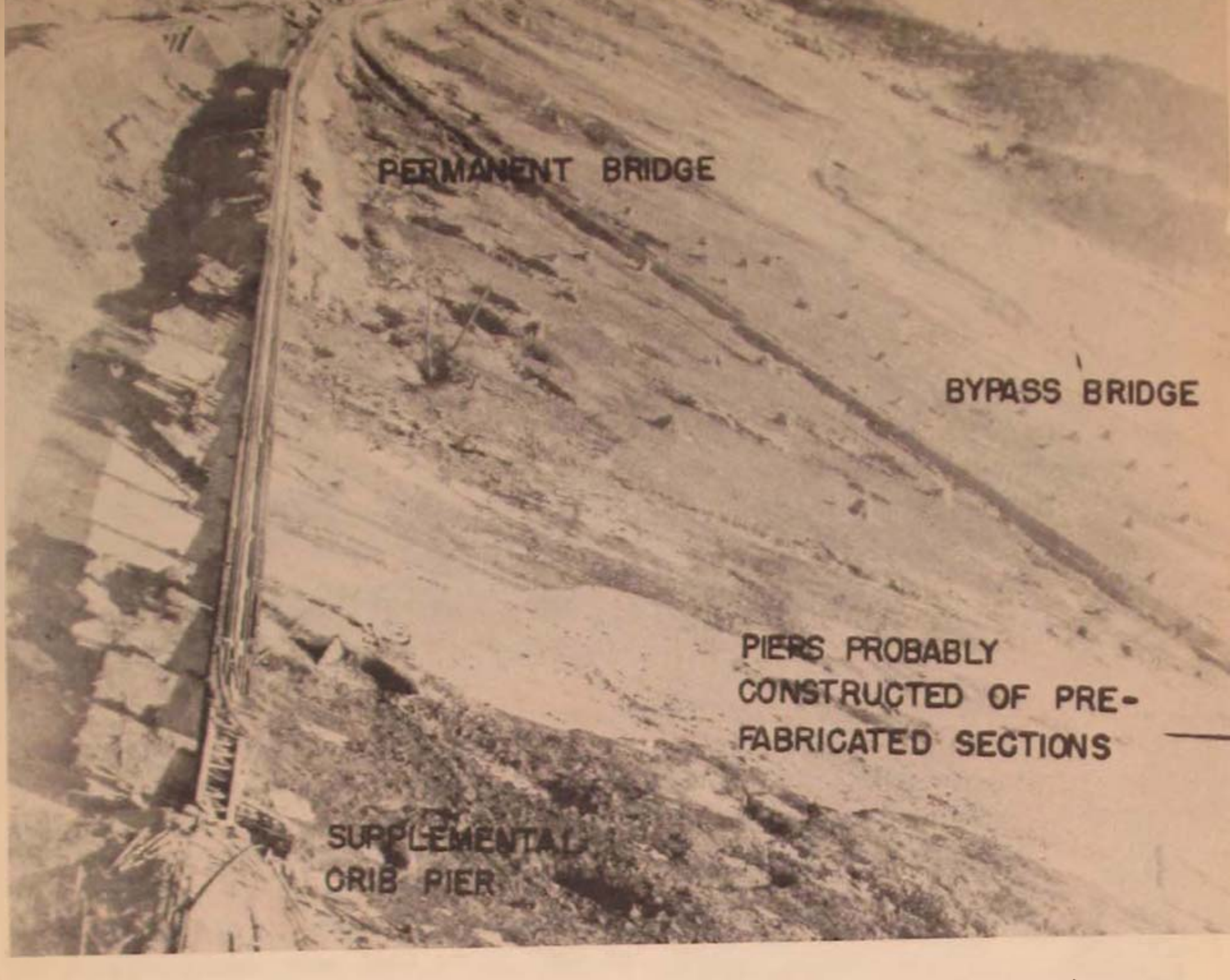


cause he lacks heavy machinery and steel for fabricating deck-girder spans. As a result, hundreds of temporary by-passes have been constructed throughout North Korea. These by-passes have no set pattern, but are put together from whatever materials are at hand and will be adequate for that particular topographic problem. For example, the mountainous terrain in North Korea forces railroads to follow the coastal plain wherever possible. Along the coast river beds are usually broad, but streams are shallow and meager except in the rainy seasons. This factor has been fully exploited by the enemy when he constructs a by-pass bridge. Every effort is made to extend the fill approaches as far as possible into the river bed. These approaches are generally of earth and rock fill, and though very shaky and precarious in high-water seasons, they will support the relatively light tonnage loads of enemy trains.

In locations where rivers such as the Yalu, lower Taedong, and lower Chongchon present major barriers and have considerable water in all seasons, by-pass construction has been largely of wooden pile piers or trestle bents with connecting wooden stringers. Although not capable of carrying a great load, this type of bridge has proved to be the easiest to repair. In a few instances, as much as 200 feet of damage to such a by-pass has been repaired within 48 hours. But this is an extreme example, since even less serious repairs usually require 48 hours or longer. One prime example of enemy ingenuity is the construction of by-pass bridges at locations where the permanent bridge is still serviceable. In these cases FEAF had to knock out not one but two or even three bridges at one location in order to halt through traffic. Naturally each additional by-pass bridge constructed was placed as far away from the others as possible. At Sinanju, on the Chongchon, there was at one time a total of four serviceable by-pass crossings of this important river barrier.

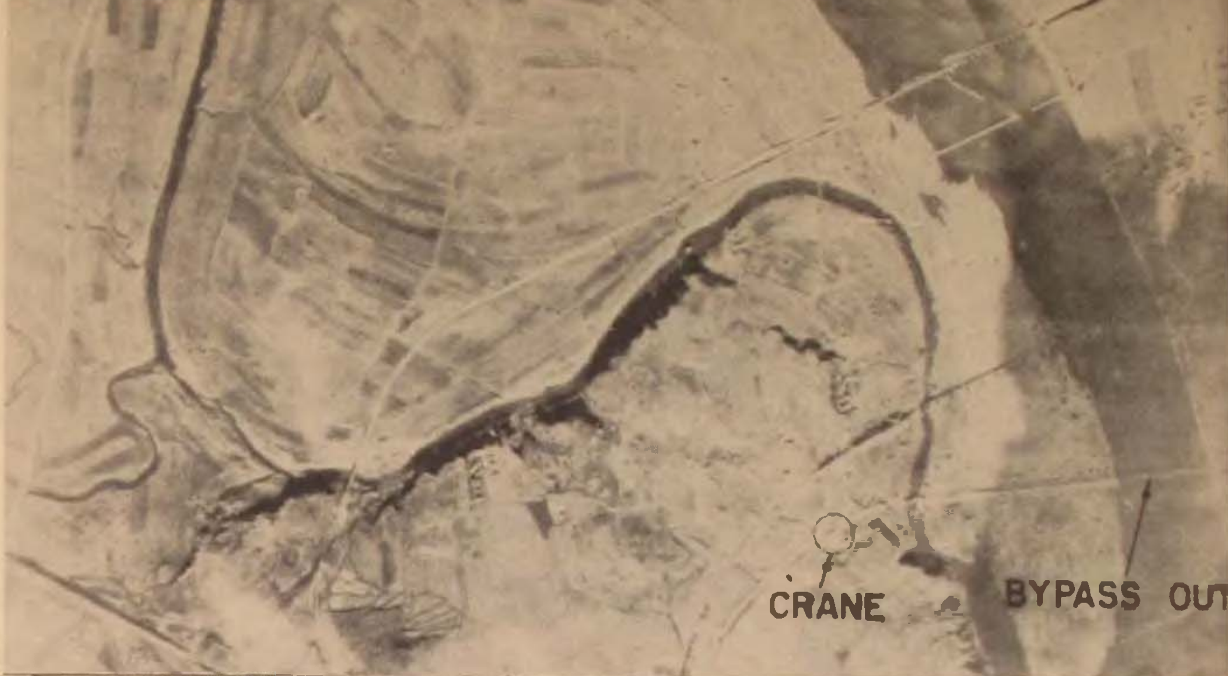


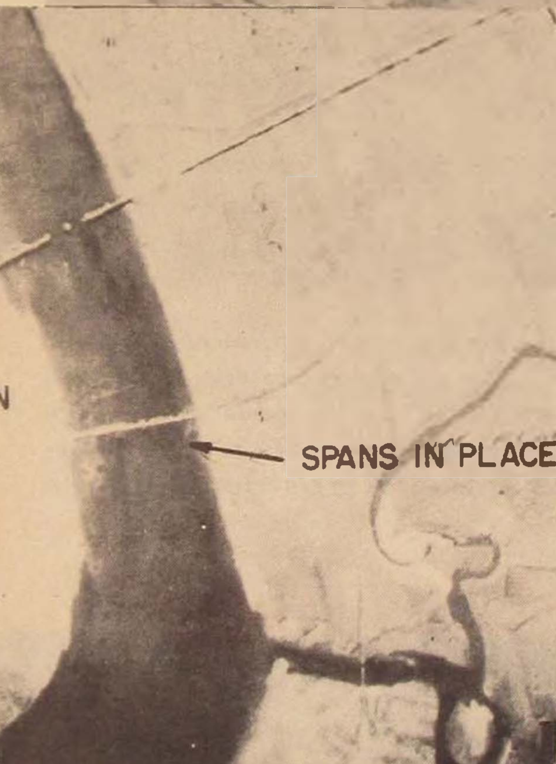
The completely destroyed railroad bridge on the right has been torn down and cannibalized to repair the other bridge in the center. Seven of the permanent concrete piers have been reinforced with massive timber piers. The diamond-shaped timber piers are built on sandbag foundations and filled with rock and earth ballast. The black square in the foreground encloses a pile of extra steel rails. Across the river, another black square marks a pile of surplus railroad ties. Left of the bridge are two steel spans.



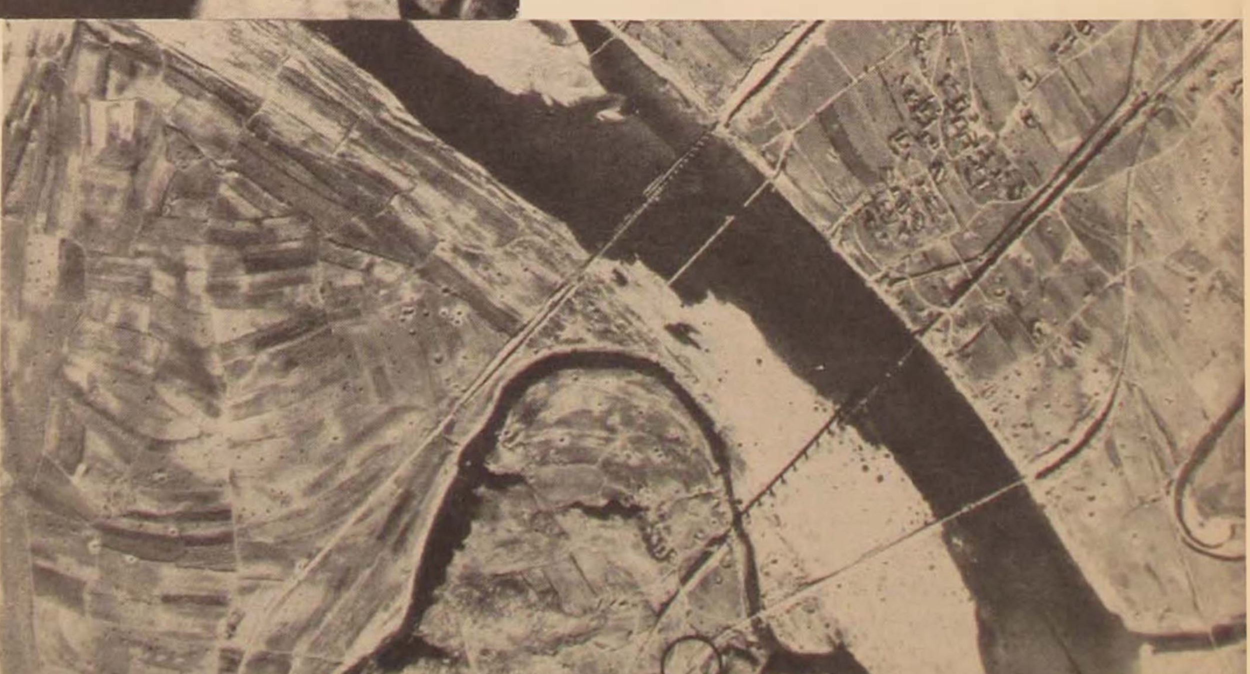
When these two permanent railroad bridges were knocked out, the Communists constructed a temporary rail bridge by-pass (right). The permanent bridge (left) was cannibalized for the steel span now in place (foreground) in the permanent bridge under repair. A wooden crib pier supports the replaced span. Wooden piers in the by-pass bridge at the extreme right are probably constructed of prefabricated sections.

Stranded in this bombed-out marshalling yard are flatcars loaded with wooden prefabricated bridge sections. These prefabricated sections are apparently built in Manchuria, since the first photographs on which they were identified found a trainload of them. parked on a siding only twenty miles south of the Manchurian border. Since then they have been spotted throughout northwestern Korea. The great advantage in these prefabricated sections is that they are easy to replace when a damaged bridge is being repaired.





These three pictures show the lengths to which the enemy will go to convince us that a bridge is unserviceable. On 7 November 1951 a daylight photograph (above) showed that a by-pass railroad bridge long unserviceable still had two spans down. A photograph taken at 2200 hours that same night showed the spans in place and a train crossing the bridge. When a photograph taken the following day (below) revealed that the two spans were out again, the cat was out of the bag. During the night a crane moved up, put the missing sections in place, and the trains moved across. Then the crane came back, swung the spans out of position, so that by daylight the bridge seemed unserviceable. Since then as many as three bridges at one time have been operated in this fashion.



Our enemy has made little use of camouflage in attempts to hide rail or highway bridges. At times foliage has been placed on the outer edge of deck-girder rail bridges to disrupt shadow lines. Some highway crossings, of a type erroneously referred to as "underwater bridges", have been used, and are generally quite difficult to discover. These are usually nothing more than fords, built up with sandbags, timber, or crushed rock to within a foot or two of the water level. The best examples of deceptive techniques have appeared at rail crossings. In some instances, after repairing a damaged bridge, the enemy leaves one or two spans out of the bridge during the day, but puts them in place during the hours of darkness, when 95 per cent of all traffic movement takes place. This ruse was first uncovered in November 1951, when for an unusually long period an important rail crossing remained apparently unserviceable because two spans were missing. Then a night reconnaissance photo revealed the spans in place with a train crossing the bridge. The next day two spans were again missing from the center section of the bridge. This technique was employed at as many as three bridges simultaneously. Another example of attempts at deception was revealed at the pontoon crossing of the Yalu River at Chongsongjin, near the Suiho Dam. After a successful strike against the pontoon bridge, the enemy reconstructed the bridge, but kept it dismantled in sections during daylight hours, only to swing the missing center sections out into place at night to allow vehicle traffic to cross the river. This ruse was also discovered by a night photo aircraft.

Against an enemy repair organization with this caliber of planning, organization, and high adaptability, an interdiction campaign conducted under present restrictions can never achieve its goal of complete denial of resupply to the enemy. But it can and does make him pay a heavy price for every pound that gets through.

Headquarters, Far East Air Forces

Higher Frequencies for Ground-Air Communications

S. B. Wright

UNPRECEDENTED demand for radio telephone communication facilities has called for ever-increasing efforts on the part of communications experts to make available to general use the relatively abundant channel space at the higher frequencies. Fortunately technological advances made during and since World War II are keeping pace with new demands. One important result of these broad developments is the current conversion of the airplane communications system of the United States Air Force and her sister services from very high frequency (VHF) to ultra high frequency (UHF).

As long ago as 1934 it was decided that the UHF band would be used for military communications because this great extension of the radio spectrum would best meet the requirement for more channels. But techniques necessary to make the change were not sufficiently advanced, and under the pressure of the Second World War the VHF system was adopted as an interim measure. After the war, the problem was attacked with renewed vigor and recently the conversion of the Air Force from VHF to UHF was begun. While many technical problems remain to be solved before UHF can reach its ultimate efficiency, the program has now passed the "point of no return" and the conversion is rapidly being completed.

The demand for additional channels would have required either an extensive refinement of existing VHF equipment or the development of new UHF equipment. The choice of the latter course offers many advantages. For example, the provision of a large number of channels using older designs of equipment would require fantastic stocks of piezo-electric crystals for both transmitters and receivers. But new, greatly improved devices are capable of flexibility and rapid channel shifting with a small number of crystals. While this and other advantages might have been realized by redesigning VHF equipment, it would have been a waste of critical national resources to provide new VHF equipment when the shift to higher frequencies was inevitable.

Coming at a time when our military services are being expanded, conversion raises the question of its probable impact on the over-all efficiency of the military communications system. From the pilot's point of view, little reorientation will be needed. The operation of the new equipment in the cockpit is identical with the old, except that many more channels may be selected with the illuminated selector switch which has replaced the familiar push buttons. The push-to-talk feature of the pilot's telephone is retained.

While some features cannot yet be disclosed, certain technical aspects and problems of the conversion can be pointed out. The progress made in meeting these problems is highly reassuring to the future of communications.

BROADLY speaking, a radio system should meet its requirements with maximum conservation of physical resources (such as frequency space), and with minimum interference between systems. Conservation dictates that the weight, size, and numbers of components (such as vacuum tubes) and the needed amounts of electric power be held to a minimum consistent with operating requirements. Recently developed techniques have overcome the natural reduction in efficiency associated with higher frequencies. This improvement, by greatly expanding the usable radio spectrum, provides opportunities for increasing the effectiveness of channelization.

As frequency is increased, the necessity for minimizing interference also increases because of the greater number of channels in use. Equipment itself becomes more complex, and may be subject to types of interference which were not a problem in older equipment. Solution of these interference problems will require vigilance and ingenuity as more and more of the available frequency space is used.

Propagation

Radio waves at frequencies up to about 30 megacycles (MC)—and higher, at times—are reflected from the ionosphere, making possible long-distance transmission. Frequencies above 30 MC ordinarily penetrate the ionosphere and most of their energy is not returned to earth. Their paths are usually limited to distances somewhat greater than the "line-of-sight." As seen with light rays when dawn precedes sunrise, radio waves travel around obstacles to some extent. But for many practical purposes, they may be considered to obey the laws of geometric optics for frequencies in or higher than the UHF range (Figure 1).

Optical radio paths are less affected by atmospheric disturbances than long-distance paths obtained by reflection from the ionosphere. Consequently the power required to transmit radio signals at high frequencies over optical distances is generally less than that required to transmit at low frequencies over long distances. This trend is of

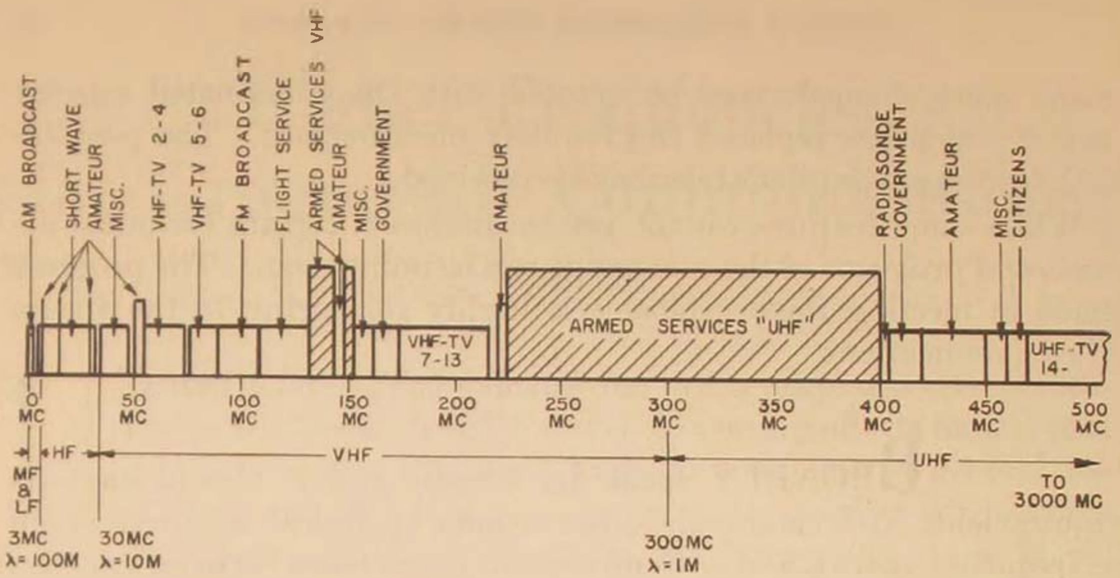


Figure 1. This graph shows part of the radio spectrum, from 0 to above 500 megacycles per second (MC), and the corresponding wave-lengths, λ, in meters (M.) The customary dividing points between the bands are designated medium frequency (MF), high frequency, (HF) very high frequency, (VHF) and ultra high frequency (UHF). The locations of the old and new Armed Services channels are indicated by the cross-hatched rectangles. In the United States, the new Armed Services UHF band contains about 11 times the frequency space formerly allotted in the VHF band. Important users of neighboring frequencies are (1) television and (2) mobile, such as taxicab, fire protection, and police vehicular communication systems. Television channels are so designated, the others are allocated in the blocks marked "Misc." and "Government".

great importance in engineering new systems, since it reduces the interference range as well as the cost.

Signal-to-Noise Ratio

The effectiveness of a given communication channel depends on the margin by which the signals (transmitted sounds) used to modulate (change) the carrier frequency (radio wave) exceed the noise heard in the receiver, including interfering signals on carriers of different frequencies. The common unit of measurement of this margin is the decibel (db).*

The fundamental intensity relations obtained from radiating one watt of radio frequency power into space are shown in Figure 2. It is evident that the farther the receiving antenna is placed from the transmitting antenna, the weaker the received intensity will be. A straight edge placed across the scales in Figure 2 and rotated with the pivot on a given frequency shows that the effect on free-space

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*A decibel (db) is a standard unit for comparison of two quantities of electrical or acoustical power. The ratio of power levels expressed in decibels: $db = 10 \log P^1/P^2$, when P^1 and P^2 are the power levels. One decibel is roughly the amount of intensity change that is perceptible to the human ear, and, since it is logarithmic, it corresponds to the response of the ear.

transmission of doubling the distance between transmitter and receiver is always 6 db. Doubling the frequency, when the distance is constant, weakens the received power by 6 db. This is shown by the dashed lines of Figure 2 through 150 MC (marked VHF) and through 300 MC (marked UHF).* The loss occurs because a dipole antenna is shorter at higher frequencies; less voltage is intercepted in the electrostatic field, so that the received power is correspondingly weaker. This penalty of using the higher frequency band must be offset by increased amplification in the radio transmitter, receiver, or antennas,** or some combination of these.

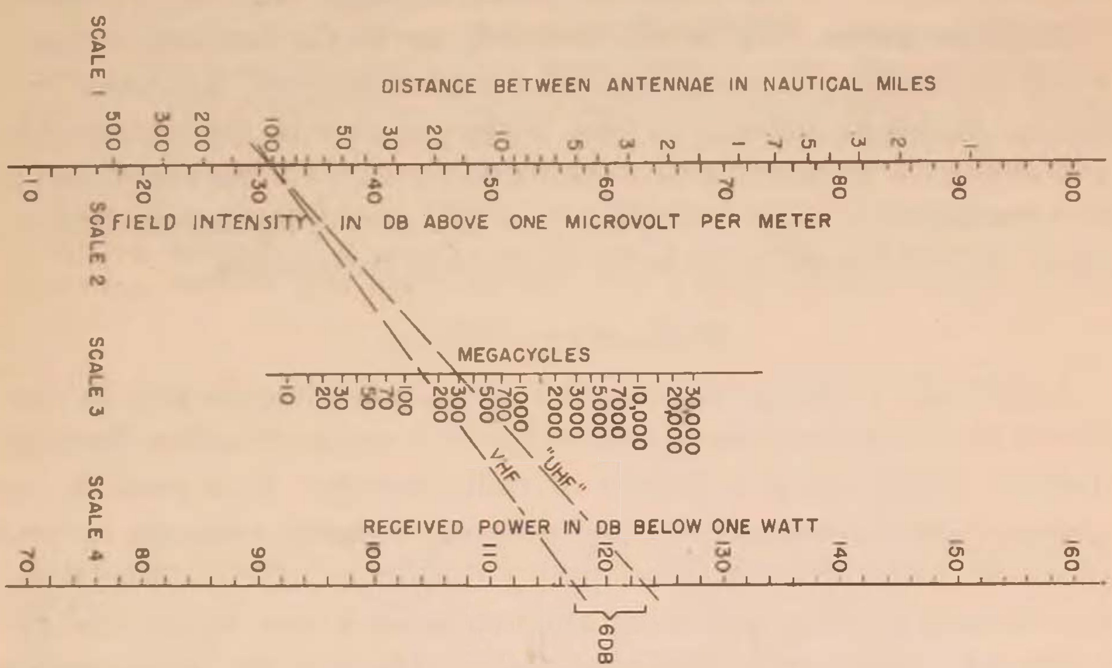


Figure 2. The fundamental relations between distance, frequency, and received power are obtained by intersecting a straight-edge with the scales on this diagram. Scales 2 and 4 express in different terms the received field intensity: scale 2 is in units independent of frequency and antenna size, while scale 4 takes into account the reduction in size of a dipole antenna to compensate for increases in frequency.

An advantage of a higher frequency is that less external noise is picked up by the receiving antenna. This is particularly true of the noise generated in the vicinity of cities, from sources such as electrical contacts in machinery and household appliances, medical devices employing radio, and leakage from power lines. There is also less disturbance from atmospheric noise (static). But receiver set noise (hiss) increases somewhat with frequency, and at about 400 MC be-

*The intricacy of reception problems is indicated by the fact that a received power of 120 db below one watt represents the microscopic power of one-trillionth of a watt.

**Antennas may be designed to concentrate radiation (or reception) in certain directions at the expense of reducing it in others. This is equivalent to a power gain in the favored directions, and has other advantages as discussed later.

comes roughly equal to the average external noise found in urban locations. Set noise will normally predominate in the UHF receiver, although it is not the clearly predominant limitation it would be at frequencies well above 400 MC. Where set noise is a limiting factor, either higher transmitter power or greater antenna directivity will offset its increase.

Shadow Effects

Obstacles in the "line-of-sight" path between a transmitting and a receiving antenna may weaken the power received, depending on the size and location of the obstacle. When no other obstacle is present, transmitter power will be effective only up to the limiting distance where the bulge of the earth acts as a natural barrier. Increased frequency makes an obstacle appear larger relative to the wavelength, weakening the intensity within the shadow area. Yet tests have shown that transmission in the vicinity of 400 MC carries beyond the line-of-sight, although usually not so far as at lower frequencies.

Reflection Effects

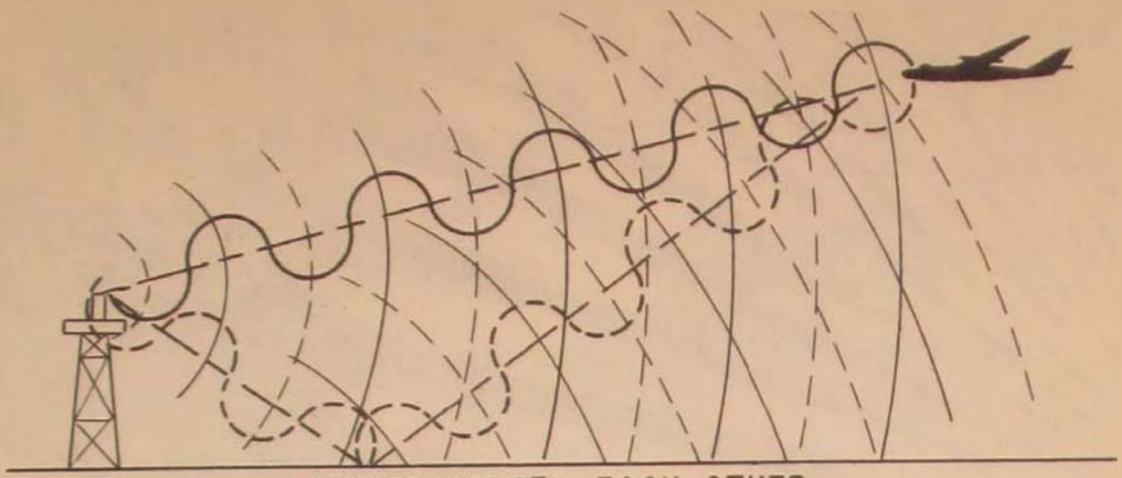
At 300 MC (1 meter wavelength) several wavelengths may be contained in the spaces between an airplane antenna and various fuselage surfaces which act as reflectors of radio energy. It is possible for transmission to occur over several different reflected paths, in various phase relations with the direct path. Buildings, hillsides, and metal objects such as wires and other antenna located near the ground antenna may cause similar reflected paths. The resultant transmission may be described by an average value that decreases with frequency and distance, with a superimposed variation that depends upon specific conditions. In some cases increased transmitter power or antenna gain may be necessary to step up intensities weakened by reflection. In practice antenna gain by directivity is limited to the ground installation, because an aircraft antenna is required to operate effectively in all flight attitudes.

Reflections From Earth

One fairly consistent source of reflection is the surface of the earth, particularly if it is smooth (Figure 3).

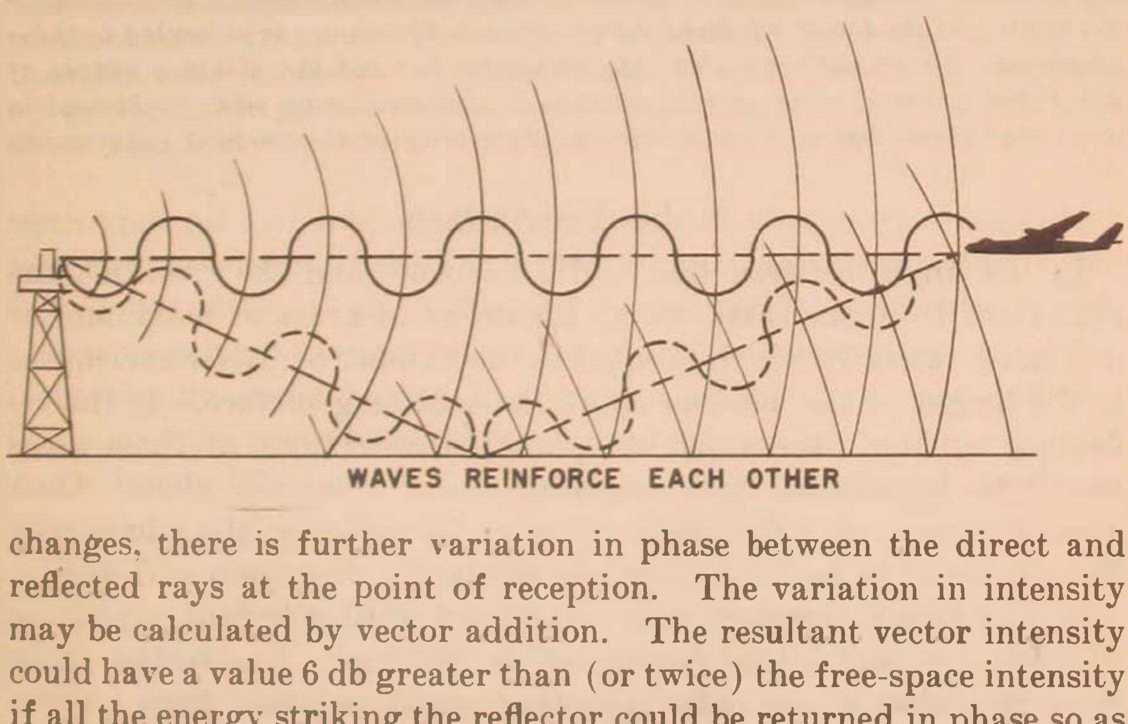
Reflections from such a surface within range of a transmitting and receiving antenna cause variations in strength of signals from free-space transmission.

Because a reflected ray travels farther than the direct one, it arrives at the receiving antenna somewhat later. As the reflection point



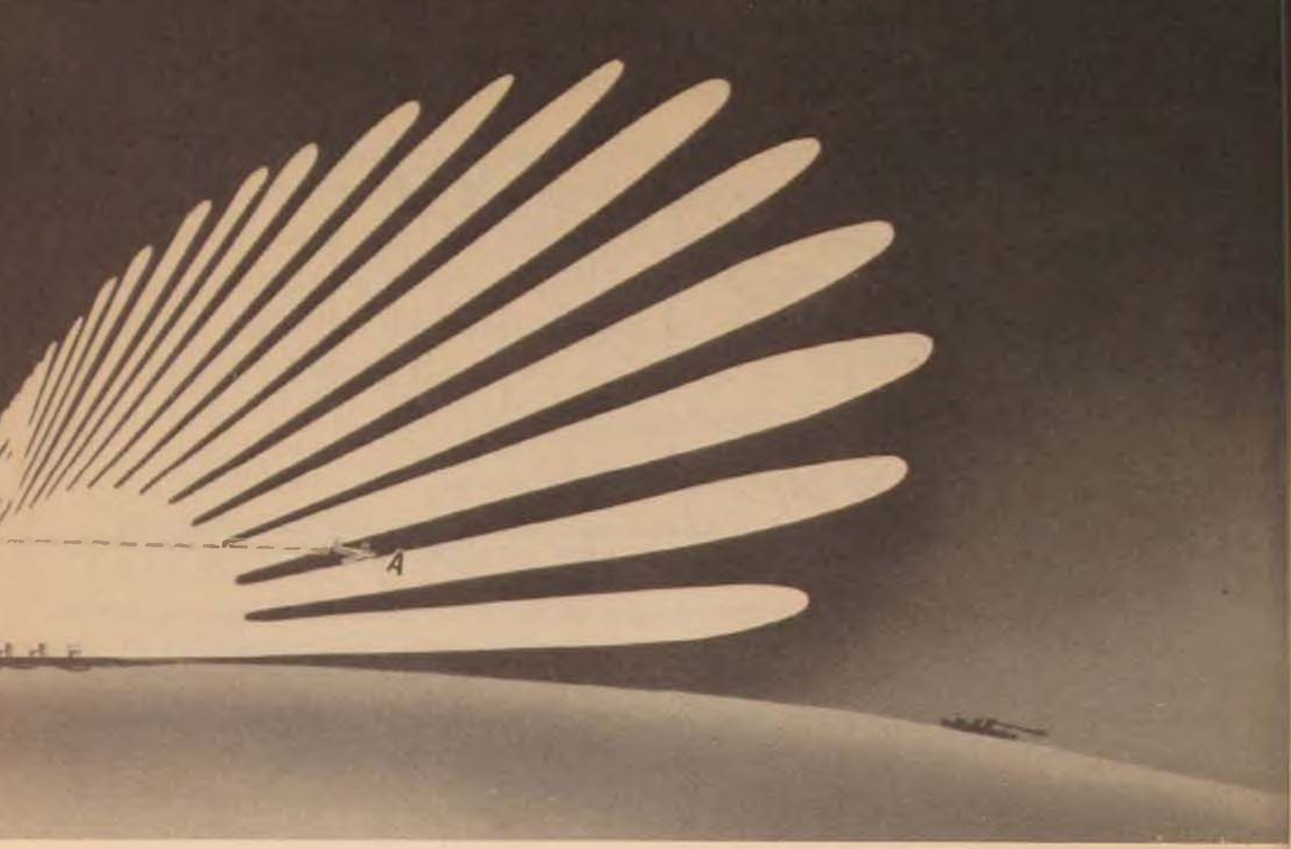
WAVES CANCEL EACH OTHER

Figures 3 and 4. Radio waves reflected off a surface still have the same wavelength at the receiver as do waves which travel directly from the transmitter to the receiver. Since reflected rays travel a longer path, they arrive at the receiver later than the direct rays. If direct and reflected waves arrive at the receiver out of phase, they cancel each other (Figure 3). The degree of cancellation depends on the strength of the reflected wave. But if the difference in time of arrival is such that the waves are received in phase (when the two paths differ by half a wavelength), the waves reinforce each other and then give a single, stronger signal (Figure 4).



WAVES REINFORCE EACH OTHER

changes, there is further variation in phase between the direct and reflected rays at the point of reception. The variation in intensity may be calculated by vector addition. The resultant vector intensity could have a value 6 db greater than (or twice) the free-space intensity if all the energy striking the reflector could be returned in phase so as to reinforce the direct ray. Or the resultant intensity could become zero when the direct and reflected paths resulted in vectors equal in amplitude but opposite in phase (compare Figure 3 and Figure 4). Actually, reflection from the earth is not perfect, and variations of 10 to 20 db ordinarily can be expected. Reflections from local objects may increase the variations. Since antennas with horizontal polarization are subject to greater variations than those with vertical polarization, the latter type is used in air communications.

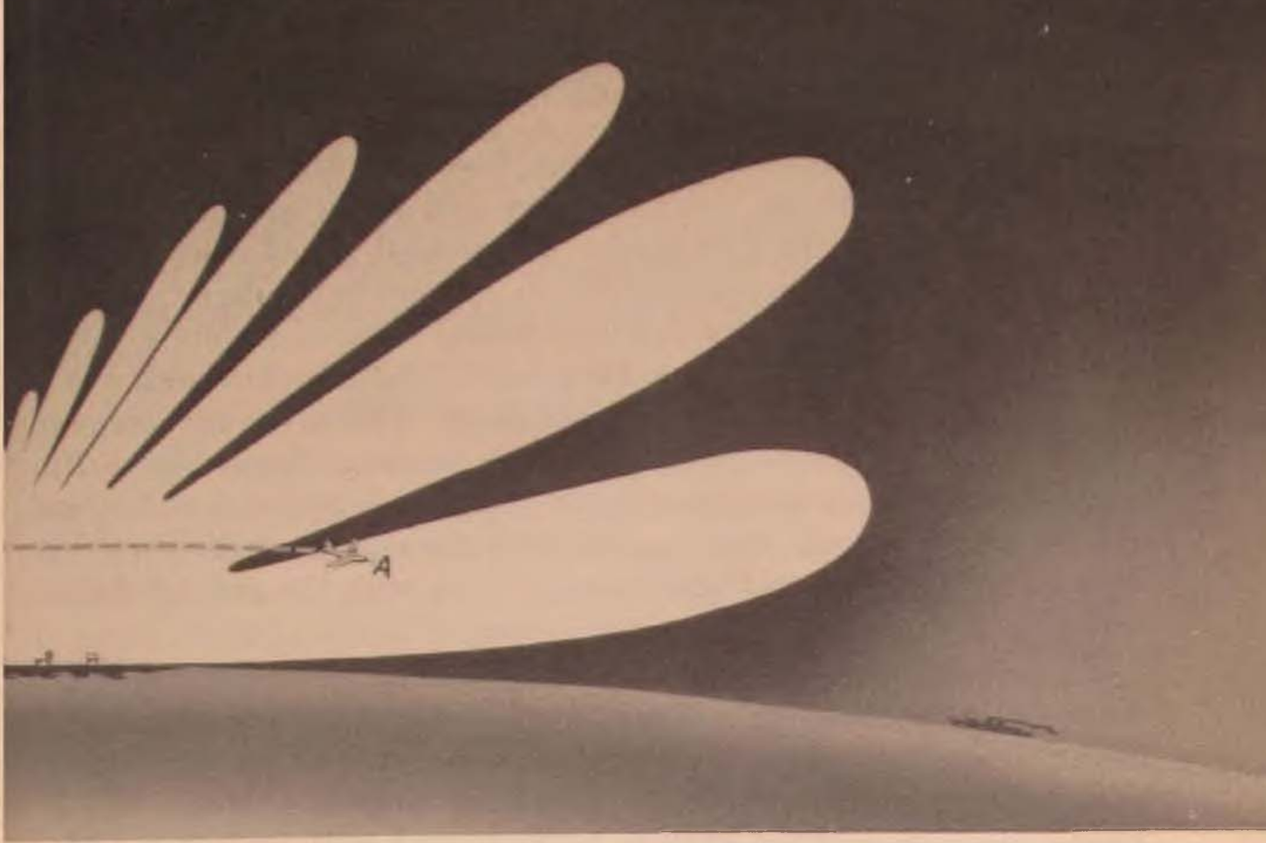


Figures 5 and 6. Cross-sections of areas of radio intensity above a ground transmitter (located at the lower left-hand corner of each figure) are represented in these two diagrams. These patterns illustrate principles but not the distance ranges of any Air Force systems. The ground antenna is assumed to be omni-directional in the horizontal plane, but to have maximum directivity at the vertical angle corre-

Lobe Formation

In the angle between the "radio horizon" and the "zenith", the reflections from the earth set up a number of areas of maximum or minimum intensity which is equal to the number of half-wavelengths in the height of the antenna above the reflecting surface. If the reflecting surface were a perfect plane, cross-sections of these areas would be hyperbolas with curvature away from the plane. Over great distances with the earth acting as the reflector, these lines may be considered to be approximately straight. Figures 5 and 6 illustrate how reflected rays create a wave-like variation in field intensities. The effect is called lobe formation, or "lobing". The lighter areas show the lobes where radio reception would be better than a given value, while the dark slots between the lobes and just above the earth represent areas of weaker reception. These are called "nulls." The points where the lobes converge are generally called "lobe minima."

The difference between the pattern shown in Figure 5 and that in Figure 6 is caused by the difference in the height of the transmitting antennas. When both the transmitting and receiving antennas are ground-based, the only null of consequence is the one between the



sponding to the third lobe above earth in Figure 5, which is also the angle of the lobe minimum between the first and second lobes in Figure 6. The ground antenna heights above the reflecting surface which would produce these patterns at 246 MC are 50 feet for the 25-lobe pattern (Figure 5) and 20 feet for the 10-lobe pattern (Figure 6). Minor lobes caused by local reflections and lobes near the vertical are not shown.

earth and the first lobe above the earth. Transmission occurs at or near the lower edge of this lobe. The higher the antenna, the larger the number of lobes and the closer to the ground is the first lobe. Such a pattern improves transmission for ground-to-ground paths and for ground-to-air paths having low vertical angles above the horizon. The same pattern and a similar improvement occurs in air-to-ground transmission from a low-flying aircraft to the ground receiving antenna.

When both antennas are airborne, their relative motion may cause an audible variation in transmission called "lobe modulation." This effect may render communication between closing aircraft unintelligible, depending on their proximity, altitudes, wavelengths, and design of equipment.

When one antenna is ground based and the moving airborne antenna is relatively high, lobing may temporarily weaken transmission while the airplane is in a null. For example, an aircraft flying away from the ground station (position A, Figure 5; approximately 75 nautical miles from the ground station, at 40,000 feet altitude) would be traversing the large null between the second and third lobes above earth.

In Figure 6, the same aircraft at A would be in the first lobe. By making the ground antenna more directive just above this lobe, the intensity received in the null would be increased. And since redirection would weaken the reflected ray in relation to the direct one, the lobe minimum between the first and second lobes of Figure 6 would occur at a greater distance from the ground station, and the null would not generally cause failure of transmission. This is the advantage in choosing a ground antenna height which produces fewer lobes. But the reduction in the number of lobes raises the lower edge of the first lobe farther above the horizon, reducing the maximum distance over which low-flying aircraft can communicate with the ground station without an increase in transmitter power.

These results have been confirmed by Joint Armed Services flight tests at the Patuxent River Naval Air Test Center. A given percentage increase in frequency produces the same effect on lobing as a corresponding percentage increase in ground antenna height. A relatively small percentage change in frequency will shift the lobing pattern so that lobes at one frequency occupy the spaces of the nulls at the other frequency. This increased frequency requires a corresponding reduction in antenna height to avoid increased lobing. At the average distances illustrated, an excellent signal would be received at lobe edges from a transmitter having an output of a fraction of a watt. With a transmitter having many watts output, there would be a corresponding gain, to be used as margin against lobing, multiple reflection, and shadowing at distances illustrated, or as increased distance range, or a combination of these. Measurements made at several sites (overland) show sufficient signal strength in the nulls to provide adequate communication in a system utilizing AN/GRC–27 and AN/ARC–27 equipment. It should be noted that this form of lobing is also experienced in the VHF range, and it probably accounts for some transmission "drop-outs" reported by pilots in the past. Communication in such cases could have been resumed at a different frequency or altitude.

Remedial Measures

This discussion should make it clear that any frequency increase will reduce transmission distances unless accompanied by an increase in transmitter power or some equivalent step-up in intensity. USAF planners have met this problem with directional antennas having maximum directivity at angles tilted above the horizon, with the use of short, low-loss coaxial lines between radio sets and antennas, and with selected power requirements for the radio transmitter designs. Additional means for overcoming undesirable effects are being studied.

Pilots can help by reporting the frequencies (channels), time, and aircraft position for any failures in air-ground communication. The Joint Frequency Allocation Panel has recognized the advantage of the lower UHF frequencies for long-distance transmission by reserving most of the lower part of the Armed Services band to air communications.

Problems in Interference

Once the design of a new system has been established, the effects of interference must be examined. The problem is vastly more difficult in communications than in broadcasting because communications signals from distant transmitters must often be received on weak carriers in areas where powerful transmitters are also operating.

Tests on UHF equipment conducted under supervision of the Air Defense Command at one of the Air Defense Command control stations have indicated several important sources of internal interference:

1. *Transmitter and Receiver Intermodulation.*—Interference can occur when two or more nearby transmitters are "on the air" simultaneously and when new frequencies generated by intermodulation happen to fall on other operating frequencies. This type of modulation is incidental to the transmission of the desired signals on assigned carrier frequencies, but it arises in the same manner as useful modulation. It becomes troublesome when ground receivers with high sensitivity are located in the vicinity of multiple transmitter installations and can be avoided by careful selection of families of frequencies.

2. *Response to Specific Spurious Frequencies.*—Occurs at certain frequencies when only one interfering transmitter is in operation near the receiver. The number of affected channels is relatively small, and it is good practice to operate on frequencies free from adverse effects.

3. *Desensitization Effect.*—A strong undesired signal relatively close to the frequency band of the desired signal may reduce the gain of a receiver by normal action of the automatic gain control and by overloading in early amplifier stages. As the frequency difference between the two channels increases, receiver selectivity reduces the amplitude of the unwanted frequency and minimizes desensitization.

The problems in operating UHF ground installations where the above effects may occur are being attacked successfully by Rome Air Development Center. Highly effective methods have been developed for choosing frequency allocations which will avoid these difficulties.

An airborne receiver is not likely to be affected by equipment in other aircraft. But interference from external sources on the ground is more likely to be heard in an airborne than in a ground receiver, since the number of possible interfering sources increases approximately as the square of the altitude of the receiver. Two major external sources have been reported by pilots of the Wright Air Development Center, where communications equipment is tested.

1. *Harmonics of Ground Transmitters.*—Second harmonics* from radio transmitters operating at carrier frequencies in the range of 112.5 to 200 MC, third harmonics of those in the range of 75 to 133.3 MC, and fourth harmonics of those in the range of 56.25 to 100 MC, are potential sources of interference within the military UHF band (225 to 400 MC). See Figure 1 for important users of these frequencies.

2. *Spurious Outputs of Television Receivers.*—Considerable energy is radiated from television receiving antennas, generated by the beating oscillators in television receivers. Some of these frequencies fall in the 225–400 MC band and may cause interference to airborne receivers operating near urban areas. Poor adjustment of television receivers may increase the frequency range which is affected.

Reduction of Interference

As use of UHF increases, commercial and government planning and laboratory groups must continue to improve equipment designs so that interference may be controlled at its source. The Federal Communications Commission is faced with the difficulties of interband interference, and the Joint Frequency Allocation Panel has problems in allocating channels within the Armed Services band.

With the present UHF equipment, the most important single means which can be taken to minimize interference is that of careful selection of frequencies and transmitter locations to avoid co-channel interference, interference between channels having adjacent frequencies, and the sources of internal and external interference. The using organization can contribute greatly by carefully supervising its communication operation and maintenance.

IT has been shown both in theory and in practice that equipment operating in the UHF frequency band can give adequate coverage for most air-ground communication requirements and can make available a much greater number of channels. In the struggle to make the most effective use of these facilities, Air Force pilots have a unique opportunity and a special responsibility to bring to the attention of their command headquarters any observations of fading and interference of communications signals. Their cooperation will pay dividends in continued progress in communications.

Bell Telephone Laboratories, Incorporated

*A harmonic is a component of a periodic quantity having a frequency which is an integral multiple of the fundamental frequency. For example, a component the frequency of which is twice the fundamental frequency is called the second harmonic.

. . . Air Force Review

Survival Training in the USAF

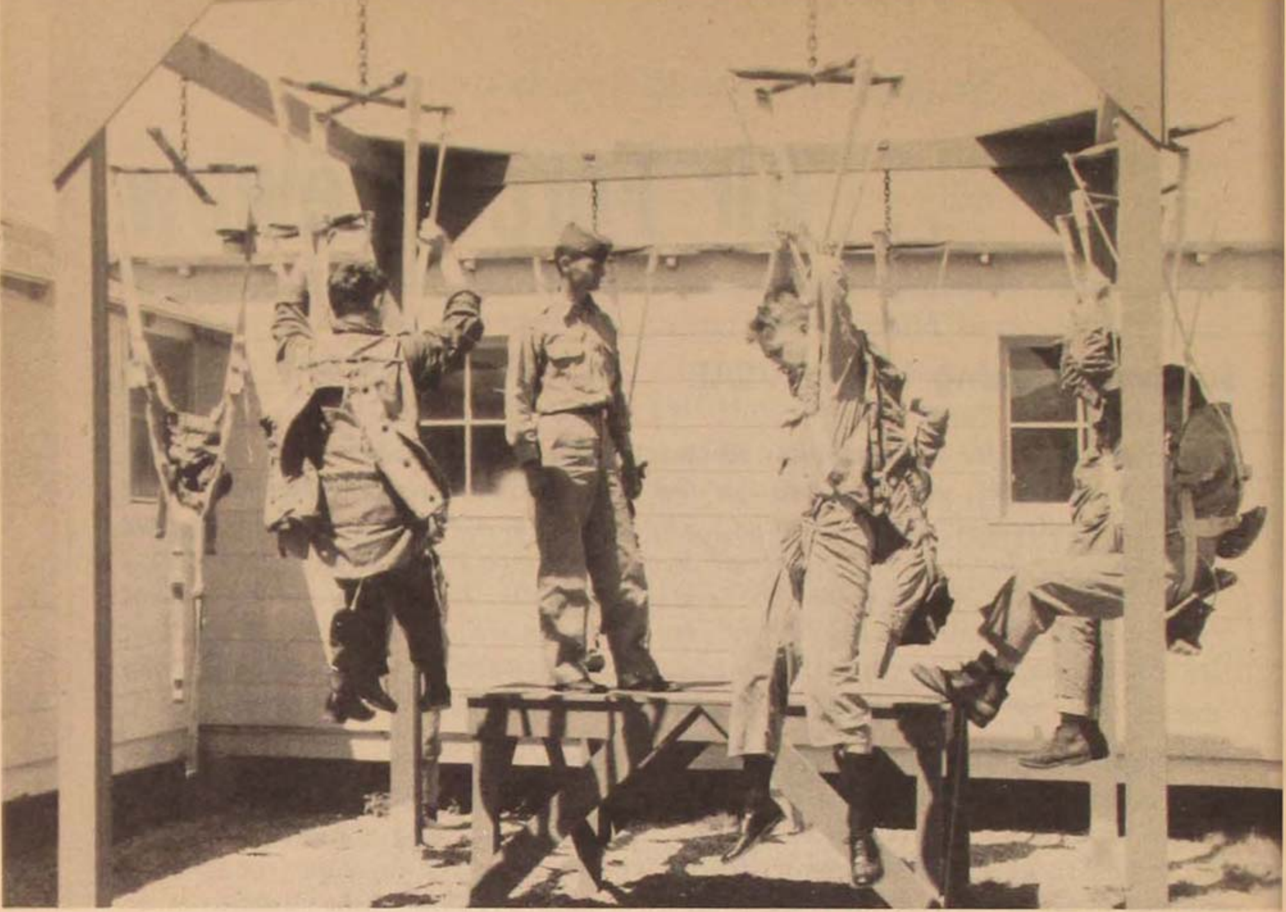
Prepared for the Quarterly Review *by the Arctic-Desert-Tropic Information Center, with information and photographs furnished the Editor by Hq, Strategic Air Command; Flight C, 7th Air Rescue Squadron, Air Rescue Service; 28th Strategic Reconnaissance Wing, Heavy, Rapid City AFB; 36th Air Division, Davis-Monthan AFB; Para-rescue and Survival School, West Palm Beach, Fla.; Hq, Travis Air Force Base; Hq, Technical Training Air Force; 55th Strategic Reconnaissance Wing, Medium, Ramey AFB; 5001st Composite Wing, Ladd AFB; and Hq, Turner AFB.*

When Captain Able and his crew members Baker and Charley man their B–47, their mission may carry them over every major type of Earth's terrain. Operating from a North African base, they may return to base via survival situation in desert, at sea, in jungle or swamp, in mountains, or in tropic, temperate, or arctic regions. Long-range transport missions pose the same possibility to crew and passengers alike. The fighter pilot flying his relatively short combat radius in many areas of the world may go down in any of enormously differing terrains. Even practice missions based in the Zone of the Interior may range from the arctic to the tropics, from swamplands to high mountain ranges.

Hence the USAF survival training program as it is today.

In World War II, survival was pretty much a regional problem. An aircraft that took off in the Arctic was likely to fly most of its mission over the Arctic. An aircraft based in the tropics flew most of its missions over jungle. Therefore the survival equipment furnished and the training given aircrews were mainly regional. Most of the training was given in the overseas theaters, and most of the survival kits were issued in the theaters.

The old regional concept of survival equipment and survival training is inadequate for the post-war Air Force. Likewise a new approach to survival has been developed. Analysis of crashes, ditchings, and bail outs in World War II shows that many crewmen who could have survived and returned to duty lost their lives or were crippled because of ignorance of basic survival procedures rather than inadequate equipment. Under the present survival training program, loss of men for this cause is minimized. Less emphasis is now being placed on equipment, and more on the man who uses it. This does not mean that development of equipment is ignored. Survival equipment today is better than it ever has been, and it is continually being improved. What has been changed is the attitude that the equipment will take care of the man. Now the man is taught how to use the equipment to take care of himself. The individual's responsibility in assisting in his own rescue is also being emphasized. The potential survivor is taught that unless he is physically unable to do so, he must consider himself an active member of the rescue party. Finally, and perhaps most important, the "it can't happen to me" attitude is being fought. Everyone who flies in a military aircraft is being taught that he may someday be forced to survive in an unfavorable environment.



Many a survival incident has ended before it began, because the man did not know how to make a parachute landing or how to get out of the harness. At Davis-Monthan Air Force Base, crewmen are taught how to guide a parachute, how to take up landing shock, and how to get out of the harness on land or water. The training device enables the student to learn by experiment how to adjust a parachute harness properly for actual use. It also affords drill in procedures for stopping oscillation and for guiding the parachute in the air. Included in the basic survival course is a rigorous physical training program designed to strengthen the muscles employed in parachuting.

As a result of this training, the aircrewman develops an attitude of "It may happen to me, but I'll be ready for it." When emergencies do arise, a man with this attitude meets them calmly and takes immediate action. If he does go down, he knows what to do and how to do it. And he generally survives to return to duty, whether his survival depends upon proper use of signaling equipment for a fast pickup or upon a long hike home while living off the land.

Recommendations from USAF crewman downed in Korea stress that a successful survival story usually begins long before the man concerned climbs in his airplane. These men, all of whom have survived under rigorous conditions, give the following list of requirements for the successful survivor:

(1) He must be mentally prepared for the fact that he may go down.

(2) He must be in good physical condition.

(3) He must have serviceable survival equipment attached to his chute harness or easily accessible in the aircraft.

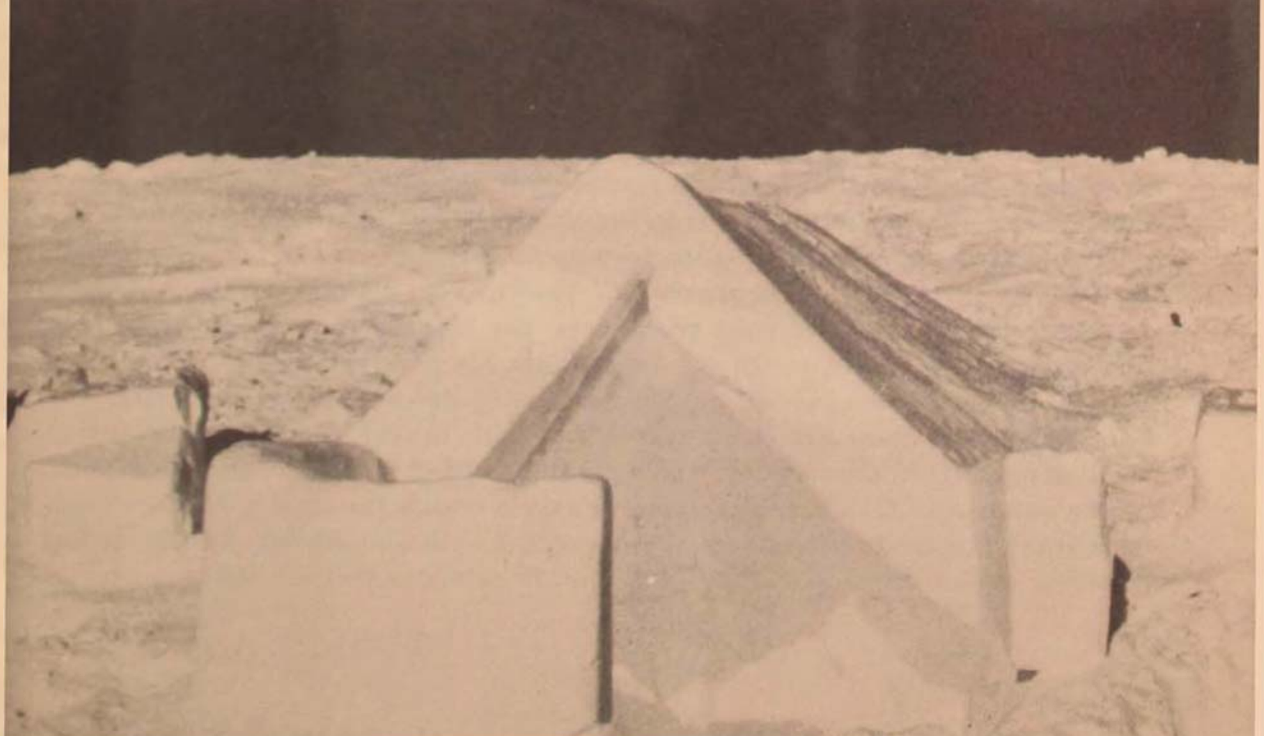
(4) He must be proficient in the use of this equipment, especially the water survival gear and the signaling devices.

(5) He must be dressed for ground conditions.

(6) He must be thoroughly familiar with bail out, ditching, and crash landing procedures—so familiar that he will know, without undue deliberation, exactly what he must do in any given situation.

A survival weapon is part of every survival kit. At Stead Air Force Base, students in the Strategic Air Command's advanced survival school are instructed in the weapon's use and limitations. During training each man fires enough rounds to become thoroughly familiar with his own capabilities and those of the weapon. The rifle shown is the SAC survival rifle, M–4, carried in the SAC E–1 kit, which fires the caliber .22 hornet cartridge. Other survival kits carry the rifle-shotgun, M–6, firing a .22 hornet cartridge and a .410 shell.

Shelter is a big item. The survivor often faces the problem of building a suitable shelter from available natural materials and the equipment he has with him. The Alaskan Air Command teaches crews how to construct a shelter trench with blocks cut from hard-packed snow. Snow structures are surprisingly warm and easy to heat. Arctic tests have shown that well-built snow houses and snow caves can be kept comfortably warm in sub-zero temperatures by a candle burning in a tin can. The snow shelter has one disadvantage. Snow is excellent sound-proofing material, and unless a listening post is maintained outside the shelter, searching aircraft may pass unheard.



Sleeping on the ground in the tropics is a sure way of collecting moisture and insects. Ramey Air Force Base survival school teaches construction of a hammock from the canopy and shroud lines of a parachute. This para-hammock provides a jungle-bound airman with a comfortable sleeping accommodation and protection against ground moisture and disease-bearing insects. A nylon parachute is a storehouse for improvisation. From it a man can make clothing, shelter, ropes, and numerous other useful things. Packed with each parachute is Air Force Manual 64–15, "Emergency Uses of the Parachute," which shows in detail many of these items.

(7) He must know how to guide his parachute in the air, how to make a parachute landing on the ground or in water, and how to get out of the harness after landing.

(8) He must have enough information about the terrain over which he is flying to know what to expect if he comes down.

(9) He must know the operating limitations of rescue aircraft, so that he can assist in his own rescue.

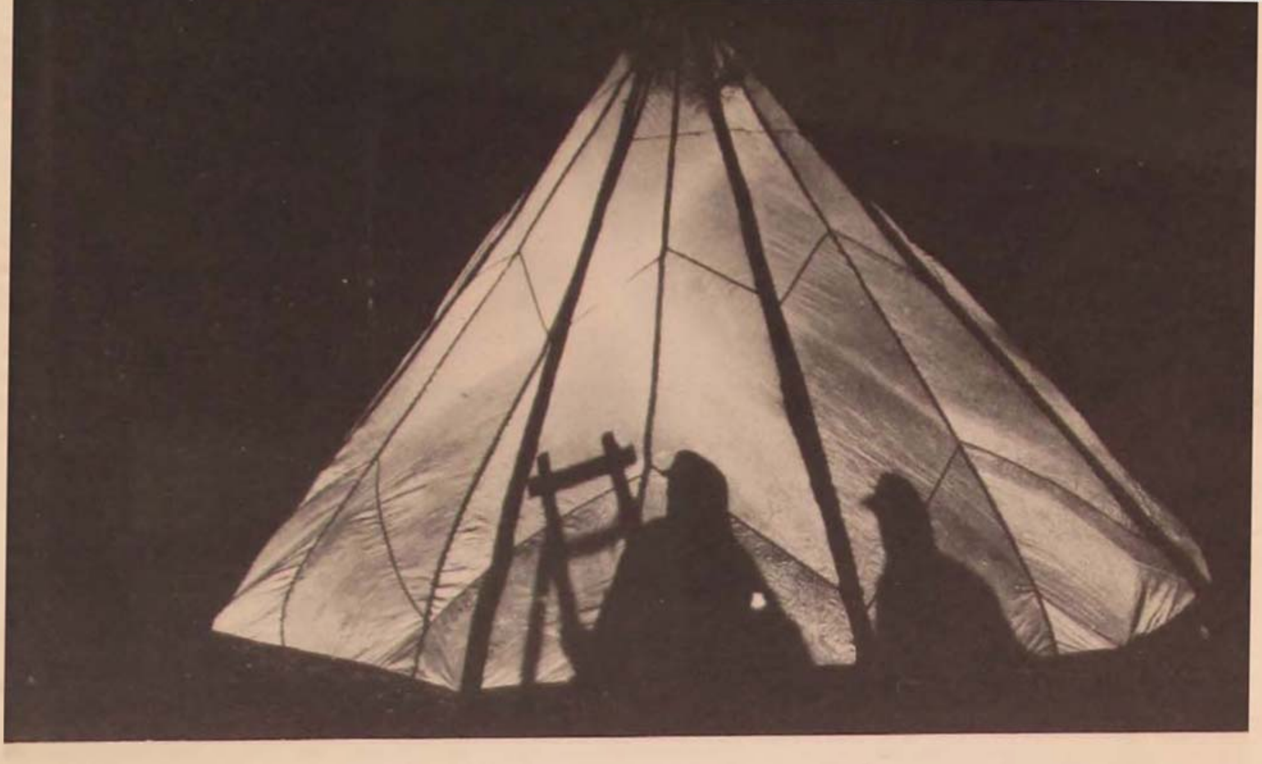
These requirements are valid for any climate or terrain. The man who has gone through the Air Force survival training program will usually see to it that he meets them before taking off on a mission. If he does not, the training has failed.

Teaching Survival

What are the essentials of survival? How are these techniques taught? The subject matter of survival training can be divided roughly into two broad classes: first, specific techniques and procedures which must be learned so well that their execution in an emergency will be almost automatic, and second, general procedures and information which the survivor can vary to fit his situation.

In the first class, bail-out procedures, use of parachute, use of such water survival gear as the Mae West and the dinghy, and all the other emergency procedures need constant drill to ensure that they are performed properly in emergencies if the man is in a state of shock. They are probably more a part of flight safety than survival as the term is usually understood, but are normally included in survival training programs. The survival manual, AFM 64–5, makes no mention of these emergency procedures, not because they are not important but because the survivor will not be opening his survival kit and reading the manual unless he has carried out his emergency procedures satisfactorily.

In the second class are those subjects usually taught under field conditions, such as woodcraft, seamanship, and signaling. These subjects cannot be taught by the numbers. All a survival course can do is expose the student to a few problems, teach him a few procedures, discuss others with him, and expect the student



The para-tepee is an easily constructed and comfortable shelter. All that is needed are one or more long poles and a parachute. To the man waiting for rescue, the para-tepee has the additional advantage of being highly visible at night. Nine poles support the cover of this tepee built by students in the Davis-Monthan Air Force Base survival school. If only one pole is available, it is used as a center pole, and the edge of the canopy is staked down or weighted down with rocks. Or the parachute can be suspended from an overhanging limb at the right height, and no poles are necessary.

to take over from there. In a short course it is obviously impossible to simulate all the possible emergencies which may be encountered in a world-ranging Air Force. But a few problems, properly presented, can show the student that, with his survival kit and a bit of horse sense, he can survive in any environment.

A USAF survival course in the field usually covers signaling, shelter, fire-making, living off the land (including hunting and fishing), use of clothing, orientation, and techniques of travel. A few examples from each of these subjects show the type of training given.

Signaling is a subject of prime importance to the survivor. One man, a group of men, or even an aircraft is not too easy to spot from the air, especially with limited visibility. Crewmen are taught to use standard signalling equipment and to improvise additional signals from natural resources. Experience in Korea has brought out that the fastest rescues are made of those men who have practiced using the signalling equipment in their kits. This equipment includes signal mirrors, smoke flares, and emergency radios.

The signal mirror can be used by a man with no previous training, but it can be used more efficiently if a man has practiced with it before he needs it. One man in Korea downed on a life raft in rough seas said this: "The pilots acting as cover stated that they had no trouble at all locating me when I used my signal mirror. This I attribute to the fact that all pilots of my squadron, including myself, had been briefed on the use of the mirror and had actually practiced using it."

Each student sets off one or more smoke flares. Surprising as it may seem, several pilots downed in Korea did not use their flares because they were afraid

Land navigation is one of the most important subjects in survival schooling. The airman, accustomed to traveling many miles a minute, must readjust his thinking and navigational techniques to traveling overland on foot. Here in the mountains of central Puerto Rico crewmen from Ramey Air Force Base survival school are learning to plot their way through the jungle. Careful route planning is essential for jungle travel. Students are taught to plot the entire route on the map and to determine compass bearings before they start into the dense undergrowth. All students must demonstrate ability to measure bearings with the survival-kit compass, important equipment for traveling overland.

they might be burned. Others have been unable to fire the flares because they did not or could not follow the instructions printed on the flare.

Students are also checked out on the various types of emergency radios. All are simple to use and have the instructions printed on the set, but like any other piece of equipment, they can be used inefficiently if the user does not understand their limitations. For example: the familiar Gibson Girl radio does not transmit unless it has a satisfactory ground. During World War II there were several instances of crews down in the Arctic on glaciers, frozen ice, or frozen ground grinding merrily away on the Gibson Girl for hours without ever sending a signal. Survival students are shown how to avoid this difficulty with a wire counterpoise instead of a ground.

Improvised signaling is also taught, so that the man who has no radio can communicate with rescue aircraft. The variety of improvised signals is limited only by the ingenuity of the survivor. In grassland, trenches can be cut. In bush country, vegetation can be cleared. In the arctic messages can be tramped in the snow.

Travel overland under survival conditions demands careful preparation. Students at the SAC survival school, Stead Air Force Base, are required to improvise a pack harness and to use it on a field trip. Here an instructor adjusts straps on a home-made pack at the start of a three-day hike made under simulated survival conditions. On this hike the equipment and rations carried are those which would normally be found in the survival kit. The hike over very rugged terrain provides a test both of the student's stamina and of his ability to navigate overland.

During signaling instruction students are briefed on cooperation with rescue aircraft. All rescue aircraft have limitations on the type of field they can get in and out of, even helicopters. If the man on the ground understands these limitations he can often assist the pilot in finding a landing area.

Shelter is often a man's first need after he hits the ground. In the survival schools, use of the parachute for emergency shelter is stressed, since a survivor will almost always have one with him. The parachute can provide shelter in many ways. Early in World War II, its construction was found ideal to furnish a cover to an Indian tepee. If no poles are available, a parachute can be used as an improvised sleeping bag or as a cover for a trench or lean-to.

Each environment offers a different shelter problem. Surprisingly, the arctic is one of the easiest places to improvise a shelter. Hard-packed snow can be cut out in blocks to build huts or igloos. If the snow is deep enough, houses and caves can be dug in the snow itself. Snow is an extremely good insulator, even in extremely low temperatures. The heat from the small stove packed in the survival kit or from a candle will heat up a snow house or snow cave to an agreeable temperature. Yet the arctic does have pitfalls to trap the uninitiated. In 1948 a crew down on the Greenland Ice Cap almost froze to death trying to heat up the cabin of their C–47. The metal fuselage transmitted the heat to the cold outside very rapidly. Their rescuers moved them to a snow cave, where they easily kept warm until they were picked up.

In the tropics the shelter problem is generally protection from sun, rain, damp ground, and insects. Large-leaved jungle vegetation can be used to make a temporary roof, and the ever useful parachute provides a hammock and mosquito protection.

Firemaking is a simple but important task to the survivor. He will need a fire under most situations, in cold climates to keep warm, in all climates to cook food or to act as a signal. The emergency kits provide matches, but not an unlimited supply. Therefore instruction is given on how to light a fire from various materials, how to conserve fuel, and how to make a fire without matches. Environmental peculiarities are stressed For example, building a fire under a snow-covered tree is a poor practice. When the fire gets going, the snow on the tree begins to melt, falls, and puts out the fire.

Living off the Land. The problem of living off the land will not arise if communication with rescue aircraft can be established. It has not been a major problem in Korea. Yet situations may arise where men will have to live off the land for months. In a short survival course the most that can be done is to demonstrate hunting and fishing techniques, using the snares, fishing gear, and gun in the survival kit and to overcome the uninitiated man's natural resistance to eating unfamiliar food. A man well-trained in survival will look at a lizard or a seagull with an unquestioning hungry eye. He will read the following memorandum on the uses of a caribou carcass (which was prepared by an Alaskan Eskimo) with real appreciation—not just loss of appetite:

> Meat for food; hide for parka, trousers, mattress or sleeping bag, or hair separate for stuffing; leg skins for one pair short mukluks; head for soup and butter; sinew for thread; bones boiled to eat as soup, with lye for soap, for glue, or as a source of grease; eyes for pudding; fat from viscera for food; stomach eaten, including contents; intestines washed and dried for storage of food, or split and sewn into raincoats or windows; heart, liver, lungs and kidneys eaten on the spot.

A man who looks upon the entire animal and vegetable kingdoms as possible food sources has a very good chance of surviving in any environment.

Clothing is not usually a problem to a military man. He wears the uniform of the day. Yet there is enough variation in the clothing worn by air crews to

Strategic Air Command's survival courses drill crewmen in coping with mountainous terrain. This student at the Camp Carson school practices the mountaineering technique of "rapelling," a method for descending sheer cliffs. In "rapelling," a doubled climbing rope, anchored above, is passed under the climber's leg, then up and across his chest and shoulder, and down his back. The friction of the rope across his body allows him to descend slowly and securely. The rope shown is a commercial climbing rope, but a stranded airman could improvise a rope from parachute shroud lines.

mean the difference between survival and death to a man who bails out. The best rule to follow is to dress for each flight as for a walk home. Some aircrews have learned this by bitter experience. A navigator in Alaska once bailed out in midwinter wearing low quarter shoes and flying boots. He landed in the snow barefoot. He now wears combat boots safetied to his suspenders with wire.

When space limitations in an aircraft prevent a man from carrying all the clothing he might need on the ground, his emergency equipment may do double duty. Parachutes have substituted for overcoats and socks. Anti-immersion suits have been used as windbreakers. The survival student is briefed on all these expedients. He is also briefed on how to wear clothing. For example, a warmly dressed man working hard in extreme cold weather may sweat profusely. When he stops exercising, he will be in danger of freezing because of his wet clothes. The wise man in this situation either works at a slower pace or takes off part of his clothing.

Hiking.—An important part of the curriculum of survival schools is a long hike. On this hike many an Air Force man has discovered that neither his feet nor his body was quite up to the task. He usually resolves to stay in better shape. The hike is also an orientation and ground navigation problem. To the crewman used to traveling hundreds of miles an hour and looking at the terrain from above, the transition to a walking speed and a horizontal view comes hard. He soon learns that airline routes are for the birds and that a man on foot goes around instead of over obstacles. This experience gives most students an appreciation of terrain which will be very valuable in a survival situation.

The Okefenokee Swamp, although in the temperate zone, offers as difficult foot travel as is likely to be found in the world. Turner AFB survival school students cross a section of the swamp on a navigation problem. In swamps the approved navigational technique is to select a landmark a short way ahead on the compass course and walk, swim, or crawl to it and then choose another landmark ahead in sight and on course. Poor horizontal visibility and the sameness of the terrain make it easy to get lost.

Although the survivor has some food in his survival kit, he must always be alert to supplement these rations. A Camp Carson survival student fishes with tackles from his survival kit to hook and land a pan-sized trout. The plastic box on the ice at his left contains a varied assortment of hooks, lures, and lines, designed to provide a fish dinner in any waters. In many parts of the world fish are the most reliable source of food. A cheering fact for the survivor-fisherman is that the unpopulated areas that present the worst survival problems are not very likely to be fished out.

Drinking water is one of the survivor's biggest worries. A student at Ramey AFB survival school solves his immediate problem by chopping a young coconut filled with refreshing milk. His drink is better than ground water in that it does not need sterilization. After he has satisfied his thirst, he can make a meal from the meat of the nut. Analysis of World War II survival stories shows that the survivor who found a good supply of coconuts had solved his food problem. The meat of the coconut is edible and nutritious, green, ripe, or sprouting.

Anything that crawls, swims, flies, or walks is possible food for a survivor. During Turner Air Force Base survival instruction in the Okefenokee Swamp, two likely candidates are picked up for the main course at dinner. In hot climates live reptiles may be kept for days without danger of the meat spoiling, but catching snakes alive is not advised as a survival practice unless the survivor knows what kind of snake he is grabbing. Students are taught to handle snakes to overcome fear of them.

Miscellaneous.—Some items of survival training, such as health and hazards, geographical studies of strategic areas, and studies on ethnic groups liable to be encountered in these areas are usually taught by lectures. Such materials often are best taught by arousing the student's interest in a particular area to the point where he will continue reading and studying about it.

Other sources of information.—All survival training is not handled by the survival schools themselves. The survival training officers and intelligence officers in operating units are responsible for maintaining a continuous course of instruction on certain aspects of survival. Other Air Force organizations are responsible for keeping Air Force personnel informed of the latest in survival techniques and procedures. Of these organizations the most active in the field of survival is the Arctic-Desert-Tropic Information Center. This organization is responsible for collecting, evaluating, and disseminating within the Air Force pertinent information concerning survival in the non-temperate climates. ADTIC has prepared AFM 64–5, "Survival", the standard Air Force manual on survival, which is packed in all survival kits. This manual has recently undergone revision for re-publication in January 1953. In addition to this and other Air Force manuals ADTIC prepares studies on items of

Sea survival training is realistic at Ramey AFB school. Crews climb into life rafts and drift a half day in the open sea to learn how to use their rafts and equipment before they are picked up by a crash boat. The balloon-like objects floating beside the rafts are sun stills, which provide a continuous supply of drinking water as long as the sun is shining. In the raft are desalting kits to take the salt out of sea water when the sun fails to shine.

regional interest for dissemination among Air Force organizations and personnel interested in survival problems. It has also served as advisor to many of the survival schools now operating in the Air Force and has provided them with much of their instructional material.

USAF Survival Training Program

Air Force survival courses fall roughly into three classes: basic, advanced, and regional. The basic courses are usually given by operating units to their own students; advanced courses are operated by commands, with a majority of the students coming from their operational units; regional schools are operated by overseas commands, mainly for their own personnel.

In the basic course, aircrews and others who need the survival training are

In the Strategic Air Command everyone from the Commanding General down practices periodic ditching drills with water survival gear. General Curtis LeMay and the crew of a C–97 are simulating a ditching in the Offutt AFB swimming pool. In this drill each man dons a survival suit and a Mae West, jumps into the pool, inflates his Mae West, inflates the life raft, and climbs into the raft. Practice soon makes perfect.

Rescue usually is a two-way job. The stranded airman must always keep in mind that he is expected to assist in his own rescue by keeping in communication with potential rescuers. Students at Rapid City Air Force Base survival school are learning how to operate two types of emergency radios. Whenever possible, the radios are used by the students for actual communication with aircraft in flight to point up the limitations of the equipment. Drill in the use of communications equipment is essential, so that a man will be able to use it even if he is in shock from crash or bailout.

given a week or more of instruction in the basic techniques of survival, with emphasis on actual practice. A man does not become an expert on survival in a week's time, but during that week he can be indoctrinated with the proper attitude toward survival, find out what his equipment will do, and probably the most important of all, find out his own limitations. As one survival instructor remarked, "It's surprising how much more interest these boys take in physical training after they have dragged themselves and a 40-pound pack up and down these hills for three days."

After finishing the basic course, a man may go on to one of the advanced survival schools, either as an individual or part of a crew. At present the Air Force has two advanced survival schools. Strategic Air Command operates one and Military Air Transport Service the other. The SAC school, formerly at Camp Carson, Colorado, is now at Stead Air Force Base, Nevada. This school is primarily for SAC personnel, but other commands have a quota. The MATS school, formerly at Mountain Home, Idaho, is now at McCall, Idaho. Its students are drawn mainly from Air Resupply and Communication Service and Air Rescue Service, but other MATS organizations and other Air Force commands are represented.

Even though a man has graduated from an advanced survival school, his survival training is not over. All SAC units have a continuing survival program designed to maintain the aircrew's proficiency in survival and to keep it informed of current developments in survival equipment. In most SAC units, crews periodically take field trips in which they live off the land and their survival kits. In at least one unit these trips are not announced before-hand. The crew does not know it is scheduled for a survival exercise until after returning from a mission. After debriefing, its members board trucks which take them to the survival area.

Regional survival schools are found in several theaters, the Alaskan Air Command for example. All rated personnel and anyone else in the Alaskan Air Command who might get into a survival situation must attend this school. Emphasis is on Alaskan problems, and a field exercise takes up most of the course. From first-hand observation the students learn what they must be prepared for.

Rescue pilots often need help in selecting a landing site. Ramey Air Force Base survival trainees learn how to bring in a rescuing helicopter to a safe landing in a jungle clearing. Crew member at left gives "land" signal to pilot. Still visible by the palm tree in background are puffs from a smoke signal used by center airman to attract attention. Survival students are taught operating limitations, so that they will be able to select pickup sites intelligently.

The Pay-Off

Is the survival program a success? Have the men who have gone through survival training fared better in emergencies than those who have not? Reports from Korea indicate that survival training is efficient and has paid off.

A B–26 pilot who had to bail out says, "The parachute training at the SAC survival school enabled me to stop oscillation, to turn around in the chute, to land with the wind behind me, to prevent getting tangled in my shroud lines, and to free myself from the chute properly." A fighter pilot who bailed out over water and was floating in his dinghy only a few miles off the Korean coast said of his rescue, "Here my survival training paid off. The fighters were only about 300 feet off the water and I was bouncing all over the place, as the waves were 12 to 15 feet high. Yet I hit them with my mirror. They spotted me and began orbiting my position so I knew I was located at last." Another man who had been hit on the head in getting out of the aircraft and struck the water while barely conscious said, "Almost automatically I grabbed both cords to my Mae West and inflated both sides . . . I observed several F–84's circling the area. Since I was not thinking consciously what to do, I guess it was the subconscious result of my training that told me to release my Mae West dye marker." A gunner who bailed out in mid-winter on enemy territory was able to walk back to the U.N. lines over rough terrain during sub-zero temperatures. He said that he had been very careful not to get over-heated and to rest periodically before he got exhausted. He attributed his survival to remembering these details which he had read in an arctic survival manual.

The pickup is the payoff. This is an actual pickup in a Korean rice paddy. Guided by the easily visible signal in the foreground, the helicopter had little difficulty in finding and identifying the ground party.

NATO Activities

THE U.S. AIR FORCE AND NATO

Colonel Robert C. Richardson

"Your primary mission, in close conjunction and cooperation with, and supported by, the CINC, Allied Army Forces, and such Naval authorities as I may designate, will be the defense of the Central European area." Thus did General Eisenhower, the Supreme Commander of NATO forces in Europe, recognize, in his letter of appointment to General Norstad, the CINC of the allied Air Forces, that NATO air power should share the responsibility, coequally with landpower, for the defense of Western Europe.

Our North Atlantic Treaty command arrangements and plans all point to the fact that a successful defense of the free territories of Europe can only be achieved through the proper cooperation of air and land forces, a cooperation in which neither excludes the other. This is now achieved by strategic integration at the highest policy level, with independence and autonomy of command for each arm, under an over-all commander. This cooperative integration should permit the dominant role to switch from one arm to the other rapidly and smoothly in accordance with the dictates of the situation.

The role of the U.S. Air Force in NATO is twofold. First, it is to be ready to fulfill the commitments that we have accepted with respect to the strategic air arm. Second, it is to provide a fair and equitable contribution to the allied tactical air forces required to stem an initial enemy advance.

An understanding of the aims and objectives of the North Atlantic Treaty is prerequisite to understanding the role of the U.S. Air Force in NATO. Why are we in Europe and what are we trying to do? We are in Europe because the security of the U.S. would again be seriously endangered if the entire European continent were to come under the domination of Communism. To prevent this, we must build both the will and the means by which the free countries of Europe can defend themselves with limited U.S. assistance.

Aggression is within the current capabilities and possible intentions of the U.S.S.R. The immediate conquest and occupation of either the North or South American continents is not now considered a capability. But the military and political consolidation of Western Europe and the Mediterranean littoral, including large agricultural and industrial developments and much of the earth's trained manpower, against the commerce, systems, and ideologies of the United States might terminate the American way of life. The United States has grave responsibility to ensure that territories of the NATO nations can be defended and the objectives of the North Atlantic Treaty attained.

The problem of holding all, or part, of Western Europe is complex. It cannot be segregated and treated as separate and distinct from global considerations. The standard of living which the free democracies require will not permit them to build and maintain, in peace time, standing armies numerically equivalent to those in slave states. We cannot hope to meet the immense forces of the Soviet Union on land, sea, and air fronts, forces so positioned that the Soviet can bring all his power to bear at the time and place of his own choosing, unless we are prepared to generate equivalent forces reduced only by what we can credit ourselves for technical superiority. To meet the initial threat, we will have to total all our assets on a world-wide basis. Our military operations must support each other. Having lesser forces, we cannot affort duplication or even unrelated efforts. This fact alone requires that the defense of Europe must be considered as part of the global problem.

A successful defense of Western Europe against military attack would require that the enemy's initial onslaught be met by adequate force to arrest it as far to the east of the Rhine as possible. This means that initial Soviet capabilities for invasion must be offset by equivalent Allied capabilities for defense. Conversely the Soviet build-up after D-day cannot be matched quantitatively, since we have never contended that NATO could support, in peacetime, forces sufficiently numerous to provide a mobilization base equivalent to that of the U.S.S.R. Continued success could only result from the application of other forces favorable to us, principally the strategic air offensive. This fact automatically makes the NATO air effort indivisible from the global air effort.

While building adequate forces to resist the initial attacks, NATO must count upon the success of the strategic air offensive to stop the enemy's subsequent build-up and thereby reduce or hold him to our size. Our land-tactical air team in Europe should eventually be able to destroy, capture, or immobilize enemy land and tactical air power. It would be able to capture positions, key areas, and critical points. It would be able to cope with the enemy air threat to its area of responsibility. But for the achievement of decisive major effects in a war with the U.S.S.R., reliance on the land-tactical air team alone would lock us in an inescapable death grip with vast territories and vast populations, a death grip from which we could not extricate ourselves and which would have mutual exhaustion as its best possible outcome.

Thus the entire NATO defensive operation is planned as a "grand delaying action," aimed at securing the time required for a reaction to be felt from the NATO strategic air offensive. Only when the tactical and strategic air efforts are taken together can our true capabilities for defense be evaluated. Both are NATO efforts. The first basic undertaking of the NATO strategic concept provides that the U.S., aided where practical by others, will be primarily responsible for the strategic air offensive. From the onset, NATO recognized the dominant role of this arm in the collective defense and counted it as a major asset. In so doing, it entrusted the U.S., without demanding unreasonable explanations or justifications, to carry on with its development.

The role of the strategic air forces in NATO needs no further comment. It is almost wholly a U.S. responsibility, and its strength and outstanding state of readiness is well known. The development of the U.S. contribution to the tactical air forces is different. It must be considered in conjunction with the development of the NATO air forces as a whole. This task, like that of building land forces, could not be delegated to any one nation. It required the close integration and cooperation of all. To this end, NATO has retained for itself the development of the land-air team in Europe and has created the Supreme Command (SHAPE), to carry it out.

The NATO land and tactical air team must be built to resist and prevent entry by enemy armies upon allied territory during the time needed to secure the decision in the air. The NATO navies must act defensively to prevent naval attacks against our flanks and to secure our lines of communications. Strength must be massed in the decisive aerial field: first, for counter offensive operations, which must be decisive, since circumstances will not allow us to match the enemy mass in other fields; and equally, for strategic cooperation with land forces in protecting our territories from destruction, pending the decision. It would seem criminally unfortunate if the civilized heritage of Western Europe was again crushed by an invader just prior to his collapse, especially if caused by the lack of one division or one wing that might have enabled us to hold him back until his forces reacted to the over-all air offensive.

If our allies fully utilize their resources unimpeded by man-made political, economic, and social barriers, the NATO nations in western Europe could generate the air and land forces required for their initial defense. In this event the U.S. would contribute the reserves and reduce its defensive outlay by concentrating on mobilization potential and the counter offensive air arm. It therefore behooves us to develop European military self-sufficiency. In air it is one of our vital roles to provide the backbone and nucleus around which non-U.S. NATO tactical air power can be generated and expanded.

When General Norstad took on the building of an integrated NATO air team, he found the task had two distinct phases: first, forces that existed had to be improved; second, new forces had to be raised, trained, and deployed.

The forces available consisted of a miscellaneous and generally uncoordinated aerial pool programmed by the individual nations since the war. In essence Europe in 1950 presented what might be described as a miscellany of units of varying composition and capabilities, which under hostilities might or might not act in furtherance of a collective plan. The military organization of the Western Union powers had made some progress in developing plans but lacked money and command responsibility, without which little could be accomplished.

NATO's immediate task was to realize a small but effective force, of limited but measurable capability, which could be counted upon to operate efficiently in the event of aggression, in accordance with a predetermined plan. This first step has been largely achieved. By the provision of matériel, equipment, training facilities, and guidance; through the establishment of an integrated allied command organization; and by proper emphasis on standardization to ensure flexibility and the best use of our limited back-up, *we now have a NATO tactical Air Force in being.* It is a force which, although quantitatively inadequate, would extract a costly price from any enemy which engaged it.

To illustrate the importance of the improvement phase of the NATO air development, frequently overlooked because of the far greater effort required to obtain an increase in forces, I would point out that in 1950 the U.S. and U.K. world-wide air order of battle was less than the total number of combat aircraft in the Air Forces of other Western European nations, although the latter consisted mostly of a miscellaneous aggregation. If nothing else were accomplished, the transformation of the European contribution to the NATO Air Forces into an effective and useful force would therefore have more than doubled Allied capabilities.

The greatest problem that first confronted NATO leadership was that of increasing the forces in being. This was especially true with air forces, since many of the countries never had them worthy of the name and therefore lacked experience or understanding of the task. During discussions of force commitments on NATO Defense Committee and Council levels it was enlightening to note that, whereas the proposed increase of one battalion in land forces would unleash violent economic debates, squadron complements of first-line aircraft were frequently added to national contributions without serious objections. It was obvious that many thought, and some still think, that if you have a pilot and an airplane you have an air force. The result of progressive education on this subject during the past two years has been repeated cut-backs and stretch-outs in the national air commitments. All agree, however, that if NATO is to have an acceptable defensive posture we have to build air forces, as well as perfect those in being.

The problem of building air power in Europe divided itself into two phases: (1) national evaluations of their respective abilities to raise and support air forces from the point of view of manpower and infrastructure alone; and (2) national and NATO evaluations of each nation's capabilities to expand her armament industries, first to sustain the forces in being and to be raised and then to contribute to their initial equipment. There has been much delay as a result of this approach, but in all fairness to the U.S. taxpayer, we had to use up national, European, and lastly U.S. aid capabilities in that order.

At the onset we were faced with the fact that all nations, like the U.S., had some sort of air force program. Nearly all these programs had to be readjusted and increased to fit the plans and needs of the team. Readjustment was easy, but persuading nations to increase their air effort was much as if the U.K. Parliament had tried to get the U.S. Congress to up the 70-group program in 1946 over the opposition of other services and at the expense of the social programs demanded by the electorate. It was not easy to change the emphasis from economic recovery to rearmament, for even the U.S. through ECA had insisted that primary effort be devoted to the former. The peoples of democracies do not adapt themselves to sudden changes in national course as readily as those obliged to accept the dictates of Communist governments.

Another substantive factor in our calculations was the attitude of the European public. If sacrifices were to be made for defense, there had to be a will to resist. This will could be generated only by evidence, especially in the air, of sufficient means to offer a prospect of success. A rapid deployment of U.S. air forces was in order. The void had to be filled to some extent as a prerequisite to the achievement of our over-all build up. Lacking confidence in the goal and tangible evidence of U.S. support, government commitments would attain little support from apathetic and reluctant peoples.

So far the U.S. Air Force units deployed in France and Germany have proved their worth. To get them in fast, we were obliged to accept conditions which in some instances were more rugged than during the war years. On technical considerations alone this did not make sense and incurred strong staff opposition. The command decisions to go ahead have been more than vindicated. Men and officers alike rose to the challenge. They are developing their bases, learning the languages, and consolidating good will. Again it is not sufficient that governments agree to the need for the NATO air forces in Europe, unless these units and their bases can be married up. Without good relations between the people in a country and the nonindigenous NATO forces therein, the program can never be achieved. It is an essential task of our units to respect the sacrifices of their hosts and to ensure that their conduct does not weaken the all-NATO team.

Our struggle to get under way is achieving success. Inertia has been largely overcome. Since the establishment of SHAPE, in January 1951, air exercises have been held at an increasing rate. Each shows an improvement. At this writing, the completion of June Primer is a definite mile-stone. Squadrons were quickly and efficiently shifted from one area to another, operations were effectively controlled, air warning and control systems from the Baltic to the Italian coast observed and directed the maneuver, and with little effort several thousand sorties a day were flown. This contrasts markedly with capabilities of 1950 and 1951. I think it is safe to say that most of the foundation has now been established. We need, however, to build strength on and around it, to eliminate duplication, to improve efficiency and training, and to ensure the availability of the all-important logistic back-up for sustained operations. The latter is our weakest point at the moment. So far we have concentrated on front-line strength and the building of combat units as a first task. Now we must consider building endurance into the teams. This is now our most important effort, one whose importance is highlighted by our experiences in Korea.

Although our NATO air forces in Europe, U.S. and Allied (for to our thinking they all form but one integrated team), would give a good account of themselves in the event of war, there is much left to be done. Experience may indicate there are better command arrangements to be adopted. The increased range of our new equipment, air refuelling, and dependence on support from tactical and strategic bomber forces indicate more and more the need to centralize all the air direction under one command capable of fast and effective action. The airfield problem is by no means solved. The spring of 1952 provided exceptional construction weather, thus giving us a two months head start, but there is still a very long way to go. When Field Marshal Montgomery turned over Western Union, he indicated in his report to the Standing Group that he had practically no bases suitable for modern jets in Western Europe. While some deficiencies still exist, great progress has been made. By the end of 1953 we should have a large share of the bases needed. Logistic deficiencies, however, will still be acute.

Training is essential. Little by little we have been standardizing our doctrine and techniques, a slow process because of national desires, the U.S. being the most difficult. The different national contributions have had no trouble working together. The standard of proficiency of the various air forces, though, varies greatly. In some instances it is unacceptably low. They have lacked equipment, and what they had must be used for transition and basic tactical training. Suitable gunnery ranges are few, and all-weather fighter operations are in their infancy among the allied units. But these are factors readily corrected as equipment becomes available, and it is now flowing in at a good rate. We now have a small but relatively integrated and operational NATO Air Force. That was the big hurdle—the one with the built-in headwind—to overcome. It gives us the wherewithal to improve and expand.

The air build-up lags behind that of the army. The need to develop bases, build aircraft, and in some nations generate the entire air force organization from scratch has introduced unavoidable delays. We can now say that the goal is in sight. A strong, integrated European air force with European Defense Command deployed in conjunction with British, Canadian, and U.S. forces in central Europe, should be a reality by 1954.

Within the NATO air forces, the U.S. Air Force must bear a large share of the burden. It must provide nearly all the offensive punch necessary to equalize our mass to that of the enemy, and to afford the decision. It must also, and with equal energy if we are not to chance an empty victory, contribute to the tactical air elements necessary, in cooperation with allied land forces and supported by naval forces, to prevent the over-running of our territories.

To adapt a quotation from Mr. Churchill, it is fair to say that NATO, having started like a lot of staves stuck together with political putty, is rapidly evolving into a bundle of faggots bound by a rim of steel.

Supreme Headquarters, Allied Powers Europe

Photo Notes

Automatic Weather Station

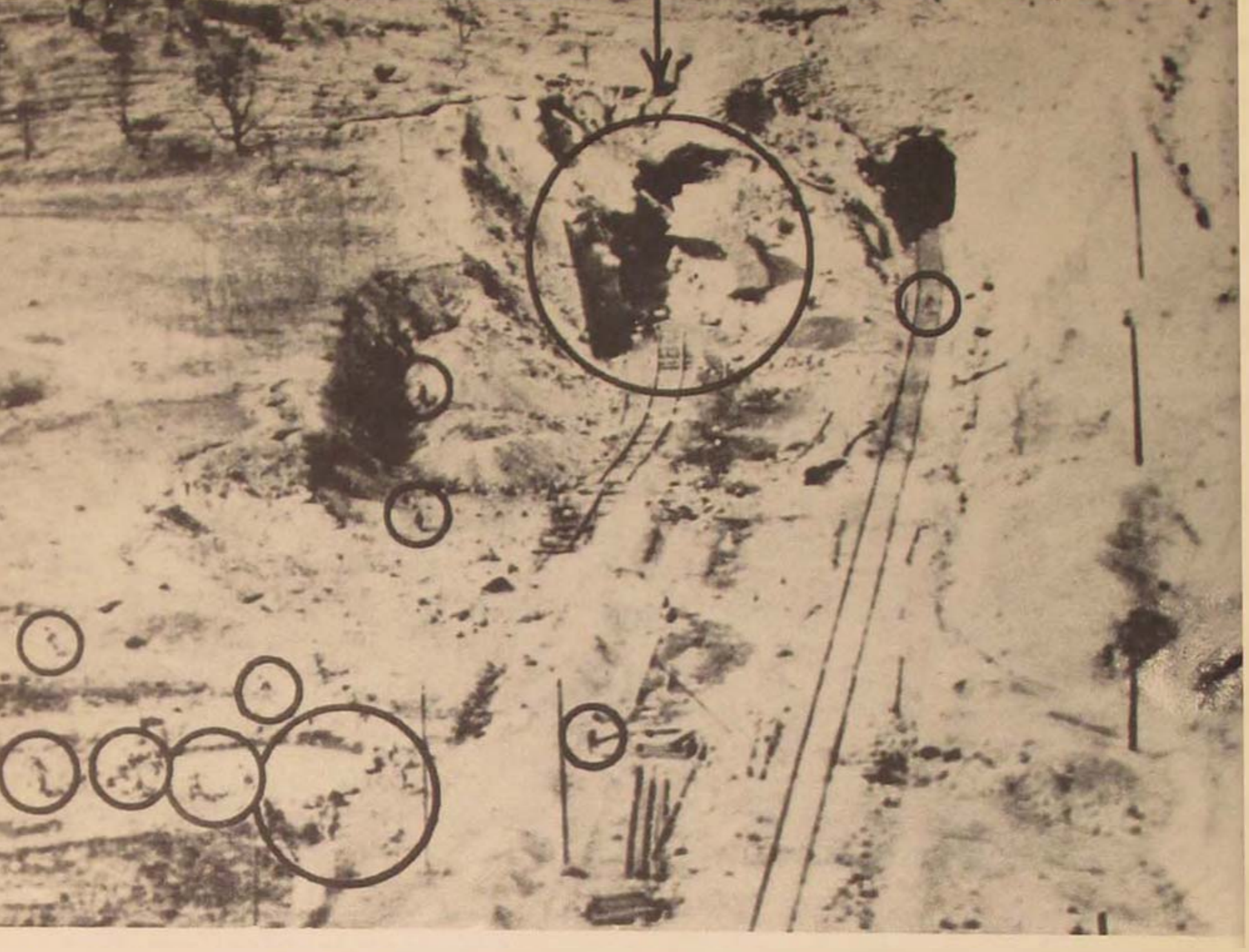
On the rim of the Arctic Circle in the cold, gray desolation of the Bering Sea, the world's loneliest weather station sends in regular reports to the Air Weather Service. The site for this latest USAF automatic weather station is the tundra-covered, fog-shrouded island of St. Matthew, a thousand miles north of the Aleutians and only 300 miles from the coast of Siberia. The only evidences of life on the island are occasional silver foxes, herds of caribou, a deserted quonset hut at an abandoned Coast Guard installation, and the prefabricated hut housing the automatic weather station.

Six weather-observing instruments protrude from the hut: an anemometer to record wind speed and direction, a thermometer, a hygrometer to measure relative humidity, four photo-electric cells to record the amount of sunlight, and a tipping bucket to collect and measure rainfall. All these instruments connect with the automatic "brain" inside the hut, which records the various readings and automatically transmits the information on two different radio frequencies every three hours. Received at Aleutian stations, the data is relayed to central weather stations throughout the world so that it may be incorporated in the global picture of the day's weather.

The St. Matthew automatic weather station is the second to be placed in operation. Like the one at Amchitka in the Aleutian chain, St. Matthew is much less expensive to operate than a manned station. Since it requires only one maintenance check a year, it is also much more practical than a manned station in such a bleak and difficult outpost. And it has eliminated the difficult personnel problem involved in selecting compatible crews for isolated stations where the men would be continuously in each other's company for months on end with radio their only outlet to the outside world.

Like this point of land in the cold bleakness of the Bearing Sea, the lonely island of St. Matthew lifts its mountain peaks to a leaden sky. Fog-shrouded for days on end, St. Matthew is the site of an Air Weather Service automatic weather station.

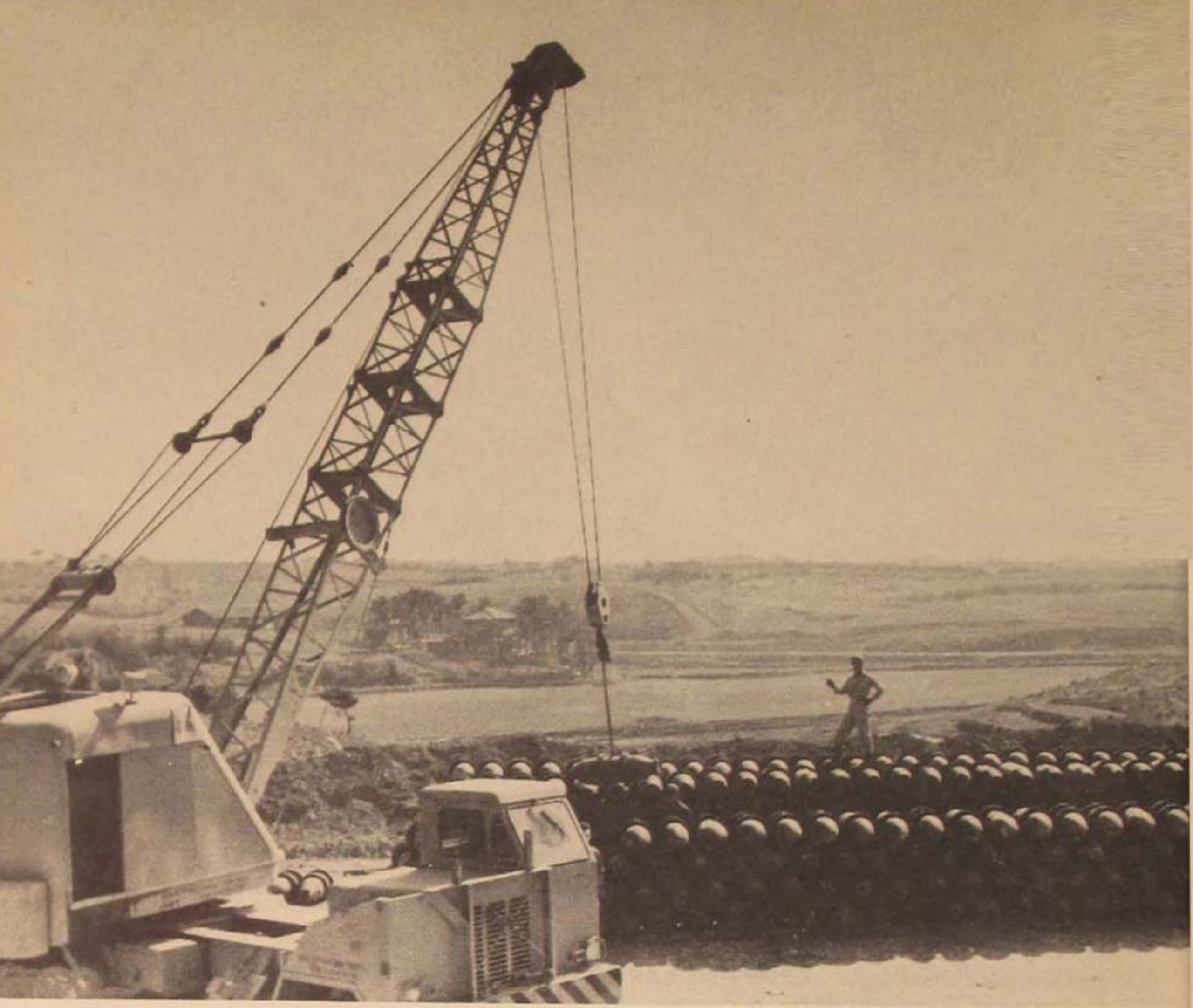
In the photograph above, members of the crew which installed the automatic weather station on St. Matthew island are uncrating some of the weather instruments which are to be installed in the prefabricated hut in the background. After making a hazardous landing on the rock-strewn beach in a heavy surf, the 14-man crew spent 25 days on the gloomy island erecting the hut and installing the equipment. The completed station (below) is self-sufficient for one year, barring breakdowns. Then a maintenance crew will visit the island to refill the fuel drums which supply the gasoline engine powering the automatic equipment and to inspect and reset the instruments.



Hunt for Cover. *Deep in North Korea, a FEAF reconnaissance aircraft dipped low into a mountain pass to take a low-level oblique photograph of the damage done to an enemy railroad tunnel by a previous U.N. air strike. The photograph (above) shows that one tunnel entrance is completely caved in and that the Communists have apparently given up hope of repairing it, since the railroad track is now covered over. Obviously the Communist labor crew has had previous unfortunate experience with U.N. aircraft. Men (shown in smaller circles) are scrambling for cover in every direction.*

Human Starter. *When an engine starter failed on this B-17 in Japan, one of the crewmen recalled an old trick. Using "bungee" elastic cord, the crew turned the engine over with man's oldest form of locomotive power—a strong arm and a strong back.*

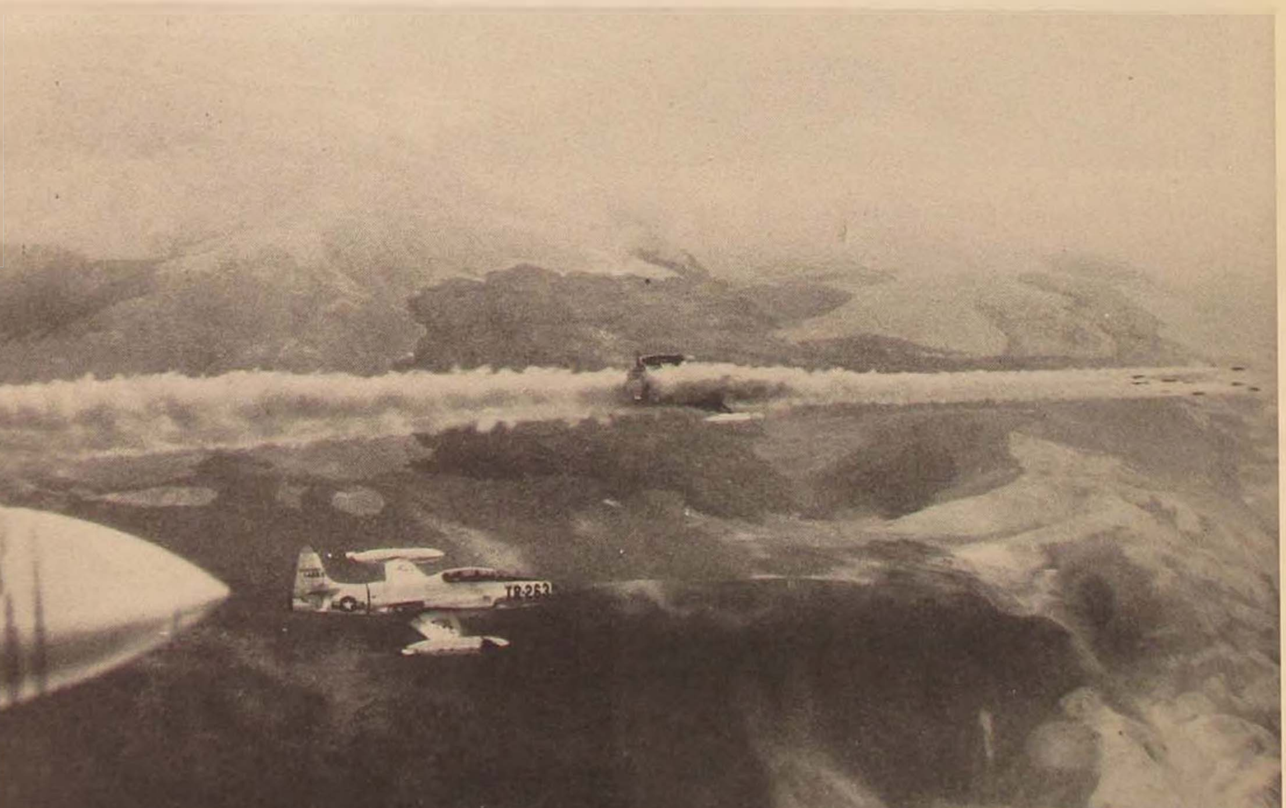
Photogenic Firepower. *One of the routine jobs of the ground crews in Korea is to "fire in" the guns of FEAF combat aircraft before their missions. Guns must be checked for accuracy and convergence on the target a given distance away from the aircraft. Above, tracers from the four caliber .50 machine guns converge into a point of fiery destruction. Below, the 14 forward-firing wing and nose guns of a B–26 light bomber seem to spout solid streams of fire into the night in this firing check.*

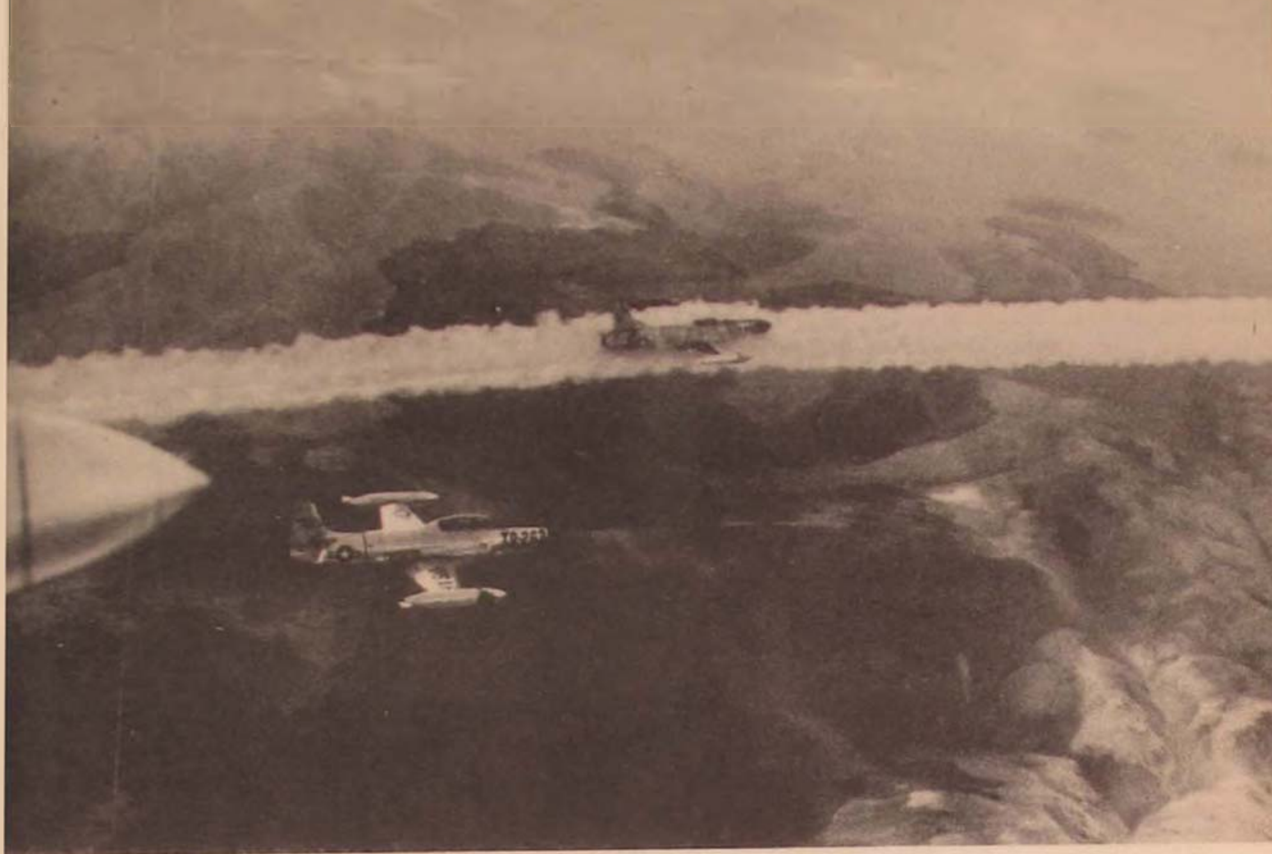


Egg Storage. *In new revetments carved out of Korean hillsides, row after row of bombs are being stored for use in the Korean air war. To create the needed storage room without using any of the precious arable land in this war-torn country, more than 630,000 cubic yards of earth were removed from mountainsides and 11 miles of roadbed were laid in two weeks' time. To protect the stacked ammunition from local "free enterprise" (for an example of the dangerous activities of local freebooters, see* Air University Quarterly Review *[Spring 1952], V, no. 2, p. 103), guards accompanied by fierce, keen-nosed dogs patrol through the far-flung revetments night and day.*

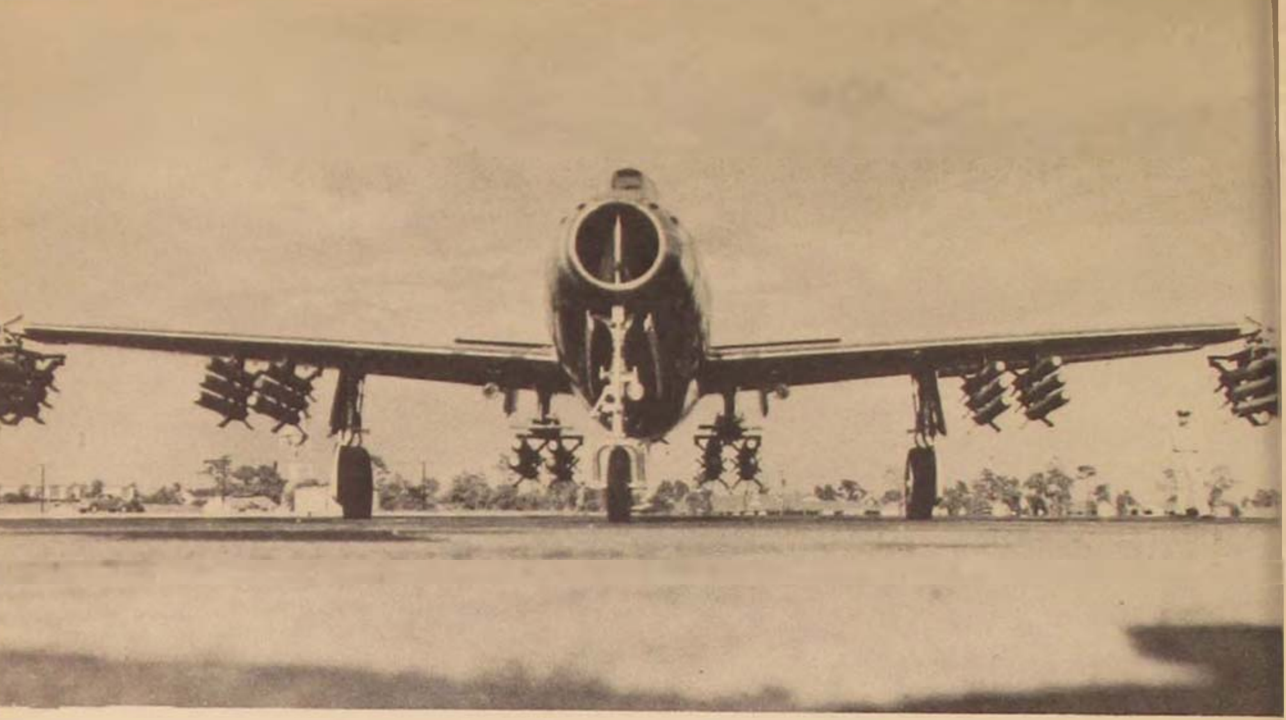
Flying Trailer. *Increased maneuverability on the ground and in the air is claimed for this new air-cargo pack developed for use with the new XC–120. Mounted on four tandem sets of detachable wheels, the cargo pack can be towed by almost any military vehicle (top). Loaded at the factory or warehouse with as much cargo as can normally be carried in a C–119 Flying Boxcar, it is towed directly to the aircraft, and locked into position under the XC–120 with the aid of the aircraft's internal hoists (center). No time is lost in cargo handling, since the aircraft can quickly unhitch one cargo pack and take on another. The cargo pack floor, made of extruded magnesium channels for light weight, strength, durability, and low maintenance costs, stands at normal truck-bed or freight-dock height. Freight can be loaded through wide, double-folding doors in front and rear. When the cargo pack is in position, these doors are opened and locked in a modified "V" shape (bottom) to reduce air resistance in flight. The detachable wheels and towing bar are stowed in the XC–120 during flight, so they can be quickly reattached to the cargo pack at its destination point.*

Salvo. *This dramatic series of photographs records the firing of a rocket salvo from the new F–94C. The Starfire is an all-weather interceptor packing 24 2.75-inch Aeromite rockets in a ring around its black, radar-crammed nose. Observe at ground radar stations "talk" the pilot close enough to invading aircraft for the Starfire's radar operator to pick them up on his own set. Once in contact, the F–94C electronically locks on its prey, tracks it, close the distance at 600 m.p.h. or more, takes aim, and fires. Any one of the rockets can destroy the largest enemy bomber. In the photograph above, the rockets have just been fired. With a blinding flash and a cloud of smoke they leave the rocket tubes. The rockets, now self-propelled (below), speed away from the aircraft toward their invisible target. The third photograph (top of next page), taken one second after the rockets were fired, has already lost the rockets from view. Companion aircraft in the foreground is a T–33.*





Sidearms. *The newest addition to the formidable armament of the F–94C is shown in the photograph below. A rocket pod has been installed just inboard of the tip tank on each wing. Each pod contains 12 2.75-inch Aeromite rockets, all of which can be fired in less than one-quarter of a second. The pod's fiberglass nose cover is disintegrated by the gas pressure built up within the chamber a split second before the rockets are fired. If a different armament combination is desirable, machine gun pods can be substituted for the rocket pods. Each machine gun will carry 265 rounds of ammunition. Delivery of the new weapons to the Air Force for installation on F–94's now in service will begin in the next few weeks. By spring, F–94C's will be equipped with these potent new sidearms as the aircraft come off the assembly line.*



Big Brothers. *For use against ground targets, fighter-bombers prefer the larger and more penetrating 5-inch rocket to the smaller Aeromite used by interceptors. Here an F–84E Thunderjet is shown with its total of 32 five-inchers slung beneath its wings. This tremendous firepower is in addition to its six .50 caliber machine guns.*

Decoy. *In a desperate attempt to divert U.N. fighter-bombers and bombers from smashes at Communist airfields in North Korea, the enemy has gone to considerable trouble to construct realistic dummy airfields. The theory seems to be that fast-flying jets seeking a target of opportunity will be taken in by the superficial likeness of the dummy field to the real thing and expend their bomb loads on a worthless target. The dummy airfield shown below has been given a different appearance from the fields around it. Shacks have been erected to simulate administrative buildings. A fake flak battery has been placed on the upper left edge of the "runway." The swept-wing dummy MIGs in each of six revetments have even been raised off the ground so that they cast a real shadow. Built-in bomb craters would make it look more like the other Communist airfields, but the enemy relied on U.N. air forces to supply those.*

Books and Ideas . . .

The Panzer Leader and the Blitzkrieg

COLONEL J. A. BEALL

WORLD WAR II has already become one of the most thoroughly documented wars in history. To the mushrooming list of authoritative memoirs we must now add that of *Panzer Leader* by Colonel General Heinz Guderian.*

Panzer Leader is primarily an autobiography. Guderian was an outstanding tactician, one of the best of World War II. He held successively important command positions in the German Army. He was Corps and later Panzer Group Commander in the Polish and French campaigns of World War II. He was Panzer Group and later Panzer Army Commander in Germany's attack on Russia. In 1943 he was made Inspector General of Armored Troops and finally Chief of the German General Staff. *Panzer Leader*, then, is a detailed diary of a commander, a factual and personal account of the war from the German viewpoint.

But *Panzer Leader* is more than an autobiography. It is the story of the development and implementation of a concept—the concept of the effective employment of massed armor, so well demonstrated in what became known to the world as "blitzkrieg." It is the story of the struggle of this German officer to obtain recognition for the organization and employment of armored forces as an integral element in modern battles. The English military historian, Captain B. H. Liddell Hart, says of Guderian that he had a "tremendous impact on the course of events in our times. Without him it is probable that Hitler would have met early frustration in his offensive efforts. His opening run of victory in the Second World War was only made possible by the Panzer forces that Guderian had created and trained and by his audacious leading of these forces in disregard of his superiors' caution."

It is true that the concept of the Panzer employment was not original with Guderian. He admits adopting ideas of the Englishman, Liddell Hart, who in turn says, "The conception of this deep strategic penetration by armored forces developed in my mind initially from study of the long-sustained drives carried out by Genghis Khan's all mobile forces in the Mongol campaigns of the 13th century." But it was Guderian who adapted the idea to the capabilities of the tank and implemented it in World War II.

Guderian's success as a proponent of the tank in the German Army is all the more impressive when we recall the obstacles which he had to overcome. The limitations placed on Germany's 100,000-man army, as the result of the Versailles Treaty, forbade the manufacture of tanks. Early experiments, therefore, had to be made with mock-ups and canvas models which the veterans of World War I thought absolutely ridiculous. School children were accustomed to sticking their pencils through the canvas walls to have a look at the inside, and Infantrymen usually defended themselves against the "tanks" with sticks and

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***Panzer Leader, by Heinz Guderian (New York: E. P. Dutton Co., 1952, $7.50), pp. 528.**

stones. In fact, it was not until 1928 that Guderian himself ever saw the inside of a tank:

Lack of equipment was not as great an obstacle as lack of foresight in his superiors. As late as 1931, Guderian was told by his inspector and superior, Stulpnagel, "You are too impetuous. Believe me, neither of us will ever see Germany's tanks in operation in our lifetime." It was not until 1933 that Guderian's first "break" came. Watching a tank demonstration in Kunndersdorf in 1933, Chancellor Adolph Hitler exclaimed with delight, "That's what I need! That's what I want to have." This implied approval of Hitler's assisted Guderian a great deal in overcoming the doubts of his army superiors. Many obstacles were yet to be overcome, but from that day in 1933 forward, the Panzer Corps was destined to be a reality.

In October 1935 three Panzer Divisions were formed. Guderian's next problem was to keep the new Panzers from being employed in dispersed and ineffectual parcels. Had it not been for Guderian's tenacity, the new Panzers would probably have been split up as infantry support weapons. His expression "Klotzen, nicht Kleckern" (literally "Boot 'em, don't spatter 'em"—or strike concentrated) became the byword of the armor.

Indeed it was not until September 1939 that Guderian was able to prove his theory of massed armored tactics in the Polish campaign. In the attack on France in June of 1940, it was upon Guderian's assurance of the Panzer's capability that Manstein evolved his plan for the breakthrough at Sedan. And it was Guderian's leadership which placed that plan in execution.

It was through no fault of Guderian that these early victories were later to bear bitter fruit. In the Russian campaign Guderian lead the Panzer group to the outskirts of Moscow and was summarily relieved for making a strategic withdrawal when his troops were exhausted. After the German Army had been severely beaten in the Russian campaign of 1942, Hitler recalled Guderian to rebuild the Panzer elements of his armies. It was Guderian who warned Hitler of the weakness of the Atlantic Wall—an inherent weakness in any defense that lacks sufficient reserves. After the Allied landing, Guderian was made Chief of the German General Staff, which position he retained until one month before the end of the war.

To the commander of military forces, Guderian's book is replete with examples of military leadership. In many ways Guderian was the German counterpart of America's Patton. The frequency with which he visited the troubled parts of his front were the marks of a good ground commander. The courage with which he personally led units who had been stopped was one of the big factors in the German early successes. The audacity with which he attacked, many times belaying the doubts and fears of his superiors, is to be commended. As a German General Staff officer, he had been taught to observe both men and officers coolly and sensibly and to report his findings honestly. It was the trait of reporting what he thought his superiors *ought* to hear instead of what he thought they *wanted* to hear which made Guderian one of Hitler's most trusted advisors.

Air force readers will find Guderian's struggle for recognition of the importance of strategic employment and mass attacks similar to Air Force experiences regarding the adaptation of these principles. They will find a close parallel between this struggle and the struggle of the Air Corps for recognition and autonomy. In many ways Guderian was the Billy Mitchell of the German armored forces.

The Air Force student will also find the joint Army-Luftwaffe plans of operations informative.

> In order to establish a sound basis for cooperation. . . . I had invited the airmen to my planning exercises and I also took part in an air exercise that (they) organized. The principal matter discussed was the Meuse crossing. After detailed study we agreed that the air force could best be employed in giving the ground forces continuous support during the crossing; that meant no concentrated attack by bombers and dive bombers, but rather. . . . perpetual attacks and threats of attack against the enemy batteries in open emplacements . . .

Thus Guderian applied a principle which other tacticians often forget: it is behind the active front that the most lucrative tactical air targets appear—targets that are flushed by the necessity of activity, movement of reserves, and replenishment of supplies.

In other phases of air warfare Guderian is apparently less astute. Only three times does he mention air superiority—the times that this lack of control of the air was disastrous.

Military students will find numerous examples of tactical employment explained in detail. The tendency of many officers is to place such examples in the realm of outmoded tradition. Nothing could be farther from the truth. The modern concept of mobile land warware was the product of the marriage of modern technology with the strategic and tactical concepts of Ghengis Khan. The tactical atomic bomb, super-bazookas, and improved mines may preclude the mass use of tanks in the Guderian fashion in World War III. But the principles of strategic attacks, deep penetrations, and massed fire power which are the essence of Guderian's tactics may prove useful in future.

In the plant world no two plants or generations of plants are alike. Each is affected by external sources, environments, sunlight, heat, and humidity. In addition each succeeding generation is nourished by the decomposed substances of the last. Without these substances the soil would not be fertile. In war no two plans of operation are alike. Each is affected by external sources, environments, changes in technology, and scientific discovery. But each plan should be nurtured by the plans and experiences of former commanders. It is only through a study of history that commanders can nurture their plans from the experiences and errors of the past.

The history of warfare provides numerous examples of evolution produced by technological advancement. There have been few examples of revolutionary changes. The advent of the airplane as a means of aerially transporting not only enormous firepower but also men and material appears to be the latest evolution in the art and science of war. History is the study, above all else, of change. By reaching into the recent experiences of World War II, many useful lessons can be observed to lend perspective to the adaptation of modern technology to future war.

In reading *Panzer Leader* the student must remember that it represents only one point of view. Like so many books by former military leaders it attempts to explain, to justify, and to clarify the writer's actions under the press of circumstances. That the view is biased must be assumed.

But the book should not be discarded as just another book by a German general. For the view, albeit at places distorted and biased, is for the most part original and helpful. As a history of the development of German armored forces in World War II the book is complete and factual. As a study of the German High Command it is factual but less complete. As a study of Hitler as a political and military leader, its views are intimate yet possibly distorted.

Air Command and Staff School

BRIEFER COMMENT

Lincoln Finds a General: A Military Study of the Civil War, Volume Three: Grant's First Year in the West, by Kenneth P. Williams, pp. 585.

Professor Williams continues the projected five volumes of his classic history of Civil War operations from the view of command. In Volume I and Volume II the scene was in the East, Fort Sumter, past Gettysburg, to the spring of 1864 when the new General-in-Chief, Ulysses S. Grant, crossed the Rapidan for the decisive campaign that led to Appomattox. For reasons advanced in our review of the first two volumes (Winter, 1949, pp. 88–92) the *Quarterly Review* regards Dr. Williams' extremely readable work definitive as military history. But for Air Force officers we urge its close scrutiny as a brilliant text on leadership. The three volumes we now have lay before us, in every useful detail, the decisions and the maneuverings of McDowell, McClellan, Burnside, Hooker, and Meade, the five commanders who failed to win a decision with the Army of the Potomac before Lincoln summoned Grant from the West. In bold relief to their indecision, their delays, their irresolute cautions, their failure to rise to the main chance of opportunity, the third volume recounts the early actions in the West that tested a man, revealing him as resolute and bold, marking him as a great commander. Every page is commentary on the text Dr Williams put at the close of his second volume: "*Ulysses S. Grant remains unique after two world wars; he is still in many ways the most profitable and the most inspiring of all generals to study. He was a soldier's soldier, a general's general. He was always thoughtful of his subordinates and fitted his instructions to their experience and talents; he never forgot that his superiors had hard problems; he worked tirelessly with what was given him and made no excuses or complaints. He was the embodiment of that offensive spirit that leaves the enemy no rest.*" Required reading.

Macmillan $7.50

The Zone of Indifference, by Robert Strausz-Hupe, pp. 312.

"*If it is at all possible to reduce the historic development of the last fifty years to one fact it is this: the close of the European Age. Europe, only a generation ago the center of world power, is now the debated ground upon which powers more powerful than any European nation contests the part Europe is to play in the world order . . . If recent American foreign policy has held, despite vacillations and contradictions, to one purpose it is this: to raise Europe from the ruins of her former might, forge a Western alliance, and erect the political and military framework of a new and larger structure, the Western Community. . . . The preservation of the Western Community and hence the defense of Europe have precedence over all other commitments of the United States in world politics.*" Thus Professor Strausz-Hupe opens his analysis of the perils threatening the Western world. in particular "the alienation of the social mind." He finds a growing estrangement of Western man for the philosophical and ethical foundations of his society. He also finds a growing estrangement between Europe and America. He believes the single most important fact about Western culture today is its survival only by grace of American power. If a rupture occurs, Western culture is as good as dead.

We in the Western world, he maintains, must choose, for the survival of

Western civilization, between two alternatives: an American Empire with its European auxiliaries or "a Great Republic of the West composed of the United States and a federated Europe affiliated with the British Commonwealth as a separate, yet closely associated member." The second alternative, the reintegration of the Western community, subordinates political and military strategy to moral considerations, that is, to "the reconciliation of Western society and the restoration of that balance of power that has always been the guarantee of Western freedom." "Only a European society that is united in common devotion can resist Soviet tyranny."

Basing his argument upon a re-examination of the basis and concepts of Western culture, Professor Strausz-Hupe offers us a thoughtful and provocative book.

Putnam $3.75

Midcentury Journey: The Western World Through Its Years of Conflict, by William L. Shirer, pp. 312.
A very literate inquiry into the happenings to what we in this country used to call the Old World. Mr. Shirer, the author of *Berlin Diary*, journeys from capital to capital, from Vienna to Paris, to Frankfort and Berlin, to London trying to understand and describe the changes from that Old World which came to an end in 1914 with the first of an incredible series of social convulsions.

"Above all, it was an era of Peace . . . For many decades there has been no serious wars, so that by 1914 few could recall what war was like; Americans and Europeans alike had come to accept the idea that future disputes between nations would be settled by peaceful means. . . .

"It seemed indeed to many in the West that human society had reached a state of equilibrium that might well be permanent. Some changes there would always be in human affairs, but from now on they would be invariably for the better. And they could be wrought peacefully, without commotion, without revolution and bloodshed, without war.

". . . my father, who had died in 1913 at the age of 42, must have known no other concept of life. In his lifetime, so full of faith and hope and optimism, there had been: no world wars or even cold wars; no important revolutions, no genocide, no communism or fascism, no totalitarian dictators of left or right, no Soviet Union, no atom bombs (or hydrogen bombs)—none of the things that had dominated my own life and times. He had, no doubt, believed in the inevitability of peace, progress, and prosperity—and in the essential goodness of man.

". . . his world died with him. . . . It was soon in shambles, its venerable institutions, which must have seemed to him so stable and all. Certainly he could not have faintly imagined that his body would hardly be cold before the earth he thought so reasonable and good would be littered with the shattered corpses of millions of men who had been as decent, as innocent, as full of faith and hope as he.

"Nor could he have had the slightest foreboding that this senseless mass slaughter would be repeated on an even greater scale a quarter of a century later, nor that at the century's halfway mark, despite the incredible carnage of two world wars, the children of his planet would be living again in abject fear of a third savage conflict and that peace, which had meant to him such a reasonable state of affairs, could at the midcentury be such a damnation, compounded of such hatred and violence, intolerance and hysteria, full of so much degradation of the human spirit."

Farrar, Straus and Young $3.50

Near Eastern Culture and Society, edited by T. Cuyler Young, pp. 250.

A symposium on Near Eastern society by scholars of the U.S., England, Lebanon, Syria, and Turkey, each author dealing with a particular subject relating to art, literature, science, philosophy, religion, politics, international relations, or social problems. A storehouse of information about the Arabic-Islamic world for the reader wanting a general introduction to the modern Near East.

Princeton University Press $4.00

General Billy Mitchell: Champion of Air Defense, by Roger Burlingame, pp. 212.

A fair biography, for popular reading.

McGraw-Hill $3.00

France under the Fourth Republic, by François Goguel, pp. 198.

The recent political evolution of France as seen by one of her foremost political scientists. "This study, undertaken initially as an analysis of the political situation in France after the elections of June 17, 1951, quite naturally turned into an account and an appraisal of the first five years of the Fourth Republic."

Cornell University Press, $3

Escape or Die, by Paul Brickhill, pp. 248.

Eight true stories of RAF escapes from the enemy, embracing some remarkable examples of ingenuity, resourcefulness, and improvisation. Well told by the author of *The Great Escape.*

Norton $2.95

Technical Reporting, by Joseph N. Ulman, Jr., pp. 289.

Addressed to "students and practitioners of engineering and the sciences who have reached the point at which they have reporting jobs to do and have something to say." Covers physical and logical organization of a report, visual aids, style, emphasis, grammar, punctuation, typing, and helpful hints on going about the preparation and presentation of both written and oral reports.

Holt $3.50

The United Nations: Background, Organization, Functions, Activities, by Amry Vandenbosch and Willard N. Hogan, pp. 456.

Intended to explain the structure of the United Nations and the scope and methods of its activities, this textbook is also useful to the reader who wants reasonably comprehensive knowledge of its subject.

McGraw-Hill $5.00

Turkish Crossroads, by Bernard Newman, pp. 258.

Impressions of a journey through Turkey, a country little written about in English publications, in view of its strategic significance. Mr. Newman, who might be described as a professional traveler, has aimed at understanding the people and culture of Turkey, rather than at formal analysis in the vein of political science, and at writing for good reading rather than for study.

Philosophical Library $4.75

Russia: Absent and Present, by Wladimir Weidle, pp. 153.

A Russian emigré searches old and new Russian culture and society for clues to the nature of the Russian "soul." He points out the unique characteristics which have made Russia an enigma to Westerners—quirks stemming from such influences as the smallness of the group of élite, the conflict of Orient and Occident, the habit of autocracy.

John Day $3.00

Development of the Guided Missile, by Kenneth W. Gatland, pp. 133.

Another summary of the history and current status of all types of rockets, including chapters on space satellites and interplanetary flight. Succinct and well written, the book also has a very useful 15-page appendix which tabulates the latest available data on all known varieties of rockets.

Philosophical Library $3.75

Political science for study or reference

Russia, A History, by Sidney Harcave, pp. 699, Lippincott, $7.50.—Russian history for students relatively unfamiliar with the subject. Good bibliography of works in English.

The East European Revolution by Hugh Seton-Watson, pp. 406, Praeger, $5.50.—Analysis of the structure of the society, history, political parties, and effect of the war in the Balkans since the beginning of the Second World War.

West Africa, by F. J. Pedler, pp. 208, Praeger, $2.25.—A useful handbook introduction to the West Africans, their role in history, their production, trade, and politics.

Germany in Power and Eclipse: The Background of German Development, by James K. Pollock and Homer Thomas, pp. 661, Van Nostrand, $10.—A geopolitical analysis of the German land and people, this book deals with the evolution of the German state and society and then treats Germany region by region.

The Far East: A History of the Impact of the West on Eastern Asia, by Paul Hibbert Clyde, second edition, pp. 952, Prentice-Hall, $6.75.—A textbook on Asia's contemporary revolution, principally concerned with the growing contacts between the Far East and the West in the nineteenth and twentieth centuries. Detailed and useful history of recent times.

Europe in the Nineteenth and Twentieth Centuries (1789–1950), by A. J. Grant and Harold Temperly, sixth edition, pp. 603, Longmans, Green, $4.75.—A standard text suitable for the serious reader.

A History of Latvia, by Alfred Bilmanis, pp. 441, Princeton University Press, $6.—Extends from Baltic prehistory to the absorption of Latvia by the U.S.S.R. in 1945. The author was professor of history at Riga College of Commerce and subsequently Latvian Minister to Moscow and Washington.

Military history—recent titles of interest to the professional

Legend into History. The Custer Mystery, by Charles Kuhlman, pp. 250, Stackpole, $5.—An exhaustive examination of the how and the why of the last stand at the Little Big Horn.

Force Mulberry, by Alfred Standford, Commander, USNR, pp. 240, Morrow, $3.50.—An account of a basic operation upon which the Normandy invasion of 1944 depended for success, the planning and installation of the piers and breakwaters of the artificial harbor at the assault beaches.

Operation Overlord, The Allied Invasion of Western Europe, by Albert Nolan, pp. 230, Military Service Publishing Company, $3.75.—A former Army historian studies the background of Overlord in national strategy-diplomacy, the solution of the strategic, logistic, and tactical problems in the planning, and finally the operation itself.

Memoirs of Ernst von Weizäcker, translated by John Andrews, pp. 322, Regnery, $3.75.—Weizäcker was head of the German Foreign Office during the heydey of the Nazi regime. He has first-hand knowledge of much that lay behind German military decisions.

Hitler's Interpreter, by Dr. Paul Schmidt, edited by R. H. C. Steed, pp. 286, MacMillan, $4.—Paul Schmidt had a unique seat to view history in the making of secret German diplomacy from 1935 to 1945.

Main Fleet to Singapore, by Captain Russell Grenfell, R.N., pp. 238, Macmillan, $3.75.—The story of the disastrous loss of the great base.

Personal Memoirs of U.S. Grant, pp. 608, World, $6.—A new edition of the unpretentious, frank, and simply eloquent account of his operations by a great military leader. Completed by Grant a week before his death and first published in 1885.

The Military Genius of Abraham Lincoln, by Brigadier-General Colin R. Ballard, pp. 246, World, $5.—The first American edition of a military classic about the Civil War.

Ploughshares into Swords: Josiah Gorgas and Confederate Ordnance, by Frank H. Vandiver, pp. 349, U. of Texas Press, $5.—A biography of the Chief of Confederate Ordnance who despite the South's agrarian economy kept an army in arms and munitions that lacked in every other class of supply. Pedestrian prose but interesting because of its subject.

History of Marine Corps Aviation in World War II, by Robert Sherrod, pp. 496, Combat Forces Press, $6.50.—Appraisal by a member of the staff of *Time* magazine. Based on "all Marine documents, and many documents from the files of other services, our Allies, and the Japanese. . . ." Easy to read.

Winston Churchill, 1874–1951, by Lewis Broad, pp. 611, Philosophical Library, $6.—First American printing of this English biography originally written in 1941 and revised in 1945 and 1951. Detailed but readable.

Douglas MacArthur, by Clark Lee and Richard Henschel, pp. 370, Holt, $6.—Numerous photographs and fast-moving text.

British War Production, by M. M. Postan, pp. 512, Her Majesty's Stationery Office, London, 32s. 6d.—A study of the growth of the munitions industry from 1935 to 1945. Prepared with access to official documents.

Recalled to Service, The Memoirs of General Maxime Weygand, translated by E. W. Dickes, pp. 454, Doubleday, $6.75.—The story of the defeat of the French Army and the fall of France by its supreme commander in the dark, final hours, together with General Weygand's subsequent efforts on behalf of his country, to his arrest by the Gestapo.

Technical publication of value

The Principles of the Control and Stability of Aircraft, by W. J. Duncan, pp. 384, Cambridge University Press, $8.

D. C. Power Systems for Aircraft, by R. H. Kaufmann and H. J. Finison, pp. 206, Wiley, $5.00.

Statistics for Economics and Business, by Donald W. Paden and E. F. Lindquist, pp. 276, McGraw-Hill, $4.00.

Helicopter Analysis, by Alexander A. Nikolsky, pp. 340, Wiley, $7.50.

Aerodynamics of the Helicopter, by Alfred Gessow and Garry C. Myers, Jr., pp. 343, MacMillan, $6.00.

Elements of Aerodynamics of Supersonic Flows, by Antonio Ferri, pp. 434, MacMillan, $10.00.

Elasticity in Engineering, by Ernest E. Sechler, pp. 419, Wiley, $8.50.

Air Navigation Theory and Practice, by E. Brook Williams and W. J. V. Branch, pp. 644, Pitman, $12.50.

Physics and Medicine of the Upper Atmosphere, edited by Clayton S. White and Otis O. Benson, Jr., pp. 611, University of New Mexico Press, $10.00.

Flight Testing: Conventional and Jet-Propelled Airplanes, by Benson Hamlin, pp. 147, MacMillan, $5.50.

Reference

Naval Terms Dictionary, by John V. Noel, Jr., pp. 247, Van Nostrand,

$4.50.—Commonly used naval words and terms in the day-to-day language of the U.S. Navy and old sea-going terms still about. Commander Noel is executive officer in the Department of Seamanship and Navigation at the U.S. Naval Academy.

The Air Force Officer's Guide, by Lt. Gen. George H. Brett, and Albert Douglas, pp. 367, McGraw-Hill, $5.—The customary information on the minutiae of Air Force service—pay, customs of the service, leave, insurance, insignia, etc.—plus some useful information and hints about foreign service, combat duty, military justice, Air Force education, the structure and commands of the Air Force, the Reserves, Air Force bases, and a glossary of Air Force terms. The purely reference material has been gathered in the back of the book to make for greater readability of general topics.

Physical Geography, by Arthur N. Strahler, pp. 442, Wiley, $6.—The author's object is to present geography as a basic earth science rather than in combination with human and economic geography. The processes and forms that develop in the atmosphere and hydrosphere and on the earth's land surface are of prime interest to the military student of geography. Over 500 illustrations. Useful.

Suggestions for the personal library of arts and sciences

How to Understand Modern Art, by George A. Flanagan, pp. 334, Studio-Crowell, $5.50.—The best study yet on what it is all about for the man who is interested but who does not have any idea. It is also interesting reading, as it develops an understanding of the ideas behind modern pictures from Cézanne and Van Gogh through Cubism, Futurism, Surrealism, and many others in nontechnical language and with numerous illustrations.

The Iliad of Homer, translated with an introduction by Richard Lattimore, pp. 527, U. of Chicago Press, $4.50.—A translation intended to be as close to the sense and idiom of Homer as English will permit, it is a line-by-line rendering, with the Greek hexameters represented by lines of six-beat free verse. Unpoetic, but nevertheless good to read.

The Rise and Fall of Civilization, by Shepard B. Clough, pp. 291, McGraw-Hill, $4.50.—Labeled by the author as an inquiry into the relationship between economic development and civilization, this book examines the cultures of Sumer, Egypt, Babylon, the Aegean, Greece, Rome, and Western Europe.

Birth of a World: Bolivar in Terms of his Peoples, by Waldo Frank, pp. 432, Houghton Mifflin, $5.—A well-written biography of the great Latin-American hero.

The American Symphony Orchestra, by John H. Mueller, pp. 437, Indiana University Press, $6.—The personal history of the American orchestras and the music they played over the past century.

A History of Latin Literature, by Moses Hadas, pp. 474, Columbia University Press, $5.—Written for the "curious" literate, this companion volume to Professor Hadas' *History of Greek Literature*, does not presuppose that the reader knows Latin. Generous selections are quoted in English translation.

Revolution and Tradition in Modern American Art, by John I. H. Baur, pp. 170, Harvard University Press, $6.—An illustrated account for the nonspecialist of American painting and sculpture during the past 50 years.

Come an' Get It, The Story of the Old Cowboy Cook, by Ramon F. Adams, pp. 170. U. of Oklahoma Press, $3.75.—Homely in story and telling, finely printed and appealing, with the strong flavor of the old Southwest, this is a book any reader will treasure.

The Enduring Art of Japan, by Lang-

don Warner, pp. 177, Harvard University Press, $6.50.—With 92 black and white plates, an interesting introduction for the layman to the art and culture of Japan.

Elizabethan Poetry, A Study in Conventions, Meaning, and Expression, by Hallett Smith, pp. 355, Harvard University Press, $5.—A study of the conventions in which the great poetry of the age of Shakespeare was written. For the reader with more than casual interest.

Famous Chinese Short Stories, retold by Lin Yutang, pp. 299, John Day, $3.50.—Famous Chinese tales selected for their universal appeal.

The Song of Roland, translated by Frederick Bliss Luquiens, pp. 101, Macmillan, $2.75.—A distinguished rendition into unrhymed pentameter of one of the world's great epic poems.

The Sky and the Sailor: A History of Celestial Navigation, by H. A. Calahan, pp. 362, U. of Oklahoma Press, $4.—A fascinating book for anyone who would like to know something about navigation on the high seas or who merely would be entertained by a story of achievement.

The Molds and the Man, by Clyde M. Christensen, pp. 244, U. of Minnesota Press, $4.—Extremely readable introduction to the fungi.

Palomar, The World's Largest Telescope, by Helen Wright, pp. 188, Macmillan, $3.75.—The trials of building the 200-inch giant reflector. Recommended.

A History of Portugal, by Charles E. Nowell, pp. 259, Van Nostrand, $4.50.—A little-known story to the American reader, the great days of the Portuguese and their ebb are chronicled for the first time in English in recent years.

Bees, Their Vision, Chemical Senses, and Language, by Karl Von Frisch, pp. 119, Cornell University Press, $3.—Lucidly reported research into the astounding language dance of the bees.

Wind, Storm, and Rain, The Story of Weather, by Denning Miller, pp. 174, Coward-McCann, $3.95.—A store of information pleasantly expounded.

How to do it—suggestions for off-duty hours

How to Paint for Pleasure, A Handbook for Beginners, by R. O. Dunlop, pp. 143, Pellegrini & Cudahy, $3.95.—A fairly good starter for those who wish to try a hand at water color, oil, or pastel painting.

You Can Paint with a Pencil, by Howard Freer, pp. 94, Corwell, $2.50.—Step-by-step directions and illustrations make this the best book for the novice with a pencil that we have seen. Top value for an interesting hobby.

Sculpture in Wood, by John Rood, pp. 179, U. of Minnesota Press, $5.—Also with step-by-step directions and numerous illustrations, this admirably written book shows the beginner what he can do with a block of wood and some good carpenter's chisels and gouges. Highly recommended.

Anyone Can Sculpt, by Arthur Zaidenberg, pp. 157, Harper, $3.95.—Intended for the amateur and well illustrated, this book presents the rudiments of making simple sculptured figures in various media. Good.

The Creation of Sculpture, by Jules Struppeck, pp. 260, Holt, $6.95.—Organized into a series of problems in sculpturing, from simple studies in clay, wood, and stone carving to casting metals. Also for the beginner, the serious beginner.

Better Frames for Your Pictures, by Frederic Taubes, pp. 144, Studio-Crowell, $3.75—Comprehensive and detailed concerning the making and treating of frames in numerous finishes—also style, proportions, framing, color schemes, and hanging. Excellent.

Writing for Television, by Gilbert Seldes, pp. 254, Doubleday, $3.—A survey of the techniques of the trade by an author eminently qualified. Excellent.

Plots That Sell to Top-Pay Magazines, by Charles Simmons, pp. 216, Funk, $2.95.—Indispensable to the writer who is unfamiliar with the incredible corsets forced on "slick" magazine fiction by the editors of big circulation magazines. The thirty basic plots are analyzed, cynically but helpfully, by one of the staff of the New York *Times* Book Review section.

There's Money in Pictures, by Leo Solomon, pp. 198, Funk and Wagnalls, $3.

Without Assignment, How to Freelance in Photography, by H. Byrne, pp. 198, Pellegrini & Cudahy, $3.95.

How to Make Money with Your Camera, by Harrison Forman, pp. 235, McGraw-Hill, $3.50.—Anyone who wants to try his luck at selling some of the products of his camera for publication will want all three of these books.

Making Profits in the Stock Market, by Jacob O. Kamm, pp. 157, World, $2.—A manual intended to help "the individual interested in buying and selling command stocks." It purports to explain "a profitable hobby" to those qualified to invest some of their capital in business enterprises. The numerous dangers that await the uniformed and unwary are competently exposed.

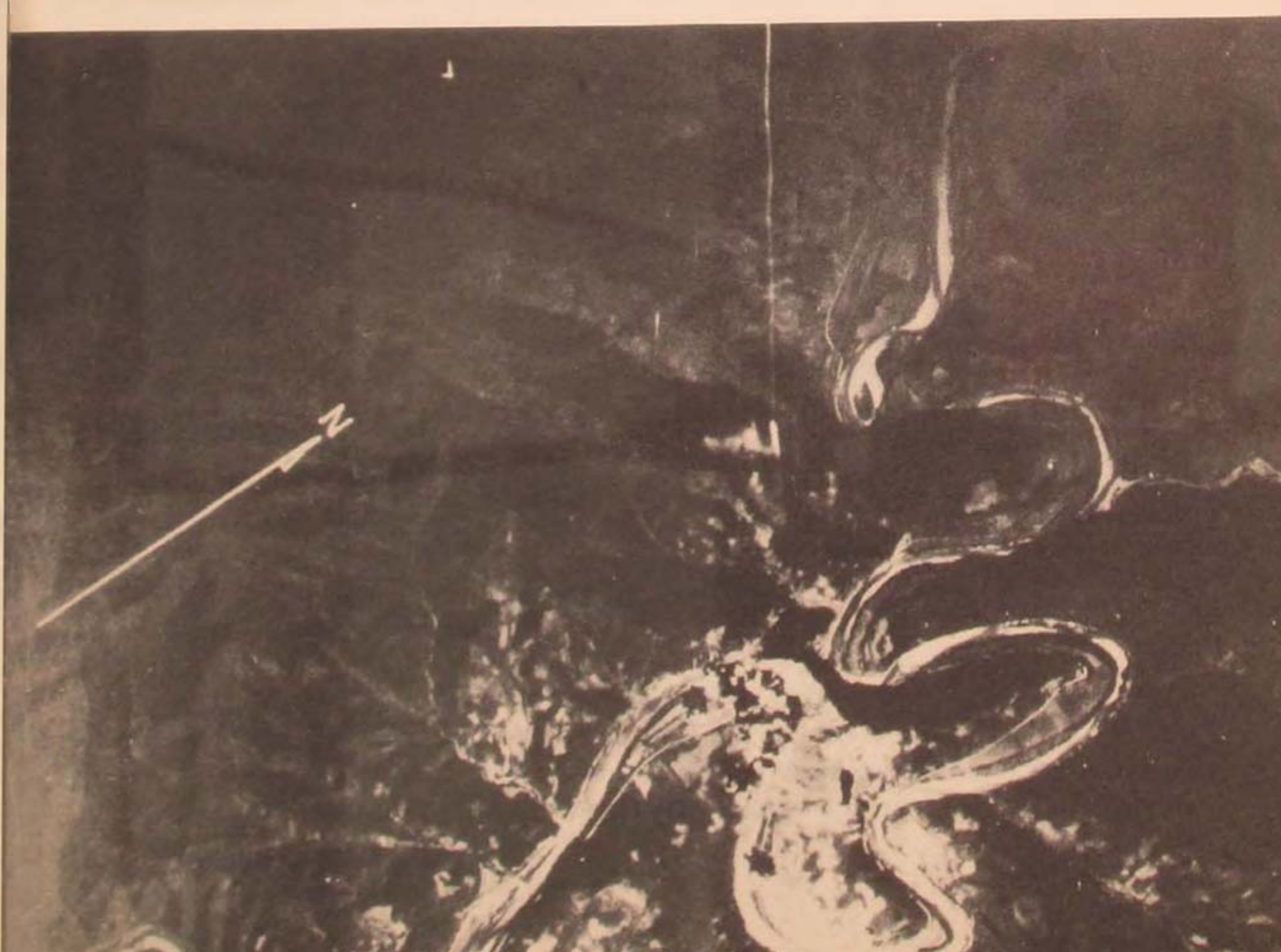
A Guide to Profitable Investment, by Harold B. Gruver, pp. 157, Dutton, $2.50.—Useful to the investor in stocks and bonds, particularly in its explanations of business cycles and the pitfalls of speculation.

Night Radar Bombing

After the first year of the Korean war, few North Korean targets remained of enough importance to merit the attentions of masses of B–29 bombers. For a time the daylight raids were continued, with one to three B–29's being assigned to bomb a target. This dispersion made each aircraft much more vulnerable, for the B–29 was intended to fly in large formations, protected from enemy fighter planes by the curtain of fire from the whole formation. Finally B–29's were largely withdrawn from day operations, and began bombing small targets under cover of darkness. That this shift has not diminished the effectiveness of the medium bombers is shown in these photographs. Radar bombing equipment and techniques have improved so much since World War II that it is routine for B–29's flying at night at 25,000 feet to do precision bombing of difficult targets such as these two railroad bridges and small marshalling yard. This is more evidence the flexibility with which air weapons can be adapted to changes in air war.

All photographs shown here are of raids made against the important rail line which runs from Manchuria through Kanggye south along the Chongchon River to Sinanju. This night strike photograph was taken on 8 July 1952, when B–29's split in two the small marshalling yard at Kunu-ri. The bomb load is angled across the marshalling yard. Numerous other bomb craters in the vicinity evidence the frequency of U.N. attacks on this target. The road which crosses the marshalling yard and the river is also straddled with bombs just half a mile short of the white patches marking the headlights of a truck convoy which has just crossed the highway bridge over the river.

These photographs show two railroad bridges being destroyed by B–29 night radar bombing from 25,000 feet. The bridge above is at Sanwang; the one below is at Huichon. Flares are dropped with bombs. When they light up, they trip a photo-electric cell attached to the automatic camera in the aircraft and the strike photo is taken.



The Periodical Press

"The Crisis in Raw Materials," Fortune, August 1952, p. 114.

Industrial planners have become increasingly aware that the United States is faced with mounting deficiencies and rising costs in the materials necessary to sustain its growth and way of life. This is the chief reason for the Presidential appointment of the Materials Policy Commission, whose findings and recommendations point to the need for a new era in planning, conservation, and research.

Soaring demands, shrinking resources, the consequent tendency toward rising costs, and the risk of material shortages in the event of another major war all underscore the strong possibility of a leveling-off or decline in the standard of living. From a time when resources and materials were practically limitless, and the problem was one of struggling to create means and methods of getting materials into use, America has moved into an era of gargantuan consumption marked by industrial and technological leadership, and finds itself facing a rapidly dwindling material storehouse. The Commission believes current material deficits are due to four underlying causes: (1) there is an ever-widening gap between American requirements and the means of satisfying them; (2) Western Europe has seriously depleted its own domestic resources through war and weakened itself further by severing colonial ties on which its economy has always depended; (3) resource-rich but less developed nations and former colonial areas are for the most part intent on their own industrialization and as a result are de-emphasizing materials export as a primary support to their economies; and (4) investment capital is reluctant to expend itself in backward areas for fear of future depression, political instability, and totalitarian threat.

In 1950, the United States with but 9.5 per cent of the earth's population and 8 per cent of the world's land area consumed nearly two-thirds of the earth's petroleum production, more than half the rubber and manganese, well over half the iron, and nearly half the world's production of zinc, copper, and lead. The Commission points out that if all the nations of the world should approximate the same standard of living that Americans have enjoyed, the world need for materials will increase to six times the present consumption.

This vast drain, greater today than yesterday and necessarily greater tomorrow than today, presents one of the greatest of challenges to man's management acumen. Reforestation, drainage, erosion control, and reclamation have offset only a part of the rate of depletion. The Commission feels that the failure to utilize marginal land to the fullest has contributed to the problem. Americans have skimmed the cream of their resources and have completed the slow transition from a raw-materials surplus nation to a raw-materials deficit nation.

Even with a population peak of 193 millions estimated by 1975 (of which a working force of 82 million is forecast), the Commission feels that the rate of growth of the economy after 1975 will remain fairly constant. Demands for everything can be expected to rise substantially, and Americans face the threat that they shall have to devote constantly increasing efforts to acquiring each pound of materials from the natural resources at hand. As the Commission points out, the real costs of materials are not measured primarily in money. They lie in the hours of human work and the amounts of capital required to bring a pound of industrial material or a unit of energy into useful form. Costs can be offset by (1) using domestic materials to a greater degree and by pushing back the technological, physical, and economic boundaries that limit current supply; (2) by shifting from use of scarcer materials towards more abundant ones, and (3) by intensification of foreign trade. Supply of minerals can be increased by improved geophysical and geochemical prospecting methods, fuller use of known resources, and by using lower-quality resources. Forest and soil exploitation—the "renewable" resources—should be used on a "sustained yield" basis, or only as fast as they are produced. It is believed that greater use can be made of presently unemployable resources (of the ninety-odd chemical elements, only a third are used to any extent by industry), and by synthesizing new materials.

The Commission rejects the idea that the American standard of living must be protected from low-cost foreign material supplies produced by "cheap labor." It believes that a modification of present trade restrictions will permit the United States to make a product of greater value than that represented by the composite value of the materials obtained abroad, and at the same time such purchases will inject a degree of economic revitalization into the economies of nations from which such materials are imported. The underlying goal of any future program should be to gain the greatest possible security at the lowest possible cost.

The United States is becoming increasingly vulnerable to material shortages. Roughly one-third of the 100 strategic materials in use (such as sulphur, coal, phosphates, molybdenum, and magnesium) are obtainable in the domestic market. Another third not available domestically (columbium, cobalt, high-grade quartz crystals, etc.) are increasingly in demand for use in high-temperature alloys and in the production of electronics equipment. A final third comprising minerals such as iron ore, petroleum, copper, and lead are partly dependent on foreign sources of supply. Because of the great consumption and critical shortage of these items, the military as one of the chief using agencies carries a heavy responsibility to hold its drain on materials to the lowest levels consistent with adequate military strength. A sound concept of conservation, in the Commission's view, is one which equates production with efficient use of resources, manpower, and materials, and which is more in keeping with America's tradition of doing things than abstinence and retrenchment.

Eugene M. Kulischer, "Russian Manpower," Foreign Affairs, October 1952, pp. 67–78.

THE Soviet Union is facing manpower problems, both as to quantity and quality, which over a course of years may modify her economic, political, and military potential. Recent figures on birth and death rates in Russia released by L. P. Beria, Deputy President of the Council of Ministers of the Politburo, suggest a population trend seriously differing from manpower figures previously supplied by Soviet propaganda.

The extent of agricultural production has always been one of the chief factors determining fluctuation in the cycle of fecundity in Russia. In addition to socio-economic factors in peacetime growth patterns, periods of bloodletting have affected Russia as they have no other nation. At the end of World War II, Kulischer points out the Russian birth rate had dropped to an estimated 15 per 1000. This figure, compared with the death rate of 10 per 1000, one of the lowest in the world, it would indicate that Russia's population growth approximated that of the United States at that time.

In spite of all efforts by the Soviet government to counteract it, Russia's birth rate has dropped over the years from 45 births per 1000 in 1914 to less than 30 at the present time. If this continues, Kulischer feels it is bound to affect the political, social, and economic structure of the nation, halt the growing reservoir of manpower, and make for a more favorable ratio between population and developed resources. It would also affect Russia's ability to wage war by imposing a serious limitation on her manpower pool.

Kulischer believes that World War II seriously lowered the birth rate in Russia, not only because of the tremendous number of war deaths which overbalanced births during that period, but because the increased slave labor system denied family life to between 12 and 20 millions of political deviants.

The effects of forced segregation on this segment of the population will be offset by the high birth rate in the decade before World War II which will make 19 million Russian boys of prime military age by 1960–61. For this reason the author feels that the period of greatest danger to the West will be in the latter part of the decade 1950.

In spite of gloomy predictions that the East will swamp the West by sheer force of numbers, the author offers the West some grounds for optimism. A large part of Russian manpower is swallowed in food production, and present superiority in numbers enjoyed by Russia is more than offset by the effects of prolonged submarginal health and living standards and the widespread unfamiliarity with technical and mechanical aspects of national economy. Though German scientific influence has been felt in recent years, professional and managerial classes—broadly referred to by Soviet classification standards as "brainworkers"—are feeling the pinch in lack of stimulation with the outside world. A decline and deterioration in over-all quality in many fields of endeavor is in progress and Kulischer feels will become even more noticeable when communism consolidates its grip on the next generation of "brainworkers."

In spite of oft-repeated claims to the contrary, living conditions for the most favored single group, the intelligensia, are far below that of pre-revolutionary times, though of course individuals have continued to profit.

Chief indication of the extent of criticism of the Soviet system is the growing number of persons in slave labor camps, and the official obsession for keeping this number a secret. Russia has begrudgingly recognized that unit production per slave laborer is far less than that of the free worker, and has shown an increasing tendency to use incentives instead of directives to gain its ends. But the Politburo is still painfully aware that anti-communist feeling within Russia may inevitably crystallize and force much-needed reforms. Meanwhile, whether quantity alone can tip the scales in Russia's favor remains to be seen.

D. F. Fleming, "How Can We Secure Dependable Allies?" Annals of the American Academy of Political and Social Science, September 1952, pp. 10–21.

AMERICAN commitments to world peace are in large part dependent on allies of unquestionable loyalty. The price of loyalty is military protection and the maintenance of acceptable living standards in Allied nations by means of economic aid which bolsters internal economies and stiffens the will to resist. Chief stumbling block to smooth Allied relationships has been our failure to convince the free world of the gravity of the Communist threat. Fleming says many Allied nations feel that the Soviet danger is not as urgent as Americans seem to think. They feel that our insistence upon quick larger-scale rearmament means lowered living standards for their people, and that impatience and rashness on our part is fast precipitating World War III.

Fleming feels that while U.S. monetary participation dwarfed that of other United Nations participating in the Korean war, strategic and diplomatic council with other nations might have brought greater unity of purpose. Many sources of friction exist. The Yalu power plant bombings, support of Syngman Rhee, the seemingly short-sighted memory of Germany's past sins and paradoxical insistence on her rearmament, and the bilateral U.S.-Japanese Peace Treaty have created uncertainty and disunity in the ranks of the Allies. Likewise, economic pressure applied on small nations to prevent them from trading in strategic materials with Iron Curtain countries has, the author feels, sometimes failed to take into account the utter dependence of these countries on such trade.

Fleming claims no satisfactory or lasting economic solution has been devised which will bind our friends to us or allow them to retain their national pride. They are compelled by circumstances to ask for and accept aid, but because of America's paternalistic attitude they are seldom gracious in their thanks. The strain on Allied good will has been further intensified by the feeling among our Allies that American leadership has offered military solutions to problems which are essentially ideological and political in nature.

As partial solution to keeping dependable allies, Fleming believes that the arms race, with its ruinous impact on debt-ridden small nations, must be modified to permit these countries to get on their feet. He also believes that settlements with the non-Communist East should be negotiated dispassionately as problems arise. He believes the United States should abandon insistence that every nation choose sides. Rather we should encourage third forces, and thereby promote the possibility of schisms in the Communist world. It should also remove the economic strings from whatever aid is rendered to needy states and should concentrate on buying the goods foreigners produce and not simply their loyalty. Finally, the U.S. should resolutely strive to avoid extension of the war, realizing that world opinion will morally repudiate its instigator. The need is for not only the ability to lead, but the equally important ability to collaborate successfully with our allies.

R. H. S. Crossman, "Psychological Warfare," The Journal of the Royal United Service Institution, August 1952, pp. 319–332.

SUCCESSFUL application of the principles of psychological warfare by democratic nations usually follows three stages, according to the foremost British authority on the subject: (1) a defensive stage in which little is asserted except national will to survive; (2) an offensive stage when sufficiency of military power gives credence and respect to its words; and (3) an occupation stage when military considerations are abridged by the political necessities of consolidating the fruits of war.

The mission of psychological warfare is to demoralize, "exdoctrinate", and reindoctrinate any enemy according to the degree of deterioration in his ability to resist. As Crossman points out, not only is the enemy camp occupied by persons steadfastly resisting attempts to defeat his government, but also by luke-warm adherents or "friends" who are compelled to serve the enemy and who are ripe for "remoralization." One of the main functions of psychological warfare is to keep these people quiet until such time as their activities may be of practical use.

Crossman feels that operationally, psychological warfare cannot be separated from the military services it works through, and that it can never be successfully employed as long as it is regarded as a last-ditch measure, to be resorted to when military measures fail. Its success is dependent on its ability to function as an advanced guard of a clearly defined policy, and only if it times its activities in relation to diplomatic and military operations.

Propaganda as the primary tool of psychological warfare could be categorized as "white" or "black" depending on its employment. "White" propaganda, according to the author, hides behind no disguise; it is openly the voice of the enemy. "Black" radio broadcasts or news reports are so disguised by half truths that no one can say that they originate with a particular belligerent. Based on broad experience and first-hand understanding of the limitations of each, the author doubts if "black" propaganda is as effective in putting over desired points as straightforward enemy-to-enemy propaganda. Psychological warfare means imposing one's will on the enemy. While "black" propaganda may demoralize the enemy to some extent, it does not make him surrender more easily, and thereby fails to accomplish what Crossman feels is one of the main jobs of propaganda.

In World War II, propaganda was employed on both strategic and tactical levels. Whole populations were subjected to barrages of radio and leaflet propaganda calculated to have strategic effects on undermining their corporate ability to resist. Tactical radio and leaflet campaigns were aimed at particular groups such as the police, government officials, or encircled military units, and have less broad but no less serious implications for the enemy. Leaflets, it has been found, are most effective if they appear as a simple, straightforward offer or statement by one honorable soldier to another.

For this reason, successful propaganda tells the truth or that portion of the truth useful to its purpose, and tells it in such a way that the recipient is unconscious he is receiving propaganda. Crossman concludes that if the art of propaganda is to conceal that propaganda is being disseminated, its hard core must be correct information. If propaganda is built on credibility and authenticity over a considerable period, it ultimately wins the enemy's trust, and makes him susceptible to your ideas.

The purpose of propaganda is not to enter into and debate moral issues with the enemy; rather it should be intended to stimulate self-awareness in his people, to encourage them to assume the roles of individuals, and to remove them from the position of being mere cogs in a machine. In a totalitarian government, individualism is the first act of disloyalty and whoever achieves this state of mind is automatically committing one of the gravest offenses. This is why the author believes it is easier to demoralize a totalitarian country than a democracy where individuals already possess this right and cannot be collectively approached by appeals to individualism.

According to the author, the high degree of success of British propaganda throughout World War II was built on lessons learned during the disastrous 1940–41 reverses and was in large part determined by Britain's objective study of the purposes and outcomes of thought warfare, which were normally repugnant to the average Englishman. The Germans, who loved propaganda, lived so closely with it and so thoroughly systematized its employment that it seldom was convincing. Frankness and the ability to admit local defeat was also an asset to the British. In one instance, British reports of RAF losses over Berlin scored a great psychological triumph for them on the Continent when these reported losses exceeded those previously announced by the Germans. It was also found that any failure on the part of the enemy to achieve an objective after he had scheduled a time limit, minimized his results and made his people believe that he had done very badly, even if in fact his actions had amounted to an unquestionable victory. The dissemination of truths which appeared incredible to the enemy was also effective when his inability to accept them boomeranged as the truth became apparent.

Crossman concludes by suggesting that during periods of peace and defensive military actions, any psychological warfare agency should work on building up credibility, studying the enemy, and getting an organization set up so that if the day comes for more positive action, it can be carried out with maximum effectiveness.

Dita Guri, "The Tito-Stalin Struggle," World Affairs Interpreter, July 1952, pp. 159–165.

During the latter part of World War II, Tito was wooed by the Allies, and as a result of aid promised by Russia and the proximity of her powerful army, he embarked on his postwar career full of sympathy for the Soviet system. During the brief honeymoon with Moscow, before 1948, he nearly succeeded in unifying the economies of Albania and Yugoslavia and lent considerable backing to procommunist guerrillas fighting the pro-Allied monarchist regime in Greece. At the time, this policy presented grave implications to the Allies whose defense of the Middle East was based on the assumption that the northern shores of the Mediterranean should always be retained in friendly hands.

After intimate experience with Soviet methods and aims, this author believes that the Yugoslavs grew to resent having their country exploited in the name of Communist solidarity and discovered for the first time that the "socialist fatherland" did not differ fundamentally from countries previously denounced as "bourgeois," "capitalist," or "imperialist."

Following denunciation of Titoist policies by the Cominform in June 1948, Russia brought a series of pressures to bear on Yugoslavia. Attempts were made through skillful use of propaganda to alienate the Yugoslav people from their leaders, and the Balkan protege of Marxist-Leninism was accused by the Politburo of serious deviation from the party line. Economic pressure on satellite nations culminated in attempts to blockade Yugoslavia. Bulgaria, Hungary, and Romania—Tito's neighbors—were rearmed at a furious pace and the question of territorial claims by them against Yugoslavia revived as a coercive measure. Tito's refusal to recant in the face of these pressures has come to symbolize the revolt of undying Balkan nationalism against Moscow's attempts to use communist movements everywhere for the purpose of advancing Russian interests. Tito feels he has always remained loyal to the ideas of Marx and Lenin, and Stalin, not he, has adulterated and corrupted its purer concepts in the name of Russian imperialism. Though Tito was afraid at one time that his "friendship" with the West might be construed in his own country as a rejection of communism, continued threats of invasion by the Balkan satellites and an intensified anti-Tito propaganda campaign made him repudiate the traditional concept of Russia as the "Big Brother" of the slavic Balkan population, and made him willing to accept direct military aid from the West.

Tito's desertion of the Stalin camp has had geopolitical effects in bolstering NATO's southern defenses. Now, as Guri points out, Yugoslavia has completed a wall of opposition to Russian imperialism which extends from Turkey in the east through Greece to Italy in the west. Of even greater significance than the purely military consideration of defense is the inevitable corrosive effect Tito's stand has made on numerous Communist parties in Europe. This has been especially evident in Italy where, before 1948, the party was steadily advancing in membership, and in Czechoslovakia where the arrest of Foreign Minister Vladimir Clementis and other Communist leaders offered proof that Russia fears "another Yugoslavia."

Prospects for Russia in the Balkans are not bright. Guri feels she must either exterminate Tito by war, and risk open conflict with the West, or reverse her uncompromising stand and attempt to conciliate Tito. It is more likely that Stalin will continue seeking some means of overthrowing his deadliest enemy.

BRIEFER COMMENT

Alexander P. De Seversky, "How to Answer Neutralism," The Freeman, 6 October, 1952, pp. 17–19. Europe is growing increasingly "neutral" as the only alternative to possible destruction by Soviet Russia and because traditional "collective security" has not been supported by sufficient emphasis on strategic air power—the only force, the author believes which Europeans feel capable of dealing with Russia and the only real cement in binding Western defense.

Demitri B. Shimkin, "Economic Regionalization in the Soviet Union," Geographical Review, October 1952, pp. 591–614. Despite historical and politico-economic differences between the United States and Russia, trends in economic regionalization have been surprisingly similar. This study of Russian strategic industry is concerned with the impact of that country's industrialization during the period 1926–50 on Soviet regional development. It also assesses future trends in Russia's economic geography and compares the patterns, processes, and rates of development of the U.S.S.R. with those of the United States during a period of comparable growth (1900–50).

Dr. A. E. Sokol, "Sea Power in the Next War," Military Review, October 1952, pp. 11–26. Effective employment of sea power in future wars against predominantly land powers with poor transportation systems is believed by this author to be one of the deciding factors in securing and supplying the bases from which decisive military attack must inevitably be launched.

Col. Rene R. Studler, "The Aircraft Gun Problem," Ordnance, September–October 1952. In spite of recent demands for increased emphasis on the use of larger caliber explosive projectiles, aircraft armament effectiveness is still dependent on volume of fire to ensure larger shot dispersion and to compensate for error in human judgment when using mechanical sighting devices. Effective armament is based on the variables of speed of aircraft, plane and angle of attack, and average operational distance between gun and target.

Edward Hunter, "Defeat by Default," American Mercury, September 1952, pp. 40–51. Western military and diplomatic loss of face in Asia has resulted from a misguided sense of sportsmanship, decorum, and protocol on the part of American diplomacy and has resulted in continuous discouragement and frustration of anti-communist Asians who are capable of dealing serious blows to communism.

R. W. Falconer, "The Application of Jet Propulsion to Helicopters," Aeronautical Engineering Review, September 1952, pp. 46–51. Jet propulsion, particularly pressure jet systems when applied to rotary-wind aircraft, can provide a source of great rotor power during hovering, climb, and low-speed forward flight, and promises new performance records where payload, range, and cost are the outstanding requisites.

Issac Deutscher, "Soviet Production: Steel Before Shoes," The Reporter, 28 October 1952, pp. 20–23. In spite of industrial strides marked by increased production of steel, food, and other basic commodities, the U.S.S.R. is woefully behind in consumer goods necessary to maintain marginal living conditions. Her historical quest for industrial supremacy may burn itself out if competitive U.S. production trends continue their upward surge.

Theodore Draper, "The Coming Battle for Morocco," The Reporter, 28 October 1952, pp. 23–27. Morocco is intended as the last stand of a French colonialism faced with the recently successful nationalist coup in Egypt and growing political unrest in Tunisia. By continuous backing of the French adminstration and maintenance of the old-time status quo, the United States is compromising the friendship of native Moroccans, and leaving herself open to a friendless future in this section of the Islamic world.

"A Note on the Swedish-Russian Dispute," The World Today, September 1952, pp. 388–392. Constant Russian attempts to intimidate Sweden and the intransigent attitude of the Soviet Union elsewhere has increased uneasiness in Scandinavia. Russian attacks on Swedish aircraft have awakened the people's intelligent interest in the country's defense and in the conduct of a more dynamic foreign policy.

"How to Block Russia," U. S. News & World Report, 7 November 1952, pp. 54–57. A noted British military expert, Maj. Gen. J. F. C. Fuller, believes that the most effective answer to communism is ideas and not armies. If the West adopts the new strategy of undermining Communist propaganda by its own counter policy of ideological subversion, it will find its most promising weapon.
M. N. Roy, "Asian Nationalism," Yale Review, Autumn 1952, pp. 96–102. Modern Asiatic nationalism differs widely in theory and practice from traditional Western concepts of the term. It lacks the basis of a truly democratic liberalism and militantly reacts to real progress.

George W. Long, "Indochina Faces the Dragon," National Geographic, September 1952. The gradual disappearance of colonial Indochina and the emergence of the French-sponsored Associated States of Viet Nam has been made possible by American economic and military aid and is a concrete answer to communism in southeastern Asia.

Donald W. Mitchell, "Mobilization Progress," Current History, September 1952, pp. 139–143. Government supervision of the production and allocation of such vital resources as steel, copper, and aluminum offers a workable solution toward reconciling domestic civilian and military demands.

"Soviet Black Sea Airbases," Aviation Age, September 1952, pp. 25–27. Recent political unrest in Iran has focused attention of both Russia and the Western powers on the highly precarious position of a region of great strategic importance, and has spotlighted Russia's growing string of trans-Caucasian air defenses protecting its highly vulnerable "under belly."

Brig. Gen. Carlo Unia, "NATO's Air Force and Italy," Interavia, VIII (1952), 428–429. Italy's military air power, reborn under the most unfavorable postwar conditions in 1947, is capable of making significant industrial and operational contributions to NATO. It has shown substantial progress in recruiting personnel, building bases, developing equipment, and maintaining liaison with other European civil and military air activities.

"Borneo Trek," Air Clues, October 1952, pp. 12–21. Recent British jungle-swamp survival training in Borneo has taught the important lessons that a person's attitude, resourcefulness, and effective use of compact survival kits to supplement jungle foraging can spell the difference between life and death.

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