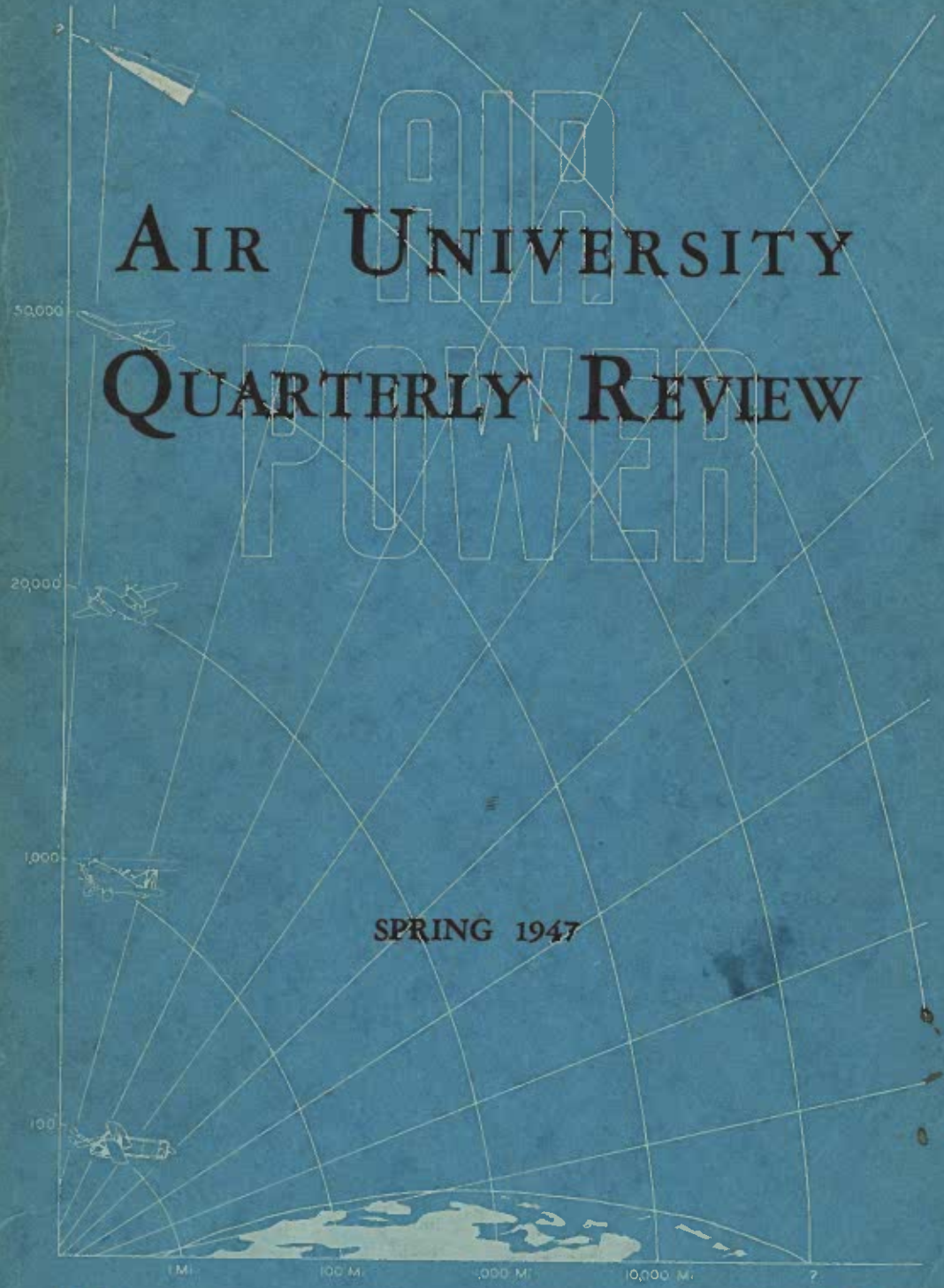
AIR UNIVERSITY QUARTERLY REVIEW



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The New Air Force and Science

Colonel Frederic E. Glantzberg

DESTRUCTION from the air is the most efficient method of defeating an enemy. It is possible to make this statement without the necessity of outlining the accomplishments of the strategic Air Forces in Europe, where they broke the back of German production, or in the Pacific, where they forced the capitulation of Japan without the necessity of ground invasion.

We have had it drilled into us that future air warfare will be a push-button affair. Most of us probably imagine that at some indefinite time in the future, aerial warfare will be fought from a master control center hundreds of feet under the ground, protected by many layers of concrete and steel. In such a control center, we might imagine a super radar-scope on which we study the world tactical situation and then, by push-buttons, send guided missiles off to remote corners of the world to implement our world-wide strategic plan.

As fantastic as such a war appears, there nevertheless seems to be general agreement that there probably will be a push-button war at some time in the future. However, when it comes to predicting the year in which we will be equipped to fight such a war, there is wide divergence of opinion. There is not even general agreement on the specific items of equipment that will be used, let alone their details of design. If we cannot agree as to what kind of equipment we will have in the future, how can we be so sure as to what kind of war we will have?

Are we not really trying to say that we are certain only that future wars will be fundamentally different from anything we have known in the past? Why do we think this? Has some new factor appeared which completely alters the

picture of aerial warfare? When we entered the last war, we entered it with conventional weapons. Now, however, we talk in terms of unconventional weapons, for which the principles of operation have yet to be devised. We speak confidently of future 1,500-mile radar ranges. Yet, to date, radar is limited to line-of-sight projection. We speak of offensive missiles with ranges of 5,000 to 10,000 miles as if they were a reality, when in fact there are many complex problems of propulsion, control, and guidance that are far from being solved.

We speak confidently of setting up elaborate nation-wide air-defense systems for the purpose of intercepting long-range, high-altitude guided missiles of the V-2 type, but we have yet to devise an effective means of intercepting such missiles. We even talk glibly of satellite observation platforms, although, except for brief periods, we have not yet overcome the earth's gravitational pull at the higher altitudes.

A few years ago such thinking would have been passed off as crack-pot or visionary, and certainly would never have been considered seriously. What has happened? The answer is that a new element has been added to air warfare which has revolutionized our thinking. This new element is the *decisive contribution of organized science to effective modern warfare*. Never before have so many scientific workers been united in the application of science to military purposes.

DURING THE war both sides developed weapons with astonishing effects, weapons which before the war would have been considered impossible. These appeared in such profusion that we became conditioned to accepting the most fantastic ideas. Outstanding examples of the many results of wartime scientific research were radar and the atomic bomb on our side. On the German side, a wide variety of jet-propelled missiles appeared.

These new developments were the direct results of scientific or applied research. For this reason there is a

tendency, until they appear in final form ready for operational use, to leave such projects entirely to the scientists. New developments, however, place serious added responsibilities upon military planners. These are the writing of suitable military characteristics, the development of new tactics, and the establishment of adequate training programs.

Sound military characteristics must be written to guide development toward end products that will be of maximum military utility. New tactics must be devised to employ these weapons to best advantage. In order for new weapons to be utilized as soon as they become available, adequate training programs must be established well in advance of the completion of these weapons. For example, we received blind-bombing equipment in the 15th Air Force without either trained operators or maintenance personnel. Precious time was wasted training these people in the field. Then, when we did have them trained, a new model came out and we had to repeat the process. Planners can no longer wait for science to present them with new weapons. Rather, by acquiring a knowledge of the capabilities of science today, they must anticipate tomorrow's weapons.

NOW LET us consider the new aspects of aerial warfare which will confront us as new scientific developments are realized.

With the advent of jet propulsion, reference to supersonic aircraft has become rather common. Yet, since the speed of sound is about 764 miles per hour at sea level and about 664 miles per hour at 40,000 feet, it may be seen that we have not developed a supersonic aircraft. Within a year, however, we should have experimental service-type aircraft approaching the speed of sound, and special research aircraft beginning to go beyond the speed of sound. Some of the optimistic hopes are for speeds as high as 1,500 miles per hour.

In the conception and design of new weapons we must keep in mind that there is overwhelming advantage in the development of air weapons which travel at supersonic speeds so that they do not require "air superiority" before they

can be used. For example, the German V-2 was highly effective even though we had almost complete mastery of the air as far as conventional aircraft were concerned. Although considerable effort is being expended on counter-measures, no effective means have been developed to date for stopping V-2 type attacks other than by destruction of launching facilities. This is the kind of weapon we should strive to develop, a type with tremendous destructive power which does not require air superiority to be effective. Only by the possession of such weapons can we immediately accomplish the destruction of vital enemy objectives in the first round of a new and sudden war.

In addition to the V-2, the Germans also investigated the effectiveness of guided missiles as defense against bombers. Although they were well ahead of us in this field of development, we were fortunate that they were unsuccessful in completing them in time to get them into service before the end of the war. The necessity for weapons of this type, however, is now thoroughly appreciated in this country, and we have a variety of projects under way for developing all types of guided missiles.

AFTER a discussion of supersonic velocities and guided missiles, the mere mention of atomic bombs and other deadly agents should suggest the possibility of weapons for offensive warfare that stagger the imagination.

Four years of vicious air war made it evident that the development of electronic equipment is closely associated with the problem of control of Air Force operations. Within five years we should see the development of communication equipment linking all Air Force units on a world-wide basis; navigation equipment for piloted aircraft which will provide safe and accurate navigation on missions up to 6,000 miles under all conditions of weather and visibility; control equipment for accurate guidance of missiles at ranges up to 5,000 miles at transonic and supersonic velocities, automatic radar-bombing and fire-control equipment to permit precision bombing and firing under all operating conditions; high-powered fixed and mobile early-warning systems to alert

this country for any offensive thrust.

Science will also contribute to the perfection of airborne armies. In spite of their great complexity, airborne operations in the recent war were not very impressive. But the probable capabilities of future airborne operations cannot be compared with, or judged by, present standards. Many new developments are in sight which will increase the range, versatility, and effectiveness of future airborne operations. Furthermore, with the development of an all-weather Air Force, we can expect that the present limitations imposed on airborne operations by weather and darkness will gradually be minimized.

ALL THESE developments may have a profound effect on future aerial warfare. Some of them have already progressed well beyond the standard equipment of World War II. However, the path of research and development is long, arduous, uncertain, and often bitterly disappointing. For this reason it is especially undesirable at this time to adopt definite assumptions regarding the exact nature of future aerial warfare. It is rapidly becoming apparent, however, that for future planning certain new possibilities of aerial warfare must be considered as being within our grasp. These are: (1) that aircraft--manned and pilotless--will move with speeds far beyond the velocity of sound; (2) that, as the result of improvements in aerodynamics, propulsion, and electronic control, unmanned devices will transport means of destruction to targets at distances up to several thousand miles; (3) that defense against present-day aircraft will be perfected by target-seeking missiles; (4) that only aircraft or missiles moving at extreme speeds will be able to penetrate enemy territory protected by such defenses; (5) that small amounts of materials will cause death or destruction, or both, over areas of several square miles; (6) that perfected communications systems will permit direction and control of national air defense from a single master control center; (7) that location and observation of targets, of take-off, navigation and landing of aircraft, and of communications will be independent of visibility and weather; (8) that fully

equipped airborne task forces will be enabled to strike at far distant points, will be supplied by air, and will be recovered by air as soon as their mission is completed.

The nature and composition of the Air Force needed to perform the mission of Air Power in the future will depend upon the ability of the Air Force and science to get together. We must realize that the task ahead involves much more than merely inventing gadgets and trying to make them work. Rather, there must be a systematic analysis of the various tasks which conventional airplanes equipped with bombs, guns, and rockets have performed in the past, tasks which now may be performed by pilotless aircraft. In other words, two developments must occur for successful solution of the problems: the *tactical viewpoint* must lead to the choice of types of weapons, and *physical science* must make possible more and more extended ranges and improved accuracy.

THE MOST familiar method in which science assists the Air Force is by contributing to the development of new and improved weapons, i.e., specific items of military equipment. Such weapons have long and complicated ancestries. Many persons take part in their development, which springs from many apparently unconnected scientific discoveries in the past. To ask who fathered any single invention has as much meaning and no more as to ask who your ancestors were. Each generation multiplies the number. Although inventive ingenuity is still of great importance, the individual inventor today plays an insignificant part in most developments. The mobilization of a large number of people, with a variety of skills directing their efforts toward a common task, accounted for the striking advances of the last war. Such groups as the Germans had at Peenemunde developed the V-2; our own Radiation Laboratory designed most of our important radar equipment.

Many steps are involved in the development of a specific weapon, although some of them may be omitted in special cases. The steps may be designated as follows: pure science, applied science, development, laboratory tests, service

tests, production, training, tactical evaluation, and service use. As the steps are interrelated, they cannot easily be separated. The well organized attack has the virtue of maintaining continuous contact between groups responsible for the various steps.

Strong interactions between pure and applied science occur as the latter develops better implements to probe the unknown. Furthermore, applied science uses all the methods of pure science to make advances in the major fields of knowledge.

THE UNITED STATES has taken the leadership in applied science but it has contributed less than its due proportion to pure science, largely because our national characteristics are such as to emphasize immediate and practical goals, and to be less interested in projects which promise material benefits only at some future date. Today's applied science rests on the pure science of the preceding generation. Just as replacing our forests or replenishing the fertility of the soil has less attraction to the American mind than the rapid exploitation of presently available resources, so the support of pure science is less popular than the application and exploitation of scientific knowledge.

The present military system of establishing requirements based on service needs is effective, provided the requirements are consistent with the state of development of pure science. To make significant progress, pure science must be supported in its efforts to advance fundamental knowledge. Many authorities have called attention to the fact that applied science has virtually caught up with knowledge of pure science. This is why the armed services are sponsoring basic research.

The recent war not only demonstrated the great power of science, particularly when specialists were organized into groups for developing new and effective weapons, but it also saw the birth of a much broader application of science to military problems. This resulted from a consideration of military problems and objectives in the most general manner,

expressed in terms of over-all tasks to be accomplished rather than in terms of the component steps calling for specific weapons. In this application, science was not restricted to physics and chemistry applied to produce gadgets, but the scientific method of procedure was applied to tactical and strategic problems. This work was pioneered by the operational analysis groups attached to the staff of most of the field commanders.

Scientific procedures involve such features as objective and quantitative analysis, objective observation of data, use of experimental method where possible, control and study of effects of variables one at a time where possible, and willingness to use all available techniques and sources of expert knowledge. These procedures can be applied to practically any type of problem with profitable results, and this fact was recognized by military leaders towards the end of the war.

In terms of such broad problems, the mission of the Air Force has been analyzed from the technical point of view by Dr. Theodor von Karman, Chairman of the Air Force Scientific Advisory Board, as follows: (1) to move swiftly and transport loads through the air; (2) to locate and recognize targets; (3) to hit targets accurately; (4) to cause destruction; (5) to function independently of weather and darkness; (6) to defeat enemy interference; (7) to perfect communications; (8) to defend home territory.

AIR POWER is directly proportional to the effectiveness with which these tasks can be accomplished by the equipment and personnel at hand or available in a short time. It is the broader role of science to inquire as to the most effective accomplishment of these tasks, to suggest lines of development of the most suitable types of equipment, to aid in such development, to devise testing methods, and to evaluate performance in terms of the over-all mission.

Every citizen and group of citizens, including those from science and industry, has an inescapable responsibility for national defense and the security of the nation. The Air

Force, however, is entrusted with final responsibility for insuring that the nation is prepared to wage victorious air warfare offensively and defensively, if attacked. We are thus led to consider the responsibility of the Air Force in promoting science, a responsibility which cannot be delegated to any other agency. Yet the Air Force would be unwise to rely solely upon its own resources in fulfilling its responsibility.

The Air Force must take the initiative in securing the cooperation of science and industry. All three groups must arrive at an understanding in order to fulfill separate responsibilities for national security. The problem of securing this cooperation during peace-time is difficult, and positive steps must be taken to insure such cooperation.

Although it is readily apparent that science must be made a member of the Air Force team, the challenge of the day is the job of building an effective partnership between the Air Force and the nation's scientific and technological potential to maintain for the United States the technical superiority in the air which will insure victory in any future war.

There are two outstanding reasons why the Air Force must view this job as one of its gravest and most urgent responsibilities. In the first place, the outlook for a possible war is not promising for America's side insofar as superiority in natural resources and manpower, the principal hope of victory, rests in superior quality of weapons. The second reason springs from the catastrophic destructiveness of atomic warfare. The best informed men say that national survival will be at stake during the initial phases of an atomic war.

MANY FACTORS have had an adverse effect on research and development in the Air Force. One of the most important was the apathy of the American people to their Air Force in the face of our nation's struggle for existence; others were the lack of funds for the Air Force, the natural lack of interest on the part of civilian scientists in military scientific

problems, the fight for Air Power, the tremendous expansion which the Air Force underwent on the heels of a battle for existence--all these factors and many others have a profound influence on research and development. Certain aspects of the military and civil service systems have also had their effect; for example, the over-abundance of security regulations and lack of incentive inherent in seniority promotion methods, the limited career opportunities for Regular Army personnel who tried to emphasize their technical education at the expense of tactical experience, the tendency to use technically trained Regular Army personnel as administrators rather than as technicians during the early portion of their careers when they should be still learning, and the limited career opportunities open to civilians and non-rated Reserve Officers.

The need for changing regulations which limit the responsibilities and career opportunities of non-rated technical officers was first stated by General Arnold in January 1945 and reiterated by General Spaatz in 1946. Thus the problem has been recognized and initial steps have been taken on the road toward a stronger union between science and the Air Force. However, much work remains to be done.

The welding of a solid and permanent bond between science and the Air Force requires action in many fields and on many levels. One of the salient problems is the education of the American people and the education of Congress by means of more effective public relations action, so that both the people and Congress appreciate the needs and understand the problems of the Air Force. This will insure that science in this country is not hampered by unrealistic security policies; and that cooperation with other branches of the service in scientific and related matters will be established.

LET US examine briefly what the Air Force is doing to foster cooperation with science and industry in order to utilize both most effectively in the interest of national security. As already indicated, the background of basic scientific

knowledge accumulated over a number of years prior to the war has been virtually exhausted by maximum exploitation during the war in the development of new weapons. While the war was being fought, little basic research was done because almost all of our scientists were engaged in developing projects essential for victory.

The result is that we now find ourselves practically bankrupt in fundamental scientific knowledge necessary to carry on applied research. This basic knowledge must be augmented and the frontiers of science pushed back if we are to make appreciable progress in the development of new weapons. For example, it is wasteful to make a contract for developing a radar set with a range of 1,500 miles until the basic research has been done to find a way of bending radar signals over the optical horizon. Similarly, there is not much point in constructing a guided missile with a 5,000-mile range when there is no known means of controlling it. We must first accomplish the basic research necessary to find means of control effective at such ranges.

Consequently, the Air Force, like the other services, is granting direct research contracts to industry and universities in an effort to further basic scientific knowledge. This year the Navy is spending $70 million on basic research; the Ground Forces, $100 million; and the Air Force, $127 million--considerably more than the other two. None of this includes the $375 million for the Manhattan Project. It is appropriate that the armed services should foster basic research, but they certainly should not have to bear the full cost. It must be remembered that basic research may have commercial as well as military value. Therefore it is hardly reasonable to charge the whole cost to the military establishment.

Much of this necessary research requires large and expensive facilities which neither industry nor universities are able to afford. Consequently, some means must be found to aid them even if at government expense.

MODERN scientific developments have shown the necessity for

much closer integration of the contributions of the specialist laboratories. Even in aircraft design it is now recognized that armament and electronic equipment cannot be regarded as accessories to be installed on almost any aircraft after completion. Just as the engine and airframe have always had to be designed together as a unit, so now the complete military weapon must be designed and developed as a whole. It is no longer possible to develop separately engine, airframe, electronic equipment, and armament, and to assemble them into a satisfactory weapon. The whole purpose of the weapon must be studied and the conflicts in design requirements of the components resolved in such a way as to accomplish the purpose most efficiently.

German experience indicates the effectiveness of development centers like the one at Peenemunde, which are needed to carry on such integrated development programs in three fields, i.e., supersonic and pilotless aircraft, nuclear aircraft, and aircraft operations. The first is self-explanatory; the second deals with the application of nuclear energy to aircraft propulsion (see Dr. Giannini's article, p. 43, this issue); the third provides for the study of traffic control at military air fields, fighter control, and radar and television applications to navigation and other operations.

Development centers of this type are likely to require test installations of large size and cost, consuming vast amounts of power. Such large facilities present many special problems. Because of their size, cost, and power requirements, more than one such facility cannot be supported by any nation. Many groups require the use of these facilities, including military and civilian governmental agencies, manufacturers holding government contracts, and other civilian groups. For this reason, the Air Force is proposing the Air Engineering Development Center.

THE TOOLS for the development and evaluation of new weapons and new tactics are laboratories, test stations, and proving grounds. The Air Force has extensive facilities of this type at Wright Field, Eglin Field, and Watson Laboratories, but

these are inadequate in the light of the more recent scientific developments.

The effectiveness of these facilities depends entirely upon the caliber of the men using them. It is a common mistake to judge the scientific competence of a laboratory by the number, variety, and appearance of special pieces of apparatus. The most impressive laboratories can conceivably turn out inferior scientific work and many major contributions to science have come from inadequately equipped and poorly supported laboratories. The point is that the effective use of scientific and technical facilities requires the best available personnel, and that good facilities are not a substitute for able scientists. We are thus led to consider the scientific and technical training of Air Force personnel.

Recruiting and training scientific personnel to staff the service laboratories, test stations, and proving grounds is but one aspect of the broad problem of the scientific and technical training of Air Force personnel. Well qualified scientists are needed not only in research and development activities but also as members of staffs and of operating units. Moreover, all personnel in positions of responsibility should be able to evaluate scientific facts with sound judgment and with some vision of future developments.

WE CANNOT expect that every member of the Air Force will be trained as a specialist in all fields of science and engineering, but specialists in all fields are needed. Each member must attain a broad knowledge of scientific and technical matters and some must be leaders in highly specialized fields. Without such leaders the Air Force is doomed to mediocrity in scientific and technical matters, with personnel who are jacks-of-all-trades and masters of none. Our program of scientific education must provide both types of training. The needs for nighly specific and specialized training of technical leaders are as great as those for similar specialized training of tactical leaders.

The problem of recruiting and training technical leaders is now under study by the Air Staff. The major source of

such personnel at present is the large number of people with scientific backgrounds who are already in the Air Force but whose scientific skills are not being utilized. Another source will undoubtedly be the ROTC groups of the graduating classes at various colleges.

The Air Force has an educational program to supplement these sources. The Air Force Institute of Technology at Wright Field is graduating 190 officer-engineers this year. This number will probably be increased to 250 next year. In addition, increasing numbers of officers are being sent to schools such as the Massachusetts Institute of Technology for graduate courses in aerodynamics, propulsion, electronics, and nuclear physics. In time this program should furnish the Air Force with an adequate number of technical personnel. Means must be found, however, to make the service attractive to these officers so that they will not be lured into civilian occupations after acquiring this education. This problem, too, is under study and undoubtedly changes will be made in personnel policies. These will make it possible for personnel to follow an engineering specialty without requiring an undue amount of time away from it because of requirements for foreign service or duty with troops.

The problem of creating conditions within the Air Force that are attractive to technical personnel is extremely complex and difficult, but it is one which we must solve if America is to remain a first-class power.

The War Department believes that the Air Force has proved it occupies a dominant position in war. We believe the Air Force represents the only immediate weapon available for retaliatory action if we are attacked.

– General Dwight D. Eisenhower,
in a speech to the National
Press Club (March 1947)

BASIC GEOPOLITICS

Major Max Van Rossum Daum

GEOPOLITICS is a dynamic subject because it deals with a living world. In geopolitics the globe is not regarded as an inanimate map projection. Instead, we visualize the geographic conditions, climate, agriculture, and resources hidden under the earth; we picture industries, economic life with its rail, river, and ocean commerce; we consider populations and races, their culture, their history, their political organizations, and their interrelationships. And now, in this air age, we add another feature: the air around this globe, which has become a new highway for commerce and in the recent war became a battlefield.

The value of geopolitics is that it will take us to a high observation point and thereby increase our thinking horizon. We will start to think in large-scale terms, such as "world ocean" and "world island group." For, in geopolitics, geography has no longer the limited and narrow meaning of school days. In its wider scope, geography, which in geopolitics is defined as the strategy of lands, resources, and peoples, becomes the reciprocal relationship between physical environment and life.

The general public knows very little of geography. Although he lives in an exciting time, the average citizen does not understand the events developing all over the world, events which may forcefully influence his welfare and destiny. He concentrates on the events themselves and ignores the nature and condition of the places where these events occur. Hence, to most people, happenings in the modern world are only parts of a confusing maelstrom of human behavior. They are confusing because they are viewed entirely apart from any understanding of environment which makes such events logical and natural. In the past, this lack of understanding led us to isolationism, which is nothing but a polite word for geographical ignorance.

Fifield and Pearcy, in their *Geopolitics in Principle and Practice*, say that "geopolitics is primarily concerned with the consideration of the political state in its geographical environment, but the study of neither geography nor political science alone is sufficient for the understanding of geopolitics. A knowledge of both the earth and the state are prerequisites."

The ideas of the Munich school of geopoliticians, under the leadership of Haushofer, became warped because of the demands of the Nazis for justification of their ambitions. These ideas were based upon the concept of Berlin as the center of a world dominated by the German master race. From a purely German standpoint this made sense. However, such a concept of geopolitics leads to war, as clearly demonstrated by the Munich doctrine, "Geopolitics is the scientific foundation of the art of political action in the life-and-death struggle of state organisms for living space."

A much broader definition of geopolitics, which even the German school accepted, is that of "the science of the relationship between space and politics which particularly attempts to show how geographical knowledge can be transformed into intellectual equipment for political leaders." For, to quote Napoleon, "The foreign policies of all nations lie in their geography."

POLITICAL geography might be called the mother of geopolitics, which grew out of political geography. The difference is mainly a matter of emphasis. Political geography considers the state in its material environment from the viewpoint of objective analysis, whereas geopolitics considers the state in its physical setting from the viewpoint of its needs in the field of foreign policy.

Geopolitics is based on history. Some geopoliticians interpret history as "geography-in-action." The geopolitical interpretation of the present is based on the history of the past, and geopolitical events of the future will arise from the conditions of the present.

The study of military, naval and air strategy is another

important source of geopolitics. So far, no authority on Air Power has achieved the eminence of Mahan on sea power and von Clausewitz on land power. The geopoliticians of Air Power are newcomers in the field of strategy, but the recent technological developments and the lessons learned from World War II will undoubtedly provide them with a vast amount of significant material for projection.

International relations are established by contacts among sovereign states of the earth. Since the interests of some sixty-odd states vary extensively, disputes frequently occur, the most violent of which result in war. Although citizens within a state are required to settle their disputes by law, the states of the world have been generally unwilling to settle their controversies by submitting them to an international body. Since the states are unwilling to modify their international policies by international restraints, they seek to express their ideas by force. Von Clausewitz, for instance, has defined war as the "pursuit of policy by other means." The great powers are those states which have the ability to implement their policies throughout the world by force.

Although geopolitics is in the main dynamic, the geographic factor tends to be static. The Mississippi River, for instance, still flows into the Gulf of Mexico whether the flag of Spain, France, the Confederacy, or the United States flies over it. Exceptions to the static element of the geographic may be found in new discoveries leading to the location of strategic materials. Uranium deposits are supplementing oil and petroleum deposits as critical strategic material. Thus certain new areas on this earth become desirable prizes, the basis for power politics, and even the cause of wars.

The dynamic part of geopolitics is in the adjustment of the state to its natural environment. The instability of Poland, which lacked natural boundaries, led to frequent partitions by other powers. Geopolitics of war, expressed by the Munich school, and geopolitics of peace, as envisioned by liberal geopoliticians, are both dynamic. Change by orderly process is essential in the political life of the

state in its geographic environment. The concept of a peaceful change is one of the greatest problems of the present.

THERE ARE six prime factors on which geopoliticians base the world power of a state: location; size and shape; climate and climatic energy; population and manpower; economic power; and political power. A brief examination of these basic elements will show how they influence the position of a state in the world.

The location of a state may be expressed with reference to astronomical factors; to land and water; to central or marginal accessibility; or to strategy in terms of land, sea, and air bases. Astronomical location is the latitude and longitude of a given place. Latitude north and south of the equator is extremely important, since latitude determines climate. All the world powers are located in the middle latitudes. Location as to land and water is of acute importance to the defensive and offensive strategy of a state. Continental powers, such as Russia, developed land power, while maritime nations, such as Great Britain, built navies. However, the proximity of Britain and also Japan to continental mainlands led to the development of both continental and maritime schools of thought.

Insofar as accessibility is concerned, location may be either central or marginal. Great Britain is an excellent example of central location with reference to the North Atlantic trade route. Of the continents, Europe has the best location and Australia the poorest. Europe is in fact a peninsula of the continent of Asia and is near the center of the land hemisphere and the industrial areas of the world.

The second geopolitical element of a state, its shape and size, may significantly affect its foreign policy. The compact shapes of countries like France and Canada become an asset in times of war. In France, leading industries are in the north and east; in Canada the population of the Dominion is concentrated in a narrow east-west strip near the border of the United States.

Climate is the third prime geopolitical factor of the state. For the health and energy of men in peace and war,

and the distribution and nature of the food supply are determined by the climate. Recent arctic studies have shown how extreme cold influences human behavior.

Rainfall and dryness are particularly significant because agricultural development is determined by rainfall. In addition, water is an important source of industrial energy and a means of commercial traffic. Although deserts are relatively uninhabited, some are valuable because of mineral deposits. The Arabian desert, for instance, has strategic importance because of its rich petroleum deposits.

Population is the fourth significant geopolitical element of a state. In war, sufficient resources of manpower are essential. One of the weaknesses of France in World War II, for instance, was that its population had not recovered from the losses in World War I.

It must be pointed out that there is a certain relationship between population density and industrial strength. In pre-industrial times, the number of people in a state had a direct bearing on its strength because their labor produced most of the energy available. In both Europe and America, however, machine-energy accounts for the greatest production. The late Professor Spykman of Yale University reduced to a common unit the amount of work done by both human and machine-energy. His study made it clear that on this basis population density alone is inadequate to indicate the amount of energy produced by a group of people. The extraordinary investment in power machinery in the Western hemisphere gives that hemisphere great strength in spite of its smaller population.

Additional important aspects of population are race, culture, language, and religion. The existence of minorities may lead to political instability. Hitler tried to get all German-speaking populations into the boundaries of the Reich, thus causing instability in the countries housing German minorities.

The fifth element of the state is its natural wealth and industrial capacity as an expression of economic power. A world power must have either the essential natural resources within its territory or the power to guarantee

access to them. This qualification automatically bars most of the states of the earth from a position of world power.

Natural resources must be developed before a state can achieve a position of strength. Russia contained all its natural resources during the reign of the Czars, yet few of these resources were sufficiently exploited to exert any influence in World War I. The United States, the Soviet Union, and the British Commonwealth are currently the most self-sufficient states. Whereas the first two are geographically compact, the British Commonwealth is scattered around the globe. Of course, no state is completely self-sufficient. Not only resources and industrial capacity but also the location of strategically valuable items are important considerations. Food production, after all outside sources are cut off, is a vital factor in the security of a state.

Transportation facilities are essential for the utilization of natural resources. Ocean and railroad routes, canals and waterways, and road networks, all play vital roles. Airways have added another. Economic power is further indicated by monetary wealth and the ability of states to finance internal and international projects. Expansionist economic policies and international cartels raise issues of a political and military as well as of an economic character.

The last element is the political and social organization of a state as a manifestation of power. Great states reflect different political and social organizations; this was particularly true before the outbreak of World War II. The United States and the British Commonwealth, as democracies, were considered capitalistic states. The present British government has modified this concept as far as England is concerned, as this government tends to be socialist rather than capitalist. The Soviet Union is a dictatorship in which the ideas of democracy and capitalism, as we understand them, have been abolished. Yet the strength of this régime was displayed in its resistance to the Nazis in World War II.

LET US turn now from the factual to the theoretical bases of geopolitics. Sir Halford J. Mackinder interpreted history as a struggle between sea power and land power. He considered

that wars between maritime nations were merely a passing phase. In that respect he challenged the conclusion of Mahan, who interpreted world history as a continuing struggle for the control of the seas. Mackinder, however, held that British sea power, outflanked by the land power of the rising industrial states of Europe, could be undermined. His theory was that the grouping of lands and resources and natural pathways as related to the seas was such that it led to the growth of empires, and in the end to a single world empire.

He saw that Germany and Russia were so situated on the Continent that should either of them get control over the other, the combination would rule the world. He propounded the concept that modern transportation was reducing continents to islands.

The famous Mackinder thesis of 1904 (See Mackinder's Map, p. 26) grew out of his theories. Mackinder organized the world from a realistic point of view. He observed that nine-twelfths of the world surface is water, and that three-twelfths is land. The unity of all this water is better expressed by the term "world ocean" than by Atlantic, Pacific, Indian, Arctic, and Antarctic Oceans.

Mackinder also noted that of the three-twelfths of the globe surface which is land, two-twelfths is the land mass of Europe, Asia, and Africa. He saw this as one continent which he called "world island." Europe, as apparent from Mackinder's Map, is actually a peninsula of Asia; and Africa, which closely hugs 2,600 miles on the Mediterranean, is attached or almost attached to Asia at three points. Thus Europe, Asia, and Africa comprise the world island which is the center of gravity of world power. The concept of a world island in a world ocean is new to those who have been thinking in terms of continents and oceans.

The remaining one-twelfth of the earth's land surface is largely North and South America and Australia. The Americas are insular rather than peninsular in regard to one another. South America lies not only to the south but also to the east of North America, and the two land masses are in echelon. The broad ocean circles all of South America except for a small part of its outline. Mackinder saw the Americas

as "outer islands." He found that fourteen-sixteenths of the world population lives on the world island (Europe, Asia, Africa), and one-sixteenth on the outer islands of North and South America and Australia.

The "heartland" or "pivot area" of this world island was strategically and geographically so located that it could dominate the world. This theoretical heartland in central Asia comprises the area presently known as Soviet Russia.

Mackinder summarized his study by his classic warning:

"Who rules East Europe commands the heartland;
Who rules the heartland commands the world island;
Who rules the world island rules the world."

Mackinder's theories were an estimate of the forces of the world existing in 1904. His concept strongly influenced the Russo-English Entente of 1907. He foresaw the danger after 1918 that Germany might recover from defeat and attempt to build another empire. He warned his countrymen that German military genius and German ability for management might integrate the huge manpower and vast material resources of the great Eurasian plain, the "heartland" reaching from central Europe deep into Asia. He suggested, as a solution, a series of buffer states which, as we know, proved ineffective under the hammerblows of the Wehrmacht.

The rimland of the amphibious lands surrounding the heartland was called by Mackinder the "inner crescent." The rimland consists of Europe, the Middle East, Arabia and the Asiatic monsoon lands. It is a densely populated buffer zone which has in the past fought off the land power of the heartland as well as the sea power from the off-shore islands like Great Britain.

What actually happened in the Napoleonic wars, World War I, and World War II, was that the combination of the British and Russian empires fought jointly against intervening "rimland" powers, namely those led by Napoleon, Wilhelm II, and Hitler. Thus, Mackinder's concept could be changed by saying: Who rules the rimland rules Eurasia, and who rules Eurasia controls the destiny of the world.

It is possible to criticize his oversimplification of

the struggle between sea power and land power, or his underestimation of the military potential of the "new world," but Mackinder understood more clearly than any of his contemporaries how modern transportation had made possible the political integration of increasingly larger land areas. No one else so realistically appraised the relative strength of sea power and land power, or showed how the balance of power might be upset by inventions such as railways, motor transportation and, finally, aviation.

Mackinder prophetically warned Great Britain, essentially a sea power, that modern inventions such as aviation could upset the balance of power.

THE DEVELOPMENT of geopolitics in Germany grew along parallel lines with German ideology. Before the word "Geopolitik" was coined, the theoretical field was pioneered by political philosophers and geographers. A professor of history named Heinrich von Treitschke first urged the expansion of the Reich by military conquest. Friedrich Nietzsche, a student of Darwinian theory, developed the idea of a Superman. Friedrich List, a German university professor and a friend of our own statesman Henry Clay, was greatly impressed in 1825 by the American Republic, a single customs unit under one flag.

Friedrich Ratzel (1844-1904) developed political geography to a point where geopolitics would naturally emerge. Although Ratzel called himself a political geographer, his followers interpreted his teachings as basic geopolitics. His laws of the growth of a state contained some good basic ideas which are still applicable. Ratzel taught that the state was an organism with the biological necessity of growing by securing, if necessary by force, the missing members which it considered essential for continued living. Rudolf Kjellen (1864-1922), a pro-German Swedish professor, expanded the theories of Ratzel.

These theorists were followed by General Haushofer (1869-1945), a professor who met Hitler through Rudolf Hess. Hess was Haushofer's aide during World War I and became his disciple in the Munich school of geopolitics. After the failure of the Beer Hall Putsch, Haushofer visited Hitler in

the Landsberg prison-fortress and inspired chapter XIV of *Mein Kampf*, which defined the Nazi foreign policy. The Lebensraum theories particularly appealed to the Nazis, although Haushofer had worked out many others. Lebensraum was nothing new, however, for this theory had been used by Friedrich Naumann during World War I, in a book widely read in Germany at that time -- *Mitteleuropa*.

MACKINDER'S IDEAS GLOBALLY PROJECTED

Haushofer was an erudite man with a vast knowledge of the Pacific. His Munich school was fascinated by theories of space. Kjellen had said, and Haushofer quotes him, that "vitally strong states with limited space are driven by natural law to enlarge their space by colonization or conquest."

Haushofer was an ardent student of Mackinder. He distinguished between oceanic and continental powers, and between resisting and renovating powers. He was certain of the

imminent doomsday of the British Empire, which he called a resisting power. He deeply revered the Monroe Doctrine, which he wanted to apply to Europe. Around these main themes he wove a mass of information gathered from topography, economics, political science, history, military science, jurisprudence, medicine, anthropology, enthnography, eugenics and sociology. All this erudition is set forth in caterpillar-length words in such abstruse terminology that even Germans, who are used to terminological language, found his writings extremely indigestible.

Haushofer modified Mackinder's ideas to a German approach. He believed that the path for German world power lay along the lines which had frightened the English: the consolidation of the German and Russian greater areas. Debatable as Haushofer's acrobatics on the philosophic trapeze may seem, the conclusions he reached were a pattern of simplicity. He projected a new world order taking shape around three regional centers: the United States of America as the leading power of "Pan-America"; the Japanese hegemony over eastern Asia as "Pan-Asia"; and "Pan-Europa", dominated by Germany, controlling the heartland.

Haushofer extolled the United States of America as an example of a nation geopolitically destined for world power. Like his earlier compatriot List, he was inspired in his theorizing by American realities. He correctly predicted the struggle between Japan and the United States. In his book *Wehrpolitik*, which discussed the United States, he analyzed the strategic importance of Iceland, Greenland and the arctic approaches to the North American continent, the vulnerability of the Panama Canal to air attack, the problems of warfare in the Arctic Zone, and the advantages United States air strategy derives from "space deepness."

THIS DISCUSSION would not be complete without a consideration of what might be called air geopolitics. Although the world island was a unity from the viewpoint of a land mass, men have chiefly lived around its lower edges. In the 1800's they began to build railroads into the land mass, and in the 1900's they began to fly over the land mass. In the early days the Mediterranean, correctly named "the sea in the

middle of the land," was surrounded by what was then known as the civilized world: Europe, Asia, and Africa. Later the Atlantic Ocean took the place of the Mediterranean as the central ocean, with Great Britain replacing Malta on a grander scale.

In 1943, Mackinder was forced by modern developments to revise his original map of the pivot area. He called the Atlantic the "mid-ocean" and drew a line from the heartland to the United States east of the Missouri River and called this whole area the fulcrum of world power (containing one billion people). The future may well see the Arctic Ocean as the mid-ocean.

Authorities call the Monroe Doctrine a truly American geopolitical expression. Before the era of polar projections and at the formative period, the Monroe Doctrine seemed logical and sensible to the Western hemisphere, because the American continents were considered detached from the crowded hemisphere of Europe, Asia, and Africa. The Western hemisphere appeared in solitary grandeur, separated from the rest of the land portions by the Atlantic and Pacific oceans.

Present polar projections show how wrong or, rather, how antiquated that concept has become. With the air age at hand, the polar seas may easily become the Mediterranean of the future. Mahan has said that "the first and most obvious light in which the sea presents itself from the political and social point of view is that of a great highway; or better, perhaps, of a wide common, over which men may pass in all directions." It is interesting to note how this observation, made by the great authority on naval power, applies to Air Power. For the air, more than the sea, is a great highway or, as man improves it, a wide common, a three-dimensional common, over which we may truly pass in all directions.

Human relationships, influenced by new advancements in technology and new concepts of geography and values, are constantly undergoing dynamic changes. The world was never in such a flux; historical change has never taken place so rapidly. A global concept in the study of political geography, seen in the light of modern technology, will produce the geopoliticians of the air age.

New Responsibilities of Air Force Officers

Colonel Noel F. Parrish

IN THE WORLD now shaping itself around us, the Air Force officer is destined to play an increasingly important role. This is true whether that world is heading for peace or war. Even if the peace we now enjoy should endure for a period beyond all dependable prediction, it must continue for years as a strange and restless peace such as this nation has never experienced.

In the past our nation has made severe and almost impossible demands upon its military men of all ranks who have remained in uniform beyond the end of hostilities. It is commonplace in every nation to observe that the soldier is a hero in war and forgotten in peace; but our own nation, during its recurrent dreams of perpetual peace, has always more than forgotten its professional soldiers.

Middle-aged Air Force officers can well remember when their appearance in large numbers was sufficient to cause alarm as well as annoyance everywhere but in the "army town" --San Antonio, and perhaps San Francisco when the fleet was not in. The flight of more than three or four military pilots to one city on the same day was considered a reckless invitation to public comment. The only exceptions were the duly authorized and duly infrequent maneuvers, which provided sufficient unfavorable comment in themselves. As for Washington, the source of all military authority, Army pilots were requested when flying there to carry civilian clothes for street wear, lest representatives of the people be reminded of their existence.

It is not surprising that military airmen not timid by nature had a strong tendency toward over-expressing themselves once they were "safely" in the air, and too often flew with a deliberate daring and bravado which was the

direct antithesis of, and compensation for, their conduct on the ground. Some can recall the extreme cases, the quiet men who expressed themselves seldom and inadequately in words, but frequently took to the air with a strange light in their eyes and a passion for disturbing not only people but even cattle and sometimes such things as sailboats, with the utmost technical skill. The decline of anonymous exhibitionism in recent years is not due to more stringent regulations, since the law of gravity was always the severest of all, but to the increasing dignity of the airman as a member of modern society.

Those men who achieved a certain dignity and too often a defiant death in attempts to demonstrate human mastery of the mysteries of flight were greater in number than those who dared to challenge the attitude toward flying, and particularly military flying, of men on the ground. The exhilarating struggle with the forces of nature, dangerous as it was, gave a man a kind of release from the pettiness of jealousy and fear. But for a man to identify himself on the ground as a military airman, and openly to proclaim his aspirations and convictions in words as well as in action, was to invite the bitterest personal attacks upon himself; attacks which too often provoked bitterness in return.

The most disturbing feature of these attacks was the fact that they came from the conservative and tradition-loving civilians, otherwise his most tolerant friends, and from his brothers-in-arms. If the airman wrote or spoke about the things he knew, such as the development of his new profession and the application of its principles, he was branded by one faction as threatening to scrap the country's dependable defenses and by the other as threatening to destroy all other nations. In their haste to discredit him, the same individuals often tried to combine these contradictory arguments by describing him as a harmless crank and, in the same breath, as a ruthless destroyer. Shunned by progressives and damned by conservatives, the handful of military airmen who founded our present Air Forces were encouraged mostly by each other.

THE CONSTRAINT of expression by Air Corps officers was not merely social and theoretical. It was a matter of military discipline. The arguments advanced by General Mitchell were not exclusively his own, nor did he differ significantly from other leading military airmen except in his argumentative manner and uncompromising attitude. He was by no means the only officer effectively silenced by the outcome of his case. Other air officers who wanted to remain in the service and hoped someday to be able to influence its policies became almost secretive concerning their ideas on new methods of warfare. Some demonstrated an interest in more traditional matters and even managed to develop an affection for horses, a characteristic which was considered in old Army circles as the one indispensable attribute of a truly military man. Prior to the late 1930's, only the boldest and most tactless Air Corps officers allowed themselves to be heard beyond the next room when discussing anything of importance to the nation. There was a period when it seemed that even the Air Corps chiefs were self-effacing to a degree detrimental to the men they represented.

Small wonder that the Air Forces of today have few senior officers skilled in the use of words. Captain H. H. Arnold, one of the most irrepressible of the pioneers, managed to keep in practice by writing air stories for his children and, later, books of a more or less inspirational nature for boys and young men who absorbed his enthusiasm and overlooked the careful vagueness of his statements. Behind the scenes, he and others fought many battles that made for progress. Such small-scale projects as the pioneer flight of a few bombers to Alaska in 1934 were carried out despite relentless opposition and criticism which immediately branded the achievement as a "stunt" intended to mislead the public concerning the feasibility of long-range military aviation.

But it was only beneath the surface that progress was achieved. Air Corps officers, greatly outranked and outnumbered, were unable to gain recognition for their warnings and proposals at top-level, and progress at that level was much slower than was demanded by awakening public opinion. As the divergence between advancing public opinion and slow

official progress widened, Air Corps officers were in an increasingly delicate position. Opposition to their efforts became more desperate. The Baker Board report of the late 1930's was really more reactionary for its time than the Morrow Board of the early 1920's had been.

The recommendation of the Baker Board, which tried to limit aviation to three-hundred-miles range, seems comic today, but it was far from comic to the military airmen who had to go on trying to build Air Power despite the throttling effect of such a policy. The achievements of a quiet but determined little group of Air Corps officers, in the face of unrelenting official opposition and disapproval, still seems miraculous even to those who watched them work. They had little support except a vaguely sympathetic public that had no idea who they were or how to help them. Yet when necessity arrived ahead of all prediction, they suddenly built the world's greatest long-range striking force.

The repression of all so-called "radical" expression among military men seems strangely illogical in a time like the present, when the *Army Ordnance Association Journal* will print and defend an article urging early preparation for an invasion of Mars in order to use it as a base for a "surprise" invasion of another country. But it must be remembered that the twenty years of peace, expected to last forever, dictated a policy of deliberate and enforced obscurity for all military men. Mere survival was an accomplishment in 1932, when the nominating convention of a major political party boasted of having reduced the nation's armed forces to the status of a domestic police force. There was nothing to do but take cover. It is not surprising that top Army officers, straining to keep their own heads down out of sight, became somewhat nervous when any officer, even a restless Air Corps officer, raised his head over the horizon or his voice above a whisper. The only way to survive was to impersonate a domestic policeman patrolling his own side of the ocean. Air Corps officers had to keep in line like the rest.

Ground and air officers alike stubbornly carried out their duties among a people hoping and trying to believe that all officers were as useless as their saber chains. It was a

weird, almost furtive existence, like that of firemen trying to guard a wooden city whose occupants pretended it was fireproof. In such an atmosphere of unreality, officers sometimes felt a little ghostly and bewildered, and turned to the affectation of imported uniforms and mannerisms, the imitation of the well-to-do, and horse culture. These psychic manifestations of a sense of social uselessness appeared in a surprisingly small number of officers. Most plodded grimly along, stubbornly reminding themselves and each other that they were real, after all, and that the things they were doing were necessary. They continued to believe the maneuvers they repeatedly planned were important and worth carrying out. The steadiest leaders steered a sane middle course. Colonel George C. Marshall painted his own house, planted his garden, and tried to improve the welfare of his few men and their families on Sullivan's Island just as conscientiously as he now tries to establish world peace.

The sudden emergence from complete obscurity of such accomplished world leaders as Marshall, Eisenhower, Arnold, and Bradley was certainly one of the greatest and most fortunate near-miracles of the recent war. Perhaps no war in history, certainly no war in American history, has produced an equal number who could rise so suddenly to such heights of responsibility. The proved capacity of the great leaders of this war to continue their leadership into the period of peace is equally remarkable, and almost unique in American history.

It is now obvious, therefore, that the handicaps of extremely limited activity, indifference, and neglect did not prevent the United States Army from producing top leaders of unquestioned ability almost on demand. Undoubtedly, good fortune played a great part in this, but the fact remains that the nation received a tremendous amount of quality from a pitifully small quantity of officer personnel. It is true that the situation in the junior grades was less favorable. Obviously, where the amount of responsibility to be distributed was so limited, no great number of officers could actually learn to share it. But we can say that somehow, despite the fact that for twenty years the nation seemed not to care very much about its Army or the men in

it, many of those men managed to live for a long while in shadow and at the same time learn how to step, without stumbling, into the spotlight's glare.

ALL PRECEDENT indicates that the time has now come for military men to recede into the shadows again. All past examples teach them to avoid unnecessary contacts, keep quiet, and practically go into hiding. Once or twice a year they might, according to precedent, venture away from post headquarters to make some statement or take some action effective beyond the local luncheon club, but any public influence would necessarily be either apologetic or defiant, since it would be something about which nobody wanted to think. Our military men who served during the 1920's and 1930's are old hands at this. Most of them, no matter how painful the adjustment, know how to go on performing duty in a nation apparently becoming ashamed of the existence of men in uniform. They could soon teach even the younger officers to conform in the same manner and, for the sake of the whole group, to give the appearance of dozing in dreamless and planless hibernation.

But this will not happen. For the first time in American history peace is not being taken for granted. There are many reasons why this is true. Principally, there are the technological advances in transportation, communication, and weapons that make the old dream of isolation completely ridiculous. There is the emergence of ideological as well as national conflict. These and other reasons need not be discussed here. The most startling development, from the standpoint of the Army officer as a man, is the fact that he is suddenly required as an organizer, supervisor, and advisor in many fields of activity, some of them far-removed from all that was once considered the limited province of the military.

It is suddenly taken for granted that education, public health, industry, research, trade, transportation, and other major functions in America must be consciously geared to the requirements of national defense. While the theoretical relationship of Army officers to both governmental and private agencies which were formerly exclusively civilian

is not yet clear, the working relationship has already begun. Of course, civilian specialties and skills have been absorbed by the Army at an equally astounding rate. The net result is a kind of marriage between military and civil pursuits which, for better or worse, cannot be dissolved.

World War II was far from total, even in Germany, despite the free use of the word. But it provided just a taste of what total war might be like. Since we are convinced we can avoid total war and defeat only through national strength, it follows that this strength must be achieved through a kind of total mobilization for peace. This involves all elements of our national life and it certainly includes the military. Since the military element of our national strength is now recognized as the shield behind which all others must develop, it is inescapable that we Americans are now, for the first time, a military people.

This is an amazing thing to most Americans. Some will refuse to accept it, but most simply will not comprehend it for some time to come. It is contrary to tradition and incompatible with custom, but it is fact. And no one can be more amazed by the necessarily militant character of our present American civilization than the United States Army officer, since no one was more conscious of its idyllically peaceful character in the past.

This new participation of the military in all important aspects of our national life is desirable because it is necessary, and it will result in a much higher level of military preparedness than could be achieved otherwise. But it will make entirely new demands upon the character and ability of the permanent officer. In the past, after putting out the fire like a good fireman, he has always gone quietly back to the fire-house and resumed his drill, observed principally by relatives, small children, and visiting dignitaries. But this fire, although diminished at present, is obviously not out, and the officer is now called upon to help fireproof the building. It is a good assignment, but it is not an easy one.

The old system is inefficient, frustrating, and wasteful of ability. It was not pleasant to be banished from the

minds, if not the hearts, of one's fellow countrymen; to work with no tools; to plan with no cooperation. It required patience, devotion, self-encouragement and, for a few unfailing leaders, long-range vision and an undismayed consecration to the cause of the national welfare. But for the great majority of peacetime officers, it did not require the rapid increase in knowledge, versatility, and breadth of understanding demanded by the new role of full-time consulting architect for a whole nation's future.

THE NEW demands made upon officers of the Air Force will perhaps require the greatest change in manner of performance. Just six years after pre-war policies which deliberately placed the Air Forces in a position subservient to the Infantry in Army organization and function, we find that only complete autonomy for the Air Force can guarantee against an almost equal degree of subservience on the part of the Infantry. Officers of the old Air Corps had to fight against traditionalism every time they tried to make a forward move. Officers of the new Air Force find themselves the heirs of a new tradition which takes progress for granted. The old timers (of ten years ago) could always be depended upon to do more than expected. Their accomplishments have gained them such recognition that they and the younger men now following them are expected to do almost anything.

Rightly or wrongly, the American public now looks to the Air Force and the scientists to protect the nation from sudden destruction. It is the greatest military responsibility in world history. Never before have the people of this nation feared sudden destruction, or invasion, or even another war. Now there is apprehension concerning both the immediate and distant future. No longer protected by broad oceans, no longer defended by strong allies, our people feel exposed for the first time, and alone for the first time. They will lean heavily upon their longest and swiftest striking arm, and they will depend to a great degree upon the officers of that arm to provide them with the sense of security necessary for the prevention of panic and despair.

Rome did not depend upon the broadswords of its legionaries, nor Britain upon the guns of its fleet, more com-

pletely than America and certain other nations now depend upon the bombs of America's airmen. The situation is an appalling one, and the responsibility is overwhelming. To provide a sense of security sufficient to allay exaggerated fears without jeopardizing the flow of funds necessary to make that security real is a task which now appears impossible.

Officers of the Air Force are no longer shielded by their pre-war lack of prominence. They can no longer depend upon being regarded as reserved, obscure, professional men doing a strictly professional job far removed from public prying and relatively immune to personal criticism. Their official lives are no longer their own. Their supposed weaknesses as well as their proved strength may be aired in the press. Their failures will not pass unnoticed. Writers of columns will mention many of them frequently, both to damn and to praise. An uneasy nation cannot be expected to take it for granted they are doing the job well at all times, and the expenditure of large percentages of the national income may often become a political issue. Differences of opinion between officers, differences of method, even differences of personality, may be of some interest to the general public at times. The sensitive soul, the retiring personality, and the exclusive spirit will be increasingly difficult to maintain in the Air Force. Its officers, as they succeed to positions of greater influence and broader contacts, will necessarily become accustomed to the give-and-take which is traditional in American public life, but has never before been encountered in peacetime American military service.

THE PRESENT is a period of recuperation from past efforts and bewilderment in the face of new problems, but the enormity of those new problems is in itself a disturbing guarantee that they will produce severe differences of opinion among our people. What military means and measures will most effectively render the nation safe from the constant threat as well as the constant danger of attack? Our foreign policies are now taking shape and the mystery of these

maneuvers absorbs the national interest. Once the commitments of policy are established, the focus of attention will shift to the principal means by which we hope to back up those policies or to prevent disaster if their peaceful purpose should fail. These are of course military means.

Such military means must produce, both in this nation and abroad, the conviction that they are effective, or we shall have no peace. The making and implementation of military plans which are both effective and impressive is a job for military men. This peace, to paraphrase von Clausewitz, is really a continuation of war by other means. The best we can hope for is that the present stalemate between the hope of peace and the fear of war will last long enough for some circumstance or method to develop which will produce a stable world situation. To Clemenceau's meritorious statement that war is too serious a business to be entrusted to generals, the American public is already discovering a grim rejoinder: This peace is too important and uncertain to be entrusted entirely to civilians. Military considerations will have a dominant influence not only upon our international policies in the field of politics, but also in the fields of finance and trade. We may expect that the bitter controversy already surrounding our State Department will begin to appear around our military planners and advisers in the near future.

Scientists have suddenly become an indispensable military requirement, a fact which is just as confusing to the scientists as to many military men. The habitual boldness of Air Force thinking and the completely experimental nature of the Air Force's past activities have resulted in some very satisfactory partnerships, but peacetime circumstances will make these working relationships somewhat more difficult. Competent research men are often apprehensive of efforts to guide their thoughts or restrict their actions, to a degree which is difficult even for an autonomy-loving Air Force officer to understand. A very high percentage of scientific research and development potential of this nation is being diverted to meet military requirements, and there are not enough scientists to go around. Business men and

industrialists are already disturbed, and not without reason.

The military will not dominate the scientific field by edict or even by law. But the huge funds which must be appropriated for scientific work on new weapons and military devices, small as these funds seem in the light of needs, will necessarily upset what might be called our scientific economy. This research must somehow be directed without being hampered, coordinated without being limited, and supervised without the appearance of meddling. Many Air Force officers will be involved in the achievement of these delicate and difficult aims, from the top research staff sections down to squadron engineering officers who will be testing and adapting increasingly more new equipment.

A new kind of tact will also be necessary in the relationship between the Air Force and other elements of national defense. So far, efforts to appropriate various Air Forces for short-range operations and purposes have been defeated. And the airman still may have a battle on his hands to prove that the air age is not a mere flash in the blue, already burned out, with rockets filling the skies and all of us digging in again.

Scientifically, however, those who do not appreciate the true value of Air Power see it primarily as ground-to-ground transportation, as a means of getting a little closer to the enemy. In their conception, the Air Force would perform a function not unlike that of the Parisian taxicabs at the first battle of the Marne.

Some Air Force officers in the top brackets, let it be said to their undying credit, have already worked toward the development of pilotless aircraft, and have predicted the day when guided and target-seeking missiles may replace the pilot's present domination of the skies. Their bold predictions, however, did not envisage missiles restricted to the concept of short-range artillery and old-fashioned wars of position. Missiles which are no more than large-caliber artillery will certainly not replace aircraft of longer range and greater accuracy, particularly if these same aircraft will be required to bring the missiles within reach of one another. Such planning, which leaps forward in order to

look backward again, would limit Air Power, not by the old method of tying it down to a supporting role, but as with Mark Twain's celebrated jumping frog, shortening its jumping range by feeding it buckshot in the form of missiles to be landed for re-launching rather than dropped for destruction.

The invasion-from-Mars-by-rocket plan is a better one for the purpose of confusing the issue, because it is most likely to maneuver a thoughtless Air Force officer into the position of a reactionary. Let no one say that such an invasion is impossible or even improbable, even though we have yet to fire a rocket more than two hundred miles or develop a satisfactory guided missile. Air Force officers, following the example of leaders who have already embraced science and technology as an ally rather than as a threat, need have no fear of progress in any field provided they keep pace. Certainly, despite the love most flying officers feel for beautiful and efficient machinery, none of them have yet shown evidence of an emotional fixation upon airplanes similar to the peculiar passion for four-legged animals which once afflicted large and influential portions of the American Army to such an extent that flying officers were actually required, as recently as the 1930's, to go about wearing horse-boots and riding breeches.

AMERICANS will expect a continuation of bold and realistic thinking and planning on the part of our Air Force officers despite all vested interests, including their own. Officers of the Air Force who are familiar with its history are forewarned by experience against the type of so-called military thinking which is nothing more than rationalizing to justify preoccupation with the previous.

The unfortunate fact is that we have not yet really advanced very far into the air age. Not even the Air Force is yet airborne, nor is it likely to be for a long time to come. Only a tiny percentage of our commerce, even of our urgent commerce, is yet carried by air. Mails are still delivered mostly by the iron horse, and sent to foreign shores by boat. We are still largely governed and controlled by a generation which regards the airplane as a surprising

and miraculous invention. Technology has shown us the possibilities, but most of them are yet to be realized. Actually, the air age is little farther advanced than was the automobile era when the airplane was invented in the early years of this century. Officers of the Air Force will be in position to advance this age more rapidly, for the benefit of national strength and welfare. Often they will work and plan through it into the future, and even participate in the awesome beginnings of the atomic age, but they can hardly delude themselves that the world or the nation, or even its military strength, is yet airborne to any great degree.

The achievement of such a goal has become a problem of education more than anything else, and it will require a knowledge of the newest and most effective educational methods. All citizens, including some in the Army and Navy, must be educated to understand that the nation has the resources for a vast expansion of its world-wide aviation potential. World economic and political conditions demand such expansion. Its achievement can be brought about only by the influence of those enthusiastic about air possibilities. Such possibilities require scholarly presentation.

The Air Force has never boasted a high percentage of scholars. Ground Force and Naval officers, on a percentage basis, have excelled in this respect. There are, of course, reasons. If the cockpit of a World War I airplane had provided General Mitchell all the facilities for lengthy writing that Admiral Mahan found on his commodious battleships, perhaps the General could have marshaled an equally imposing attack of rhetoric and of historical example to weight his arguments; and they might have been equally successful to the benefit of the nation.

Air activities have most often attracted men of active rather than literary leanings, and the more methodical minds have been needed for technological application. But with the coming maturity of Air Power, the need for scholarship in interpreting it is imperative.

Wider reading and broader humanitarian contacts for Air Force officers, leading to a better understanding of politics as the science of government rather than a dreaded interference, are highly necessary. Similarly, a more complete understanding of labor and its aspirations is a prerequisite for effective industrial planning and coordination on the part of men who habitually think only in terms of management and control. A diminution of petty racial and sectional prejudices and superstitions is likewise necessary in order to avoid the blundering creation of unnecessary antagonisms in national as well as international dealings. Dogmatism and limited understanding cannot help to unite the nation in the coming years of crisis. Air Force leaders will necessarily become concerned with the breadth as well as the vigor of their opinions. If the younger men can retain the vitality and determination of the Air Corps pioneers and at the same time develop the urbanity and erudition necessary for the more varied demands now made upon them, their achievements will be equally impressive.

A NATION no longer dominant in available resources, hopelessly outnumbered in manpower, and lacking a strong ally in a world disturbed and shaken, has only one recourse. That recourse is the maintenance of its world leadership in material achievement and the spirit of freedom. The development of its most envied accomplishment and the most distinctive symbol of its might and aspirations, its military and commercial Air Power, can be the most convincing demonstration of influential strength and the most effective means of tying together a disintegrating world. This development must demonstrate excellence of equipment, efficiency of organization and function, and the irrepressible spirit that has characterized our air adventure since it began. Air Force officers and their almost indistinguishable allies in other positions of military and civilian leadership will necessarily become effective agents in the promotion of this most hopeful program for the security of the nation and the peace of the world.

NUCLEAR ENERGY FOR AIRCRAFT PROPULSION

Gabriel M. Giannini

THIS ARTICLE is limited to a discussion of the cases in which the nuclear energy power plant is contained in the aircraft, piloted or pilotless. Where momentum is imparted upon the vehicle by an explosion or an acceleration caused by equipment located on the ground, the problem does not fall within the scope of aviation.

If we consider a nuclear energy power plant installed in an aircraft, it is apparent that, at least from a theoretical standpoint, there are two major classifications of means by which energy for propulsion may be derived from a nuclear reaction. The first classification is the one utilizing a "steady state" type of reaction, such as that present in a "pile," while the second uses an unstable type of reaction, one of the explosive type.

Let us first analyze a vehicle using a continuous reaction power plant of the pile type where the nuclear energy is continuously available. In this case thrust to be used for propulsion purposes may theoretically originate from three potential sources:

a. Electro-magnetic radiation, including radiant heat, and gamma rays escaping the pile, a contribution to propulsion which is virtually nil.

b. Products of fission escaping the pile, including neutrons, alpha and beta particles, whose total contribution to propulsion is also negligible.

c. Conversion of heat resulting from the nuclear reaction into kinetic energy of a working medium. This medium may be air in case of vehicles moving within the earth's atmosphere, or a working fluid carried by the vehicle itself in case of vehicles moving outside the earth's atmosphere.

These two types of power plants will be referred to respectively as "nuclear jets" and "nuclear rockets."

The influence of nuclear rocket and nuclear jet power plants on typical aircraft performance will be considered after a brief discussion of the matter of utilizing radiation. Radiation, as already stated, contributes to a minimum of the energy generated and available outside a pile. For large piles, a large amount of the radiation energy is converted into heat, since the volume of the pile grows with the cube, and its surface with the square of its linear dimensions. Radiation defined broadly comprises alpha, beta, and gamma rays, and neutrons, all of which are emitted virtually isotropically. Each of these component radiations is vastly different from the others and obeys different laws for scattering and refraction and reflection. It is therefore very difficult to conceive a practical and likely means of conveying such variety of radiations in a preferred direction, a condition for their utilization to produce thrust. Furthermore, the velocity of electro-magnetic radiation is of the order of the velocity of light, and the propulsive efficiency to be expected from this radiation is negligible. In the case of neutrons which have a lower range of velocity, the problems of reflection are extremely severe.

For all practical purposes, therefore, let us disregard at this point the direct propulsive value of radiation and consider a nuclear energy source merely as a source of heat. Let us treat it as a conventional molecular source of heat and apply its thermal energy to a working medium. As pointed out before, in the case of a nuclear jet engine this medium is air, whereas in the case of a nuclear rocket engine the medium may be a liquified gas.

The transfer of heat from the nuclear source to the working gas will follow conventional thermodynamic laws and is, therefore, not difficult to predict. It should be observed here that numerous possible schemes to transfer energy from the nuclear pile or reactor into a working gas may be devised, some of which may be practical. Considerable experimentation along these lines will, however, be required.

One should not expect to design the ideal power plant in the immediate future.

A parallel should be drawn with conventional power plants. Heat which is derived from molecular reaction, for example, may be converted into kinetic energy in a direct fashion, as in the case of gas turbines and reciprocating gasoline engines. It may, on the other hand, be transferred to a fluid acting as an intermediate working means, as in the case of steam boilers. This heat may in turn be converted into kinetic energy.

Reciprocating engines fall into numerous categories, such as two-and-four-cycles, and diesels. Similarly, in the case of nuclear energy power plants, one may suggest that heat be derived directly from the cooling of an active pile operating at elevated temperatures, or from the cooling of the neutron-absorbing materials surrounding the pile proper. Conversely, heat may be derived indirectly by circulating heat-transferring materials, either liquids or molten metals, between the source of heat and a working fluid heat exchanger, and so forth. Furthermore, possibilities of chemical reactions either of the molecular or the nuclear type, or both, taking place within the working fluid should be envisaged.

It would have been a mistake to assume, at the time oil was first drilled for, that any particular type of gasoline engine was ideal for all purposes. Similarly, it would be a fatal mistake now to assume that any particular type of nuclear energy engine would be the only or the best one.

LIKE a molecular power plant, the design of the device which changes heat generated during the nuclear reaction into kinetic energy of a fluid, is dependent upon the conditions which define both the reaction used to generate heat and the motion of the vehicle.

Today, we have at least two types of reactor which will generate heat. These are the original graphite pile, with lattice-distributed uranium, and the enriched type piles using materials more uniformly distributed. The operation

of piles is in each case sensitive in a different degree to neutron space distribution. The problem of heat removal is intimately connected with the energy and distribution of neutrons and cross sections characteristic of the various materials involved. The problems of removing heat from a nuclear reactor will vary greatly in engineering design and operation, and may involve the solution of very critically balanced reactions.

As to the motion of the vehicle, the first case may be the one in which the propulsion is performed by means of a propeller. This case will not be discussed here, since it is a specific type of torque-producing power plant which may be developed as an aircraft modification of marine or stationary type power plants. Let us, however, examine in some detail the field of reaction propulsion, namely nuclear jets and nuclear rockets. It must be immediately observed that the maximum efficiency of nuclear jets which can be derived from a thermodynamic cycle, using air as a working medium, is a function of the maximum temperatures available in the "combustion chamber." Here heat is transferred from its source into the air.

This maximum temperature is the same in the case of both nuclear and molecular reactions, because it is controlled by the practical limiting operating temperatures of the materials of which the combustion chamber is constructed. This means that, from the standpoint of thrust per frontal area of power plant, the operation of a nuclear jet can be made substantially no better than that of a molecular jet because the thrust per frontal area is the result of mass flow times the change in velocity of the air. This velocity change is in turn controlled by the maximum temperature to which air is submitted prior to ejection from the vehicle.

The foregoing circumstances place the same type of limitations upon the velocities attainable by a nuclear jet moving through the air, as exist in the case of a molecular jet. It is therefore impractical from an engineering standpoint to expect a substantially better performance from a nuclear jet power plant than has been obtained from a molecular jet power plant. However, in the case of a nuclear

jet, which consumes virtually no fuel, aircraft may be designed for landing conditions rather than for take-off conditions. The structural requirements would as a result be greatly simplified, reducing aerodynamic drag and increasing ultimate speed. All this may result in better performance of the complete vehicle.

AS WE turn to analyze nuclear rockets, we immediately find a distinct advantage over chemical rockets, if certain elements are used as fluid working media. This advantage exists because the thrust available from the rocket is related to the mass flow through the nozzle, which is a function of the velocity of the working fluid. Obtainable velocity of working fluid is, in turn, controlled by the maximum operating temperature and by the energy which may be transferred into the working fluid by the source of heat; that is, by its specific heat constant.

In the case of a chemical rocket using, for example, oxygen and hydrogen, the nozzle velocities of the working fluid are limited by the low value of the specific heat of oxygen. Advantage in the use of a nuclear source may be found, at least from a theoretical standpoint, in the possible addition of heat to a working fluid which is made exclusively of elements of high specific heat constant. As is well known, hydrogen is the ideal element in these circumstances. The use of a light working fluid with a high specific heat permits higher nozzle velocities with consequent reduction of the mass ratio of the rocket.

The desirability of pure hydrogen as a working substance is apparent when its flow through the nozzles is considered, since for a given pressure ratio and a given maximum temperature, the exhaust velocity increases as the square root of the specific heat of the working substance.

The highest specific heat obtainable is that of hydrogen, which has a specific heat of over 3.5. This can be compared to the highest specific heat of exhaust gases resulting from the combustion of the heat molecular fuels. If a mixture of hydrogen and oxygen is used as fuel, the specific heat of the water vapor resulting is approximately

0.5. The products of reaction of other known rocket fuels are less.

The use of hydrogen as a working substance takes advantage of a specific heat which is roughly seven times as great as the specific heat of ordinary working substances, and has an exhaust velocity approximately 2.5 times as great. Thus, with the same mass flow, 2.5 times as much thrust, with consequent increase in range, can be obtained by using a nuclear source of heat instead of a molecular source of heat.

The range of a rocket operating in the manner described will be greater, either vertically or horizontally, than the range of a similar unit using molecular fuels, because of the higher exit velocities obtainable. Therefore, velocities permitting escape from the earth's gravitational field appear possible with reasonable mass ratios. The low specific weight of hydrogen offers a serious barrier to attaining the desired mass ratios, making the vehicle bulky and consequently unsuited for use within the atmosphere.

At this point, it should be observed that if, for example, travel outside the limits of the gravitational field of the earth were desired, and were to be accomplished with chemical rockets, mass ratios of the order of fifty or one hundred would be required. These ratios are difficult to arrive at without resorting to multi-step rockets.

As a general statement, it may be added that, because of the rather large amounts of energy peculiar to the operation of nuclear power plants, and because both reciprocating and jet type molecular engines of high power have not been developed, it would seem logical to assume that development of nuclear power plants will take the direction of larger power units. The real advantages of the use of nuclear over molecular power are in this field.

LET US now proceed to analyze, at least in theory, the case of explosive type power plants. In this case a vehicle may be envisaged which would be accelerated by energy that successive explosions makes available. Computations of the

order of magnitude of the forces involved show, on paper, that it is feasible to propel large masses beyond the gravitational field of the earth by the explosion of a few of the present-size bombs, carried by a suitable vehicle. Methods for dissipating the heat generated by the impact of fission products and radiation upon the vehicle may never be found. It is nevertheless of interest to visualize the order of magnitude of the quantities involved.

Let us assume that fissionable material for propelling the vehicle could be exploded at the rate of about 60 pounds per minute (an average of one pound per second), and that most of the energy release is manifested in kinetic energy of the recoil fragments. Each pound of fissionable matter would thus be imparted with a velocity of about 2×10^7 ft/sec. By exploding an average of 1 lb/sec., a thrust of the order of 600,000 pounds is obtained. To escape from the earth's gravitational field, the vehicle must attain a velocity of about 40,000 ft/sec. at the earth's surface. Thus, a ship weighing 100,000 pounds would be subjected to an acceleration of 5 g., or about 160 ft/sec^2. The required velocity would be attained in 250 seconds, thus requiring 250 pounds of fissionable material. This gives a mass ratio of $\frac{250}{100,000} = .0025$. Similar computations for vehicles of other sizes permit us to arrive at the following table:

MASS RATIOS OF VEHICLES

VEHICLE SIZE	50,000 TONS 100 million lbs.	500 TONS 1 million lbs.	50 TONS 100,000 lbs.
Fissionable material required to reach the velocity of escape with one explosion (Mass ratio .002)	200,000 lb.	2,000 lb.	200 lb.
Fissionable material required to reach the velocity of escape with fission time of 5000 seconds (Mass ratio .01)	1 million lb.	10,000 lb.	1,000 lb.
Fissioning rate for 5000 seconds' thrust	200 lb/sec.	2 lb/sec.	.2 lb/sec.

In the foregoing analysis, the question of adequate structural strength to withstand the explosions has been ignored in arriving at the figures for mass ratio. However,

it is conceivable that all contributing factors could be increased in proportion to size until sufficient structural strength were attained.

In view of the tremendous power available from nuclear reactions, it is of extreme importance that a drastic effort be made toward clearing our minds of concepts which are conventionally accepted at present. We are, in fact, witnessing a change which is comparable to or greater than the change from animal-drawn to engine-drawn ground transportation and from sail to power in water transportation. We should therefore not shy away from the thought of space vehicles of 50,000 tons. Surface ships for ocean travel of this order of magnitude of weight are currently in operation. We now have, potentially available, sufficient power to permit vehicles of this weight to travel through space. It would therefore seem evident that efforts to propel present-day aircraft by using liberal-size nuclear power plants may, in the future, appear as awkward as efforts to install a 100,000-HP turbine in a hundred-foot schooner.

Although the space ship discussed may be feasible on paper, the heat-dissipation problem and the phases of constructing, launching, and controlling it in space present so many unsolved engineering problems that its feasibility from a practical standpoint should be considered even more remote than that of unmanned vehicles employing smaller jet type and rocket type power plants.

The major difficulty, however, is to be found in the problem of the disposition of fissionable products. This point must be stressed with great emphasis because of the tremendous and potentially catastrophic danger existing in the handling and operation of nuclear sources of power within the atmosphere in the form of radioactivity, either direct or induced. The products of radioactive fission, if used abundantly, may cause the contamination of a particular surface area or of the atmosphere. Here is the field where atomic power plants recklessly used may do damage to their users greater than the benefits which may be derived from them. Power plants using nuclear energy within the atmosphere must be so designed that the exhaust or working fluids

do not become appreciably radioactive by the operation of the plant.

It should be re-emphasized, in the case of chemical combustion, that monoxide and dioxide gases produced by power plants or by the breathing of animals is reconverted into oxygen by the flora. On the other hand, no de-radioactivation of radioactive substances seems feasible and no chemical transformation can affect it. As a matter of fact, since the greatest volume of matter known to exist, that forming the stars, is permanently radioactive, the problem of residual radioactivity is probably the most difficult that remains to be solved in the field of nuclear energy propulsion.

In concluding, it appears that nuclear energy propulsion has all the characteristics necessary and adequate for uses outside the range of our present concepts of transportation, and that its major field of use is in extra-atmospheric propulsion of large vehicles rather than as a substitute for present-day type chemical power plants.

It is obvious that a program to provide for national air defense such as that envisioned by the Army Air Forces is expensive, but the events which highlight the evolution of Air Power have convinced a great many thinking Americans that Air Power provides the greatest amount of defense procurable for their tax dollar. The realization of this truth must be spread so that the Army Air Forces will receive the support it needs, for in the evolution of Air Power, as in the evolution of man, an unstable world permits only the survival of the fittest.

– General Carl Spaatz
in *Military Affairs* (Spring 1947)

Economic Control in a Future War

Lt. Col. Harry A. Sachaklian

OF ALL the problems confronting a nation that is contemplating or engaged in war, none is so complex and difficult as that of directing the country's economy as an element in achieving its aims.

The experience of the past war in economic mobilization has brought out clearly and in sharp focus the incontrovertible fact that large-scale warfare cannot be successfully conducted unless the full weight of a nation's strength can be marshaled and made available for war purposes with an absolute minimum of delay.

The real strength of any nation lies in its people. If the capacity of the people to produce can be trusted, full capacity can best be achieved by allowing them full latitude, within the bounds of the requirements of war, to exercise their genius for production.

The most important lesson in economic mobilization to be learned from the past war is that a free people, led but not driven, motivated by sincere conviction and not by fear of government reprisal, will voluntarily offer all the services and efficiency that can be obtained in any mass enterprise, provided the people are endowed with intelligent, firm, and forthright leadership.

Conversely, a people whose individual enterprise is stifled by government to the extent that every living minute is subjected to direction and scrutiny, a people whose whole indoctrination has been fearful or, at any rate, unquestioning obedience to official dictum, will tend to do exactly what it is told to do--and nothing more.

The choice between free and slave types of national economy for the United States in war is obvious. Even if

this nation would temporarily accept the ruthless totalitarianism imposed in other nations, there is serious reason to doubt whether men exist who have sufficient knowledge and personal capacity to administer this nation with maximum efficiency by dictatorial methods.

Free national economy in wartime must not be misinterpreted to mean unrestricted national economy. A state of war in itself imposes definite restrictions on national economy, regardless of governmental legal action. The vital urgency of total mobilization requires the imposition of economic controls by the government in order to secure the objective of maximum readiness with minimum delay. But the element of freedom cannot be denied when:

a. the controls are voluntarily granted by the people as a means of winning the war;

b. the controls can be modified, amended or completely eliminated by popular action in the manner of our tradition.

The nature of the economic controls to be imposed will naturally vary with the type of war being fought. It can be assumed, however, that any large scale warfare in the future will be one of the following two types:

a. war as in the past, characterized by the industrial might of the United States virtually unhampered by enemy action, the scene of combat being elsewhere than our own land, and with no marked change in the technology of warfare or the munitions required;

b. war based on the awe-inspiring new weapons being rapidly developed, with no part of the United States out of reach of enemy action.

Any war fought within the next few years would, in all probability, resemble the past war closely enough to utilize the pattern of and experience in economic mobilization developed in that war. If the methods of World War II are applicable to a future war, it is only reasonable to suppose that the same personnel doing the same work would do it better the second time. Every agency of the government with a war function has made some sort of analysis of its war experience, and it would not hesitate to assert that it could improve on its previous performance.

Consequently, in the event of a war in the near future, the sensible approach would be to reconstitute a war government resembling that which existed on VJ Day and reassemble the key personnel. To set up an entirely new organization, disregarding the past, would be a deterrent to accomplishment. The time required to establish working arrangements between elements would make the new bureaucracy undesirable, even if it did seem better on a chart.

Looking into the future with bifocal glasses, we see an entirely different set of conditions facing our nation as we raise our eyes from the near future and peer a little farther into the distance. Not only will the entire war technology be subject to radical change but also the personnel that manned the old establishment will be gone, leaving us virtually without restriction in the exercise of our reasoning.

LET US then develop a hypothesis concerning a situation that may face us in the years to come.

The time is April 1965. Relations with another world power are deteriorating to a critical degree. On the 19th of April, the President of the United States is to address a joint session of the Congress on a matter "of grave importance." The day arrives. With all the world in uneasy anticipation, the President, his cabinet, his military staff, and practically all the key officials of the Federal Government enter the House Chamber. At 1100 the Vice-President introduces the President, who begins to speak. At 1101 this nation no longer has a Federal Government.

Four brilliant, blinding flashes of light, followed by four thunderclaps, and Washington is destroyed. An oily, ugly mushroom of smoke pillaring up into the stratosphere forms an ephemeral monument to the Twentieth Century Carthage.

As the smoke drifts away, the world listens in appalled silence as the aggressor nation announces in a world-wide broadcast its intention to secure peace for all time by annexing the rest of the world. This nation concludes its

arrogant statement by calling on the United States to capitulate at once or have every city, town, and hamlet reduced to rubble.

The United States is then faced with its gravest crisis. It must choose immediately between destruction and slavery. If the temper of the American people as shown throughout history is any guide to the future, we can assume that this country will choose to fight, that it will prefer the possibility of annihilation to the certainty of disgrace and servitude.

The need for a central government to conduct war is obvious. We have lost ours in the destruction of Washington. Let us consider the seriousness of our being without a recognized central government.

Our hypothesis assumes that the people of the United States would not succumb to the initial shock of this attack and would rally to crush the aggressor. Individual wrath and conviction are still forceful attributes, but it must be admitted that the days of the Minute Men are long past. Though war always was and still is a conflict between peoples, the successful conduct of war demands unified, coordinated control to avert defeat, to secure economy of force, and to prevent subsequent surprise.

Anarchy is a vacuum that human nature abhors. If no leaders are provided, the people will create them. Leaders will rise in every community, large and small, with authority either by election or assumption. When we deviate from our usual practice in forming a government, it is only reasonable to expect variation in the procedures of the government. Therefore, the principal danger in the loss of the Federal Government is neither anarchy, no government at all, nor polyarchy, too many governments, all of the latter uncoordinated and even competing for the limited resources available. If we were not able to create a government immediately to replace the one lost, the situation would be ideal for the aggressor to move in and take over, with only scattered resistance to worry him.

The first step, then, excluding reprisal attacks, would appear to be a reconstitution of Federal Government that would have all the force and tradition of American law to support it. This should be prescribed in law in case such an event might occur; such a government would then be accepted by all concerned.

The hypothesis has disposed of the existing Federal Government. The need for a central government is obvious. There remains in the country only one legally constituted entity that can act in lieu of the Federal Government. That entity is the military. There is a way, within the framework of our accepted legal tradition, in which we can meet the problem of achieving national solidarity after the possible destruction of our elected government. That method is martial rule.

The very words martial law or martial rule are distasteful to the American people. The abuses of martial law in the past have given it a reputation far worse than it deserves. But when we understand that martial law is being imposed by civilian authority to restore civilian authority, it becomes much more acceptable.

How can civilian authority impose martial law after that civilian authority has been destroyed? The answer is that we should have necessary action written into the law of the land in advance of the event.

Our legal tradition already has ample, sustained precedents to permit military commanders to invoke martial law in emergencies when time or other factors beyond control make it imperative to do so without waiting for formal direction.

This authority should be amplified to permit imposition of nation-wide martial law under the circumstances described in this article. The senior surviving military commander should be empowered to declare that martial law is in effect and that the military shall act as the Federal Government until a regular civilian government can be restored under constitutional provisions.

The Trimble Bill, which will be discussed later in this article, is one approach to formalizing and specifying the procedure that should be followed.

Whether or not any such bill is passed, the military services would find a new responsibility in supporting and defending the Constitution, which they would have to administer for a time in an emergency such as the one hypothesized here. It must be emphatically pointed out that the duty of every military officer is to support and defend the Constitution. In his oath of office he has sworn to carry out this duty. The Constitution cannot be defended by violating it.

In our hypothesis, the United States, having become a battlefield, must perforce be organized as an armed camp. Under these conditions, the senior military commander has all the legal authority necessary to operate as both Chief Executive and Commander-in-Chief in the absence of the duly elected President or his legal alternate. Obviously, if the elected President or his legal alternate survived the initial attack, he could carry out the virtually unlimited war powers of the President through the use of the same medium--martial law--if his regular administration were unable to function.

The recent division of the country into six Army Areas is ideal for the imposition of martial rule. Each of these areas should be made as self-sufficient as possible in order to permit prolonged resistance regardless of the status of one or more of the other Army Areas.

Failure to achieve centralization of command of all the armed forces, as presently proposed, would increase the problems of imposing martial rule. A jurisdictional dispute between branches of the armed forces in time of such crisis would be an incredible mockery of our conviction that this country can organize to meet any emergency and continue using methods consistent with our form of government.

Federal martial rule would not necessarily contemplate any violation of the recognized rights of the sovereign states, provided that state governments could continue to

function. In fact, much of the administration of Federal martial rule could be handled by delegation to state and local governments.

The impact and realization of common peril should be sufficient to convince the majority of the people of the necessity for common action. Public opinion would militate against malefaction to such an extent that the jackals who feed on the dead and dying could best be handled by the people themselves in their own courts.

Federal martial rule should refrain from interference in the processes of justice as long as the courts could function.

The President, temporary or otherwise, would be faced with problems unparalled in history. He would have to put together a central government immediately. He would have to institute sustained reprisal action at once to lessen the ability of the enemy to wage war. He would have to organize and immediately effect the necessary economic controls enabling him to direct the nation's war effort.

THE PRINCIPAL economic problems facing the nation in such a crisis could be divided into five general types:

1. The conservation of manpower and disaster relief.
2. The reconcentration of manpower for work and the resumption of production.
3. Increasing of the armed forces.
4. Supplying of the armed forces.
5. Meeting the basic requirements for food, clothing, shelter, and transportation.

The first problem, that of conservation of manpower and disaster relief, would be the one most forcibly apparent. It is only reasonable to suppose that the first reaction of the American people in response to the awful destruction of the initial blow would be to desert the larger centers of population as rapidly as possible.

Approximately one third of our people reside in metropolitan areas large enough to be effective targets. This

means that, in 1965, fifty-five million people would flee their homes simultaneously in a crisis of the kind described here.

Mass evacuation under the pressure of fear can readily lead to extreme panic, unless the evacuation is planned and vigorously controlled.

Evacuation of the larger cities could not be prevented even if it were desirable to do so. It would seem to be only common sense to plan for such an evacuation and to set up safeguards which could be applied immediately if our population were threatened.

These evacuation plans should be prepared by the community authorities under the over-all supervision of the Army Area. They should be based on the use of local police for the control of traffic, with each community in the line of march supplying assistance in turn as the flow reached that point.

This evacuation planning should consider the volume of evacuees using motor transport, air, rail, water, and foot as means of travel. Food and emergency shelter for the evacuees must also be considered. Above all, close attention should be paid to time and space factors in order to avoid channeling into any one traffic artery more than it can carry.

Disaster relief itself is a function best planned and administered by higher levels than the community itself, since the relief will come from sources outside the stricken area. Each Army Area should have over-all responsibility to institute relief action and should utilize as much as possible the authorities and resources of the several states. (The recent tragic destruction of Texas City, Texas, offers a grim laboratory sampling of the difficulties encountered in relieving a stricken community. It should be apparent that a similar disaster on a larger scale would completely overwhelm existing disaster relief plans and agencies.)

The relocation of fifty-five million people overnight is a task that staggers the imagination. But whatever the magnitude, the problem could be faced and overcome if proper planning has been done in advance. Our traditional reliance on local and native ingenuity would be insufficient for a problem of this immensity. Such planning must be universal and correlated.

The second problem would be the reconcentration of manpower and the resumption of productive effort. The requirements for goods and services of all kinds would be unprecedented because of the tremendous displacements.

The most important industries from the standpoint of immediate need are those classified as public utilities. Electric power, telephones, radio, water and sewage systems, transportation facilities--all are vital to the problem of immediate restoration of production. These industries are so important that they would undoubtedly be subjected to repeated attacks by the enemy, either directly or through sabotage. They should, therefore, be not only manned but also guarded. Perhaps the most practical measure would be for the war government to take over these industries and exercise direct control of the management, using personnel on hand.

The fact that our centers of population are also the principal centers of production raises a difficult problem of calculated risk. It would take brave men with courageous leadership to man the comparatively vulnerable mills and factories whose production we should need so badly.

It can only be hoped that a sufficient quantity of the goods needed to meet the initial shock of this war would have already been produced and stored prior to the outbreak of hostilities, because the gearing of the nation's industry to war after the walls had begun to topple might prove to be an impossible task.

Yet, with all that, we would have to plan on production during the war. This would be war service at least as dangerous as service in the armed forces. It would seem logical, therefore, to utilize a system of selective service

for industry as well as for the armed forces. Under martial law, no further legislation would be required as the military commander is authorized to commandeer facilities and to draft labor for emergency work.

In view of the uncertain conditions, it is doubtful whether the profit-motive system of inducing efficient production would be of any value. War production in atomic war would hardly guarantee lucrative profits.

Perhaps the most workable system would be for the government to lease outright the plant and machinery and to hire or draft the labor and management required to operate the plant. The same procedure would be necessary in regard to transportation, raw materials, and power.

It would then follow that the government should take title to all raw materials, from production or stock pile, and should direct its flow from facility to facility, until the material would be converted into the finished product. This process would leave the individual plant management with production alone as its principal concern. Perhaps the simplification of the management function would make up for the loss of the profit motives.

Labor can be drafted for service in this kind of arrangement without violation of any of our existing laws or traditions. If the views expressed by the leaders of organized labor during the past war on the subject of national service are still valid, organized labor would cooperate. Since labor would not be working for private profit, and since the draft would not be confined exclusively to workers, the system of selected service discussed would meet all the objections raised to the passage of the National Service Act of 1943.

Facilities constructed underground prior to war would probably be owned or subsidized by the government. In addition to these, the government might have ownership of standby plants that are surplus from the past war. These could be manned and put into operation without the administrative problems of ownership conversion.

The taking over of other plants, now privately owned, could be accomplished by a seizure process resembling that developed by the Under Secretary of War in the recent conflict. This process revolved around the formation and briefing of operating teams in advance of the event.

Generally speaking, the production program, to be successful, must be rigidly controlled to avoid waste of resources and to secure the right kind of products in the desired priority.

If the nation could survive the initial shock of this kind of war, and if it could institute reprisal action of equal or greater force, victory would go to the nation that could best maintain productive effort despite all hazards. We are equipped to meet this crisis as well as any nation in the world, provided that we can recognize the crisis, plan for it in advance, and carry out the plan with firm decision and unflagging vigor.

The third major problem under consideration, that of increasing the armed forces, could become relatively simple if this country adopted universal military training as a national policy. Needs of the armed forces for personnel could then be met from the Organized Reserve, according to mobilization regulations.

The armed forces must not wait for their personnel to be selected, processed, and trained before being ready for use. We in this nation have these alternatives: train currently and always be ready, or train after war begins and perhaps never be ready.

It is now apparent that the line of demarcation between soldier and civilian is nebulous in time of war. There would, in this possible crisis, be many and varied military duties connected with home defense that would not necessarily require military personnel for their performance, duties such as traffic control, fire-fighting, decontamination, air-raid precautions, the manning of antiaircraft installations, emergency housing and feeding, and guarding against pilferage or sabotage. The systematic use of all

available manpower, whether in a military, quasi-military, or civilian capacity should be embodied in the same, overall logistics or economics plan.

It might simplify the problem to confine the wearing of a military uniform to those who face the enemy in actual combat. The problem then would be to increase the quasi-military organizations, such as police and other law-enforcement agencies, on a selective basis. Under martial law, we must remember, everyone is subject in varying degrees to military discipline. The real need would be to convert the nation into a People's Army by considering the entire nation as subject to mobilization according to capability.

Supplying the armed forces would, of course, require a high priority. Perhaps the first problem in supply would be transportation, as the armed forces were adjusted and deployed to meet the attack and to initiate counter blows. Those goods and personnel readied in advance would have to be moved to the points of planned use. This movement, being immediate, would undoubtedly conflict with the mass evacuations previously discussed. This emphasizes even more the urgent need for planning and controlling the inevitable rush to comparative safety. We must not forget the lesson of the refugee-packed roads of Belgium and France in the early days of the last war.

If our pre-war preparations are adequate, we should have on hand enough material to meet the all-important initial shock. Replacement supply would be the next step. Unless we are furnished with hidden, protected arsenals in peacetime, the problems of production for war previously discussed will apply. These arsenals should be geographically dispersed in order to enable each Army Area to have its own sources of war material, as each Army Area may be forced in turn to fight a private war.

The keynote in supply would seem to be movement. Though our transportation system is now the best in the world, and presumably will be even better in the future, it would be subjected to tremendous strains. The system would be jammed

with urgent shipments and, in the first few days, probably also with refugees. We must expect the enemy to intensify the problem by relentless attacks on critical points of the system.

The fifth and last principal economic problem would be the meeting of basic requirements for food, clothing, and shelter. This problem is a part of all the problems already mentioned. People, in or out of armies, must have these three things in order to live and to work and to fight. If these are not adequately provided, we can expect people to do everything in their power to secure what they need, and more, if they can. Food riots on a large scale are novelties only to this country, and only because the circumstances that produce them have never been present for long.

Government ownership of existing stocks of food and clothing would seem to be imperative. Government ownership or leasing of available shelter would be equally imperative. If we assumed control of the raw materials that directly go into production, we could hardly ignore the raw materials that go to the producers, and that must go to the producers to keep them functioning.

These commodities should, of course, be rationed. It might even be desirable and necessary to issue them free of charge. If we take this action for granted as far as military personnel are concerned, is it so far-fetched to include the entire population? After all, we are talking about total mobilization, in which every one has a part to play. Who can safely say that one group is of more importance than another in the over-all war problem and consequently should be assured the necessities of life? It would seem simpler and certainly more popular to assume that the government of the people, whose sole reason for existence is to protect the people, should extend that protection to include the necessities of life.

In a discussion of this nature, the problem of cost, or war finance, is bound to arise. It would seem that the time to reckon cost is before embarking on a course leading to war. But once the decision to fight is made, cost matters

only in terms of resources and lives expended. It is certain that if this nation ran out of dollars, but still had bullets, it would keep on shooting.

Let us consider for a moment what would happen to the financial structure of the nation in atomic war. About 85% of the money in circulation is concentrated in New York, Chicago, and San Francisco. About 90% of the money listed as in circulation is actually in bank vaults or on deposit. If these centers of exchange and credit were blasted out of existence, the entire financial system would crumble overnight. There would be a currency shortage that would be felt at once. The destruction of the cities would annihilate records of transactions, evidence of credits, the currency itself, and the whole complicated means of doing business.

If the commodities of food, clothing, and shelter were for sale only, most people would be without them because of lack of currency. Under pressures of this kind, currency itself often becomes inflated to the point of meaninglessness. Currency is of value only for what it buys. If you cannot replace the item, you cannot use the money. We would witness, in an emergency of this kind, a nation-wide unofficial barter system that would operate to the extreme detriment of the majority of the population and would be especially difficult for evacuees.

The last war taught us that black markets are impossible to control. It would seem the better part of wisdom, then, to assure the people fair and immediate quantities of the necessities of life, by direct issue.

This leads to the thought that when currency is deemed valueless, we have the most effective way ever created to control the drafting of personnel. No work, no food. It is a far cry from the colony at Jamestown, but it is essentially the same problem.

We could solve, in a sense, the problem of war finance by not having any. All labor would be uncompensated in a monetary way, but necessities of life would be furnished. No contracts for production or purchase would be needed,

since goods and facilities would be either commandeered or leased, or acquired under the Law of Eminent Domain. Leasing and the use of the right of eminent domain require just compensation, but this compensation could be deferred until the end of the war.

IN THE event of defeat, the problem of disposing of and dissolving the martial rule imposed at the beginning of this hypothetical war would be superfluous. The victorious enemy would, no doubt, have much to say in this matter.

In the event of victory, strong pressures would be exerted to depose the emergency government, a symbol of the hardships and misery of the war. The real problem would be to establish an orderly procedure for this transfer of authority.

Since martial law would have been imposed because of the lack of civilian authority, the first post-war step should be to reconstitute a Federal Government as quickly as possible. There is no precedent or provision of law for the dissolution of martial law as imposed in this hypothesis, although there is legal authority for its original inception. There is no overriding civilian authority, except the basic sovereignty of the people, to declare the termination of emergency government.

Congressman Trimble of Arkansas has introduced a bill to prescribe such procedure. He proposes a Constitutional Amendment to authorize the following steps in case the Federal Government is destroyed:

1. The Army and Navy would name an interim President.
2. This President would call a conference of state governors.
3. They would choose two of their number to complete the unexpired terms of the deceased President and Vice-President.
4. Congressmen killed or incapacitated would be replaced by state legislators.
5. A new site for the national capitol would be chosen.

The Trimble Bill is one approach to the problem. Though there will probably be much disagreement as to the details, the general idea appears sound. It would seem that the war problem would be so urgent and crucial that there would not be time to take these steps. It might be more advantageous to continue the senior military commander as President until a new President and Vice-President could be elected according to existing constitutional procedures.

Since the crisis of war as envisaged herein would preclude regular presidential elections during the course of the struggle, it would seem more desirable to retain martial rule throughout, in order to achieve relative stability of government. Yet, since the sovereignty of the people must be maintained, dissolution of martial rule should be authorized by election within the states, with three-fourths of the states concurring, as in the case of amendments to the Constitution. This action should be made possible at any time, regardless of conditions. The United States neither wants nor needs any set of governmental controls which it cannot abolish by legal ballot.

The restoration of peace and the transfer of government into civilian hands would confront the incoming administration with problems at least as staggering as those which faced the military commander at the outset of the war.

In this period the military would be called to account for its actions during the war. It is a precept of martial law that every member of the armed forces is personally liable for his actions during martial rule. He can be called to account in both civil and criminal courts. Action under orders from superior officers is not considered a defense if the orders are found to be illegal.

This knowledge should tend to make the actions of the military under martial rule reasonable. Under martial law, the military commander may take any action he sees fit on the grounds of urgent necessity, but he must justify his actions later.

The measures proposed here are anything but desperate measures designed to meet a desperate situation. The defects in such an emergency system are so glaring that it could not stand without the pressure of common peril and without the urgency in a situation wherein the Federal Government is rendered incapable of functioning.

There will be much opposition in this country to the principle of martial rule. Yet it would be criminal to subject our people to the possibility of annihilation unless we were determined to win regardless of cost. To sacrifice many people on a question of principle does not defend the principle; it merely kills many people.

In the field of education the Army Air Forces is now committed to a program of training which will greatly strengthen its organization. Through the medium of the Air University an educational program is about to begin which will provide for basic training as well as advanced strategy and logistics. An Army Air Forces Institute of Technology functions as part of the university structure. It is hoped that these institutions will provide officers and men with an opportunity for professional improvement and constitute a means of selecting for further training personnel with special aptitude or outstanding intellect.

The Army Air Forces has the responsibility of encouraging its best men with every available means to take advantage of these educational opportunities. Candidates for technical training must be offered a long-term incentive.

- General H. H. Arnold in *Air Affairs* (December 1946)

SELECTING TARGET SYSTEMS AND TARGETS

Colonel John H. deRussy

THE MAJOR part of the USAAF operations in the European Theater from August 1942 to June 1943, except for the training and experience gained, was wasted effort. The Overall Economic Effects Division of the United States Strategic Bombing Survey, in its report on *The Effects of Strategic Bombing on the German War Economy*, stated: "Prior to the summer of 1943, air raids had no appreciable effect either on German munitions production or on the national output in general. . . . small delays were caused by the late 1942 and early 1943 campaigns against submarine production. But . . . it is impossible to conclude that either submarine production or munitions output as a whole was any smaller as a result of air raids than it would have been otherwise."

In these campaigns tons of bombs were dropped on submarine pens, but they were not materially damaged. Valuable aircraft and precious lives were lost, to say nothing of ammunition and fuel, without appreciable gain. As these bombings continued, enemy submarine warfare also continued, practically unabated. In May 1943, sea victories indicated that detecting and sinking submarines at sea was far more effective and economical than bombing submarine pens.

In September 1944, the United States 3rd Army under General Patton had surged from St. Lo across France to a line running through Metz and Thionville. There it met stubborn resistance from German troops in the forts around Metz. One fort in particular, Driant, was causing General Patton delay. He requested General Doolittle to send the 8th Air Force to Metz so that the 3rd Army-8th Air Force Team could reduce Fort Driant.

This fort was constructed underground with relatively small gun cupolas above the surface. It was known in the 8th

Air Force that heavy bombers could not hope to effect any material damage to the fort or to the soldiers within it. Yet the priority mission of the Air Force at that time was to give all possible direct assistance to the Ground Forces.

The fort was attacked by heavy bombers in coordination with the 3rd Army advance. The Ground Force attack was successful and the Army said that the bombing was of some assistance in bolstering the morale of the attacking ground troops, but it was later proved that the Air Force did little damage to the fort. Though the Air Force losses in aircraft and personnel were not great, the effort expended at Fort Driant would have contributed more to the over-all war effort -- and to the Ground Forces themselves -- if it had been directed against a more profitable target.

In both instances, the targets selected were not suitable for air attack with the equipment available, and the results obtained did not justify the effort expended. These experiences emphasize the importance of the selection of target systems and targets. It is certain that anyone who has been in a position where he was required to plan operational missions, to select targets, and to send men out to attack them, has wished that he could be more certain that the destruction of the target selected would be worth the expected loss.

Target systems and targets may be separated into many types and categories. When viewed from the standpoint of their effect upon surface operations, they fall into two categories, which we have in the past called tactical and strategic targets. Since these words leave much to the imagination, more precise definitions of our two categories of target systems and targets will be used in this article.

The first type includes targets whose destruction will affect surface operations directly and immediately, though limited in scope and time. These might be compared to the tentacles of an octopus. We nip off the ends to prevent them from interfering with immediate local operations. Hence our effect is immediate, direct, and local -- the octopus as a whole continues to live and grow. Many attacks against these

tentacles will be required before we finally reach the vitals which will destroy the octopus.

In this category we find: enemy troop, supply, artillery, and armor concentrations; oil, fuel, and ammunition dumps in the combat area; forward enemy airfields; rail bridges, lines, heads, and yards leading into the combat area; highways and highway bridges; and, in the case of amphibious operations, enemy traffic in sea and air lanes. An outstanding example of operations against this type of target was the complete stalling of the German Ardennes offensive by the annihilation of the supply and communications lines upon which the German armies were dependent. Such targets normally fall within the scope of that part of Air Power engaged in direct cooperation with surface forces.

The second type may be defined as targets whose destruction will affect surface operations no less directly--the results are less immediate but more encompassing and enduring. These targets might be considered as forming the heart of the octopus. Here he can be mortally wounded. It is true he will be tough, but once his vitals are destroyed, the tentacles wilt and die. The effects are not at once felt at the extremities of the tentacles, which wilt gradually from the body outward. The tentacles may even thrash about after death, but they will soon die completely.

Targets in this category include: factories producing oil, rubber, ball bearings, aircraft, steel, armor, and munitions; entire transportation systems; machine-tool and other industries -- the vitals of the enemy's war effort.

It is imperative to emphasize the importance of considering thoroughly the over-all war plan before permitting the force assigned to destroy these targets to deviate from its primary objective. At times, that part of Air Power primarily engaged in the destruction of the enemy's basic military strength is requested to depart from these primary target systems to attack the extremities of the octopus' tentacles. These requests require careful analysis of the results expected. The fact that it will require a great amount of steady pounding at the heart of the octopus to

drive home the mortal blow must be duly considered -- one day's respite may permit him to recuperate, thus immeasurably lengthening the time before the tentacles will die.

The targets selected in these instances will frequently be unsuitable for attack by heavy bombers or perhaps by aircraft of any type. In these situations, the commander's ability to analyze, evaluate, and select target systems and targets will meet the acid test. He must remember that only in instances when the surface action is expected to produce results decisive in the over-all war plan is such employment of Air Power justified, and that the utmost discretion must be used in the analysis, evaluation, and selection of target systems.

THESE TWO categories of targets require different approaches to the problem of selection. The first type will not permit pre-selection since the choice of targets is entirely dependent upon the tactical situation of the surface forces. Selections, then, must be made on the spot and consequently originate with the air commander responsible for coordination with the surface forces. The second type of target demands pre-selection made with due consideration of the over-all strategy of the war plan. Initial selections in this case are made on a level where such plans are available. This may be at the level of the Joint Chiefs of Staff, perhaps at an even higher level in the case of the atomic bomb.

It has been explained that targets in the first category must be selected on the spot by the responsible air commander. The directive received by this commander is very broad. A typical directive might read, "To cooperate with Surface Force A (which might be Army, Navy or amphibious) in its campaign to capture objective B, 500 miles to the east." No reference is made to target systems or targets, and the commander is left with much leeway and great responsibilities. It will be noted that he is charged "to cooperate with Surface Force A," which limits his targets to those which he must attack to assist the surface force commander in attaining his objective. It will also be noted that the air commander is further limited to cooperating with Surface Force

A only in its campaign to capture objective B, which is itself limited to "500 miles to the east." This broad directive is issued because the selection of target systems and targets in this category cannot be controlled by a distant headquarters.

The requirements for attack often change daily and even hourly with the situation of the surface forces. The air commander and the commander of the surface force must constantly work together and coordinate their efforts. The general procedure recommended for selecting targets in this type of operation is for the surface force commander to keep the air commander informed of his over-all plans and of any changes that may become necessary, and then to permit the air commander to select the target systems and targets which he knows he can attack most effectively to further the efforts of the surface force. From time to time there will also be special targets which the surface force commander will request the air commander to attack. Such targets usually arise when the surface forces are confronted with some unexpectedly effective enemy opposition or installation which they feel the Air Force could readily remove. Frequently, either such targets are not suitable for air attack or the effort required to attack them may have to be withdrawn from some more important objective. Here the coordination between the surface force and the air commander should be perfect, for together they must analyze the situation carefully and use the utmost discretion in selecting such targets.

The selection of target systems and targets in the second category is made on a higher level. In World War II general target-system directives were issued, such as the one which emerged from the Casablanca Conference. The general list of targets was broken down by the Commanding General, Army Air Forces or by the Theater Air Force commander, into individual targets, in order of priority, before being sent to the numbered Air Force commanders.

The Air Force has now organized a system of target selection which will be much more accurate and effective. The development of a directive to a numbered Air Force engaged

in the destruction of the enemy's basic military strength begins in the Strategic Vulnerability Branch of AC/AS-2. This staff will produce two definite target systems, one to be used for an area bombing attack and the other for a pinpoint or industrial bombing attack. These two systems, together with target priorities within the systems, will be furnished to the Air Force. In a national emergency, then, the numbered Air Force commanders will be given these two systems of targets, together with all the necessary operational target charts. As these targets will be already classified as to priority when they reach the commanders, the commanders will need only to consider operational factors in executing the attacks.

Now, what are the problems with which the air commander is confronted in his selection of target systems and targets? The Commanding General of an air force engaged in direct cooperation with surface forces has received a broad directive from the Theater Air Command to cooperate with Surface Force A. Assume that he is a commander who knows the capabilities of his own force; that the surface force commander is cooperating closely with him and hence he is familiar with the complete plans, situation, and capabilities of this force; and that he has superior Intelligence sources which have advised him of the composition, capabilities, and situation of the opposing enemy forces. Therefore, he knows his mission and he knows the capabilities of his forces,-- the two basic controlling factors which must be considered in selecting target systems and targets.

From the analysis of these factors, this commander selects target systems and targets whose destruction will cause maximum embarrassment to enemy forces and will consequently be of greatest assistance to the surface force in attaining its objective.

In this analysis the commander should consider:

(1) Depth -- in relation to the timing of surface force operations. The effects anticipated from the destruction of the targets must coincide with the time that those effects are desired by the surface force.

(2) Dispersion -- the target systems must not be so dispersed that they will require too great an effort for the returns expected.

(3) Cushioning -- if the target selected were destroyed, could the enemy replace it from another source before the benefit of its destruction was realized by the surface forces?

(4) Vulnerability -- is the target so protected that weapons available to the Tactical Air Command cannot reach it? Is it so effectively defended that the attack will be too costly for the returns expected? Will it require the least effort to attain the desired result?

(5) Recuperation -- what are the powers of recuperation of the target? In the case of personnel, can they recuperate from the effects of bombing before the surface force can take advantage of those effects? In the case of a bridge, can it be completely destroyed with the weapons available, or could it be readily repaired after the attack?

(6) Reserve -- does the enemy have so large a reserve that enough of it cannot be destroyed to achieve the desired results?

(7) Effective bombing range -- it is obvious that if the distance to the target is so great that the aircraft available cannot carry an effective bomb load to it, it is not worth the effort.

NEXT, let us examine the methods of selection employed by the Air Force engaged in destruction of the enemy's basic military strength. The target systems and targets for this air force are selected by the Strategic Vulnerability Branch of AC/AS-2. Dr. James Lowe, of that Branch, has explained the principles it employs in selecting targets for this air force. He submits that: the first limiting factor in target analysis is the capabilities of the attacking air force; the second limiting factor is the mission of the attacking air force; and in selecting a target system for industry, seven principle factors are involved: depth, dispersion, cushioning, vulnerability, recuperation, reserve, and effective bombing range.

To return to the air force previously discussed, and to its selection of targets, it will be remembered that the

commanding general considered: (1) the capabilities of his own forces; (2) the mission assigned to him by the Theater Air Command directive; (3) depth -- the timing of target attack; (4) dispersion of the target system; (5) cushioning within the target systems; (6) vulnerability of the target systems and targets; (7) recuperative powers of the target system; (8) reserve within the system; and (9) effective bombing range.

Thus we see that target systems and targets, from the standpoint of their effect upon surface operations, may be divided into two categories: the first including those targets whose destruction will have effects upon surface operations, effects which are direct and immediate, though limited in scope (troop concentrations, ammunition and fuel dumps, etc. -- the tentacles of the octopus); the second including those targets whose destruction will have effects upon surface operations which, while no less direct, are less immediate and more encompassing and enduring (industry, economy, etc. -- the heart of the octopus). These targets respectively come within the scope of that part of Air Power engaged in direct cooperation with surface forces and that part of Air Power engaged in the destruction of the enemy's basic military strength. The mechanics by which target systems and targets in the two categories are selected must be different, the first category being selected by the air commander and the surface force commander, working closely together, and the second category being selected on a much higher level -- the Strategic Vulnerability Branch of AC/AS-2. *But*, finally, the *basic factors* which must be considered in selecting target systems and targets -- the capabilities of the air force concerned, the mission of the air force, depth, dispersion, cushioning, vulnerability, recuperation, reserve, and effective bombing range of the target -- are *identical*.

Within this list the only variable factors are the capabilities of the air force and the mission of the air force. The difference in capabilities between the two air forces considered are obvious and require no explanation, but there may be a need for some elaboration in regard to the different missions of these two forces relative to

coordination with surface operations. To see these in terms of the octopus metaphor, the typical mission of the first force considered is to cooperate with Surface Force A in fighting its way gradually up the tentacle. Together they bite off a piece of tentacle, rest and reform, bite off another piece, and so on. In accomplishing this, the air force in question is confronted with a daily task of selecting new targets of many different kinds. It may select anything that will assist the surface force in furthering the completion of its mission -- *provided* the targets selected satisfy the conditions of our basic principles.

The other air force, conversely, is charged with pounding at the heart of the octopus until it is mortally wounded. The selection of targets in this heart area, though initially requiring an immense amount of work in a complete analysis of the industrial and economic systems of the enemy nation, does not require daily selection of new targets. We must decide, through exhaustive study and surveillance prior to a war, exactly which target systems and targets will require the least effort to attain the desired results. These the air force commander is directed to attack. Thereafter, his only concern in the selection of targets is tactical considerations.

NOW LET us look into the selection of target systems and targets relative to coordination of air with surface operations in the future.

There are, first of all, the nine basic factors pointed out by Dr. Lowe. These factors must be considered, regardless of the nature of the target being analyzed.

Second, there is the fact that destruction by that part of our Air Power engaged in attacks against the enemy's basic military strength -- those target systems and targets selected by the Strategic Vulnerability Branch of AC/AS-2 -- will in the long run have greater effect upon surface operations than the destruction of any targets at the ends of the tentacles.

Third, it should be remembered that, only in instances where there is a high degree of certainty that the surface action will produce decisive results in the over-all war plan (the complete severance of the tentacles and gaining access to the heart and vitals of our octopus), is it justifiable to divert this force from its primary objective of pounding at the vitals.

Fourth, target systems and targets for that part of our Air Power engaged in direct cooperation with surface forces cannot be pre-selected. Selection is entirely dependent upon the surface force situation and hence can be decided only in conjunction with the planning of surface operations.

Fifth, whereas target systems for that part of our Air Power charged with the destruction of the enemy's basic military strength must be pre-selected, the final decision on the one or two systems which will be singled out for destruction must wait until the coming of war. The situation of any system relative to our basic factors may change with time and circumstances.

This discussion of the problem of selection of target systems and targets has covered the classification of targets according to their effect upon surface operations, the mechanics of target selection, the factors which must be considered in target selection, a summary of these basic factors and, finally, the future of the selection of targets.

Career development is in line with our realization that our educational procedures must be geared to global concepts of war and peace. It is not enough for airmen to be technicians. They must be versed in human affairs; they must understand the political, social, and economic aspects of international relations. They must be educated to the standard required by the history-changing rôle of Air Power.

— Major General F. L. Anderson,
in an address delivered at the
Air University (7 October 1946)

NEW WORLDS FOR OLD:
TRANSPORTATION AND HUMAN HORIZONS

Major William E. Johnson

WE FIND ourselves today in the midst of a great historical transition. Nations that were once great are broken; a new world and a new order of things is taking shape. Perhaps if we view some of the highlights of history, emphasizing the part that transportation has played in changing man's world and his geographical and political horizons, we may better understand the significance of this transition and our relation to it.

Civilization began with settled life on the fertile soil of the great river basins, the Hwang Ho and the Yangtze valleys of China, the Indus-Ganges valleys of India, the Euphrates-Tigris valley of the Middle East, and the Nile valley of Egypt.

The Asiatic river basins of China, India, and the Middle East, that cradled early civilizations, were separated by rugged terrain. The difficulties of land travel, afoot or mounted, made river travel the most practical form of transportation, especially for bulky material. Consequently, these civilizations spread along the river valleys rather than overland. Seafaring was not extensive, for the rivers emptied into the open ocean or its major arms, where heavy seas, and tides ranging from 10 to 25 feet, discouraged river boatmen from venturing forth in their small craft.

These Asiatic civilizations were thus confined to their respective valleys for many centuries. During their formative years they were denied contact with other developing civilizations, and their local limited form of civilization became stabilized long before intercourse with other cultures was established. The inertia of this fixed, stagnant attitude of

Asiatics, acquired through several milleniums of isolation, is still in evidence.

In Egypt, on the other hand, the great Nile river leads to the almost tideless, inland Mediterranean Sea. Here, river boats could venture forth with comparative safety and land almost anywhere in case of storm. The many sheltered bays and minor seas, the numerous islands and promontories, facilitated travel across great distances. Thus the Mediterranean became the nursery of seamen and an inviting avenue of early marine commerce.

Cretans from the Aegean area were trading with the Egyptians in the second millenium B. C. During this period Phoenicians from the Middle East sailed the length of the Mediterranean with their trading ships. By 1,000 B. C., the Greeks, bringing iron with them, came down from the north and settled in the Aegean area and later spread their colonial and commercial activities over a large part of the Mediterranean. Then the Romans, taking full advantage of the transportation potentials of this great sea, in the 1st Century B. C. extended their empire over the entire basin.

No other area where civilization began provided such an easy transition from river to sea navigation, or such a marvelous avenue of communication between so many early settlements. The Mediterranean became the center of the world's most rapid advance in civilization and took the lead in world history, primarily because of its superior transportation facilities.

Even after the collapse of the Roman Empire, the center of civilization remained in the Mediterranean until the 16th Century, when a great advance in transportation gave the advantage to the Atlantic seaboard. This came about through the brilliance and foresight of Prince Henry of Portugal, who saw the great economic advantage that would accrue to his country if he could develop an all-sea route

to the Far East. Ship bottoms could haul more goods from the Orient than Arabian pack animals could carry across the land barrier of the Middle East to the merchant princes of Venice and Genoa.

To implement this idea, Prince Henry developed the technique of deep-sea navigation and taught it to Portuguese mariners. Portuguese seamen then began to explore the nearby Atlantic and to sail down the coasts of Africa. Vasco da Gama finally went around the Cape of Good Hope and reached India in 1497.

Columbus, a Genoese navigator, added another idea to Prince Henry's deep-sea navigation. He left the known routes and struck due west for the Orient. En route, he stumbled onto a new world. Thus Prince Henry and Columbus ended the shore-bound world of the Middle Ages and opened a new era. They laid the foundation of what we yesterday called the modern world.

Man's world and his conception of geography had never changed so rapidly as during the century following Columbus. The European world was turned inside out. The Mediterranean, for three thousand years the center of civilization, culture, and power, now lapsed into decadence. Leadership passed to the nations on the Atlantic because of this new transportation development, deep-sea navigation.

Britain, formerly a back-street nation in the Mediterranean World, now found herself occupying a choice site on the main street of a new world. The nations on the Atlantic front rapidly acquired overseas empires, wealth and power. This era of colonial expansion and exploitation, based on marine commerce and sea power, continued for four centuries.

The railroad era of transportation began in the 1830's. The great interiors of the continents could be adequately developed only after the coming of the railroad. Before this period the majority of peoples, owing to their lack of

adequate interior transportation, had been forced to cling to the tidewater fringes of the continents and to the navigable rivers.

The Germans, an interior people, remained a loose confederation of small medieval principalities, about the size of our counties, until the development of railroads implemented their unification. Bismarck accomplished political unification by means of the Franco-Prussian war in 1870, after which Germany as a nation was born.

Russia, another interior country, did not even have the advantage of hard roads, owing to the lack of stones in the populated flatlands west of the Urals. In the middle of the last century Russia hired Major James Whistler, an American Army engineer and father of the artist, to build her railroads. However, Russia did not build railroads nearly so rapidly as Germany, and even today her transportation is far from adequate. Owing to lack of good internal transportation, Russia's emergence from medieval status began only late in the 19th Century, and today that emergence is not yet complete.

China has remained a medieval nation up to the present day, because of inadequate transportation facilities. Her greatest need today is transportation. Not until that is adequately developed can she ever be properly integrated as a nation. The foregoing has indicated what a tremendous influence transportation, or the lack of it, has had on man's world and his geographical and political horizons.

NOW WE face another great transportation era with implications as radical as the changes that followed Columbus. Air Power has developed carrying capacity, speed, and range that wipe out the physical barriers of yesterday--distance, oceans, deserts, mountains, and even the arctic wastes. River boatmen opened up river valleys. Sea commerce opened up the tidewater fringes of continents and the sea lanes.

Railroads opened up interior areas. However, only air transportation goes along a universal avenue common to all places and all people. No people, no place, no treasure of the earth is now remote. All are within a few hours' reach. A new world of new relationships and new values lies ahead.

Each new expansion created the need for an instrument that would relate man to his enlarged horizon. *Only a map could fill this need* and enable him to form adequate concepts upon which to base operations in his newly-expanded world. In fact, maps were such a fundamental requisite in relating man to his environment that map-making among primitive people antedates the art of writing and recorded history. Maps have run the gamut from sketches in sand, on bark, stone, and clay tablets, to parchment maps and finally to the multicolored printed maps of today.

In 1569 Mercator designed his east-and-west representation of the world to meet the needs of the deep-sea mariners that followed Columbus. Since that date for nearly 400 years of the "Marine Age" our thoughts on world relationships have been moulded by Mercator's east-and-west world concept. It has been spread before us in our geographies and atlases, on hand maps and wall maps, and has created a yardstick in the back of our minds that we unconsciously apply to every thought on geographic relationships. When a place in Europe is mentioned we Americans reach eastward mentally. For a place in Asia our thoughts reach westward.

At the end of World War I this east-and-west world concept was still valid. Land power on the continents and sea power between the continents provided the balance of power between the nations of the world. To attack an enemy on another continent, sea power was necessary to project land power across the water.

By the end of World War II, however, the range, speed and carrying capacity of Air Power had developed so greatly

as to make it apparent that in any future war a devastating attack can be launched by Air Power alone, from one continent, against an enemy on another continent. If it should be necessary to transport armies, the critical forces and their supplies may well be moved by air. These considerations demand a complete revision of our geographical thinking. We must cultivate a new world concept based on global great-circle relationships between the nations.

The special map supplement accompanying this issue contains charts illustrating these great-circle relationships. The first of these charts to be considered, the *Azimuthal Equidistant Map of the World*, is centered on the United States and shows these relationships from the standpoint of our country. Here we see that the great Eurasian continent, with its vital concentrations of population and industry, lies closer to America by air across the arctic than it does by the old east-and-west ocean routes. Every industrial country is now within reach of the long-range Air Power of every other industrial country. America is wide open across the top of the world.

For centuries the arctic basin was regarded as worthless. The arctic has now become one of the world's most important strategic areas. A huge ice pack covers the Arctic ocean and extends over the bordering seas from shore to shore in the winter except where warm currents from the Gulf Stream flow into the arctic basin, maintaining open water off northwestern Europe to the Murman coast of Russia. The polar ice cap melts sufficiently in summer, around its perimeter, to permit reinforced ships to navigate along the Eurasian Coast. On the American side, however, icebreakers are required to force passage between the Canadian islands in the warmest months. This great ice pack rotates slowly from east to west. The stress and strain of this motion builds great pressure ridges in some areas while it opens up crevasses elsewhere. Precipitation over most of the arctic is very light, being less than ten inches and as little as two inches in some places.

The importance of the polar basin in today's air age is best illustrated by distance values:

TRANSPOLAR DISTANCE RELATIONSHIPS

Point of Origin	Distance in Nautical Miles	Area Covered
FROM EURASIA		
Iceland	2,700	Canada; Industrial U.S.A. from Washington to Chicago
Spitzbergen	3,200	Same as above
Eastern Siberia	3,500	Industrial Canada; all of U.S.A. except extreme Southeast portion
Murmansk	3,700	Canada; Northeastern industrial U.S.A.
FROM NORTH AMERICA		
Iceland	2,200	Most of Europe, three major industrial complexes of U.S.S.R. - Don, Moscow, Urals
Pearyland, Greenland	2,300	Same as above
Thule, Greenland	2,900	Same as above
Bluie West 8, Greenland	3,300	Same as above, including Siberian complexes
Point Barrow, Alaska	3,800	Industrial complexes of Japan, Manchuria, Central Siberia, Urals, Don, Moscow
Northern Maine	4,000	Industrial complexes of Europe, Moscow, Don, Urals

It will be seen why Greenland, Iceland, and Spitzbergen are the objective prizes of arctic geopolitics. We hold limited transit rights in Iceland as long as our occupation forces are in Germany. In Greenland we still technically hold several airfields.

If we divide the arctic "pie" by the longitudinal extent of each nation's arctic holdings, then the Russian slice is by far the largest, nearly 160° wide. Canada comes next with an 81° slice. Norway and Denmark divide 92° between them. The U. S. slice is a 27½° sector based on the width of upper Alaska.

Just as England found herself favored by geographical location with a choice site on the Atlantic front at the beginning of the marine age, now Russia is favored with the

choice geopolitical location for the new air age and with the choice portion of the new arctic frontier. The United States, on the other hand, is still isolated geographically without the advantages that isolation gave during the past 150 years. The oceans that once protected us now offer concealment to long-range supersubmarines that can attack our coasts and deny the sea to our surface vessels. The American arctic is a barren wasteland: the United States' portion is narrow, and the farthest removed from the vital areas of potential enemies.

On the Eurasian side, the Russians are making every effort to develop the economic potential of their arctic front, in order to make it as nearly self-sustaining as possible. The Russian Northern Sea Route Administration takes full advantage of the open water season and maintains steamer service from Murmansk to Vladivostok for three months every year. From Murmansk westward the Russians' arctic waters are open the year round for shipping or for long-range submarine operation. Three great navigable rivers, the Ob, the Yenesei, and the Lena, traverse Siberia from south to north. These and several secondary navigable rivers transport timber and other raw material from this vast interior to the arctic coast for steamer pickup. The Russians are developing farms, industries, ports and airways here, as well as exploring and exploiting their northern mineral resources. This arctic economic program is developing arctic equipment, operational capacity and the know-how.

WE THUS find ourselves in a new geopolitical era in which Air Power becomes, by virtue of geography, if for no other reason, America's primary weapon. To meet the requirements of this age, Air Power requires curricula of its own, geared to global concepts. Airmen must now be versed in world affairs -- in the physical, climatic, human, social, political, and economic aspects of nations, in order to keep abreast of the history-changing role of Air Power.

One phase of the curriculum formulated to accomplish this objective has been the inauguration of a Global Chart Program by the Air War College. A map or a chart is a

fundamental and primary aid to sound strategic thinking in peace or war. Neither sound concepts nor efficient operations, whether diplomatic, economic, or military, are possible without adequate maps of appropriate design. Because maps that would meet these requirements were practically nonexistent, the Air War College has been developing a series of charts centered on the north pole. These global charts are designed to reorient the minds of Air Force officers from the inherited east-and-west world concept to the realistic global concept of today. At the same time these maps present in graphic form the basic physical, climatic, human, economic, and transportation factors of world geography that may limit, condition, or aid diplomatic, economic, or military operations. The charts will not only permit rapid comprehension of geography in general, but they will also permit a quick analysis of any region selected for consideration, and serve as a guide to further research.

Designed as instruments to aid thought, these maps make the maximum use of the principles of graphic education, employing color and graphic expression to facilitate easy understanding and interpretation of the geography of countries and regions.

The advance edition covers the northern hemisphere only. Later, the series will be extended to include the southern hemisphere. Twelve charts of the advanced edition have been produced in wall size, 36" square, by the Aeronautical Chart Service. These charts should be on the walls of the buildings in every airfield and army post in the country, not only for convenient reference purposes, but also because their continual presence will make this global world picture and concept a familiar part of the permanent mental equipment of every officer. An understanding of the global relationships between nations will promote sound thinking in the Atomic Air Age. The map supplement to this issue of the AIR UNIVERSITY QUARTERLY REVIEW contains the twelve War College charts, in 18" hand size for individual use.

The first chart in the series is GH-1, *Political and Time Chart*. It shows countries in contrasting colors and provides a quick grasp of their global relationships. The

Standard Time Zones of the world are shown with a numbering system that permits comparisons of time from place to place.

The second chart, *Physical Relief*, GH-2, indicates the varying altitudes of the land areas and the depths of the oceans, with color layers representing intervals of altitude. This chart shows at a glance the great lowland areas, the great upland and mountainous areas, and the characteristic variations in relief of the continents.

Chart GH-3 shows *Temperature Provinces and Ocean Currents*. A comparison between this chart and the *Physical Relief Chart* will show that although the temperature provinces are primarily related to latitude, warmest near the equator and coldest near the pole, they are also markedly modified by the highlands of the world. Note how the warm climate of India stops abruptly at the Himalaya mountains, how much colder the high mountainous plateau of Tibet is than adjoining areas of similar latitude. Also, see how the warm ocean currents of the North Atlantic bring a mild climate to western Europe, whereas Labrador, in the same latitude, is cold because of cold currents flowing from the north down the east coast of North America.

Annual Precipitation, Chart GH-4, indicates the variation in rainfall from region to region. When this is compared with the two preceding charts, the influence of both relief and temperature on rainfall is evident. Prevailing and seasonal winds also have a marked effect on precipitation. The prevailing westerly winds of the North Atlantic bring considerable precipitation to Europe. Likewise, the westerly winds of the North Pacific bring rain to the upper west coast of North America, where the high mountains absorb most of it on their western slopes (Charts AU-50, GH-10 and GH-11 show prevailing and seasonal winds).

Asia, during the summer months, builds up a semi-permanent seasonal low pressure area along its southern reaches (Chart GH-11), drawing in the surface winds from the ocean in a counter-clockwise motion, producing heavy monsoon rains. In winter, Asia reverses this process, cooling off excessively and creating in central Asia a semi-permanent

high pressure area of cold, dry descending air, contributing to the desert character of this region, and causing the surface winds to flow outward toward the sea in winter (Chart GH-10). In North America and Europe, the high and low pressure areas in the path of the prevailing westerly winds move in a generally easterly direction. In the lower mid-latitudes on the east side of continents, the trade winds tend to bring rain from an easterly direction (Charts AU-50 and GH-10). Chart AU-50 shows how the air circulation of the world would move if the earth's surface were smooth and uniform and rotating with its axis perpendicular to its orbit. Charts GH-10 and 11 show the effect of the unequal distribution of the great land and water masses and the seasons on the atomspheric pressure areas and winds.

Chart GH-5 represents *Climatic Regions*. These regions are the result of the relief, temperature characteristics, and rainfall of various areas, modified by the effect of the season of rainfall. These factors determine to a large degree the vegetative and agricultural potentials of the respective areas, as well as their desirability or deficiency from the standpoint of human habitation.

The *Vegetation Chart*, GH-6, is logically next in the series, since the geographic factors shown on the preceding charts determine the type of vegetation. "Tropical Rain and Monsoon Forests" occur in the heavy rainfall areas of the tropic regions. "Prairie, Steppe, and Savannas" exist where the rainfall is either very moderate or very unequal at different seasons. "Thorn, Brush and Scrub" vegetation is found in sparse rainfall areas, and "Tundra" in the far north where precipitation is light and the hemisphere is cold.

Density of Population, on Chart GH-7, brings out clearly the great concentrations of population in China, India, Europe, and the eastern United States. Reference to the *Physical Chart* will show that the bulk of the population lives in the great lowlands of less than 2,000 feet altitude.

The next chart, GH-8, shows some of the principal *Economic Activities* of humanity. Red color brings out clearly the pre-war areas of concentrated "Manufacturing and Commerce." The primary and secondary meat-producing areas are

shown by brown dotted areas. Notice how the density of population on the preceding map coincides with the industrial and food-producing areas and how both are in areas of relatively low altitude and climatically desirable.

The unequal distribution of *Transportation* is well illustrated on Chart GH-9. We are inclined to take transportation for granted in the United States. This chart shows that areas without adequate transportation greatly exceed those that are well served.

In summary, it may be stated that transportation has been the key to the expansion of human horizons and political domination through the ages. New transportation developments have upset the world several times in history, relegating powerful nations to the background and bringing others into prominence. Again transportation is remodelling the world. Air Power has thrust us into the global great-circle world of the air age, which is replacing the east-and-west mercator world of the marine age.

The maps of the Air War College Global Chart Program may be obtained on request from the Aeronautical Chart Service, Headquarters, Air Transport Command, Washington, D. C. They are supplied both in the 18" size contained in the appendix to this issue of the AIR UNIVERSITY QUARTERLY REVIEW, and in the 36" wall-map size. They are furnished without cost to military personnel, who may also obtain them from Post Intelligence officers or through the Map Section of Operations at air bases.

The fighting plane and the bomber, ever on the alert and in scattered formation when resting on their bases furnish the only hope of defense for Pearl Harbor. If our warships there were to be found bottled up in a surprise attack from the air and our airplanes destroyed on the ground nothing but a miracle would help us to hold our Far East possessions.

– Brig. Gen. William Mitchell, in a posthumous essay (written about 1935)

EDITORIAL

The AIR UNIVERSITY QUARTERLY REVIEW was established by Major General Fairchild's memorandum of 27 February 1947, which reads in part:

"This journal of Air Power will not be just another news-magazine, nor is it intended as a periodical of interest only to the Air University. Rather, it will be a professional publication in the highest sense of the word and will reflect not only the high scholastic standards and educational accomplishments of the Air University, but also --and more important, perhaps--the best professional thought concerning global concepts and doctrines of air strategy and tactics.

"Thus, in certain respects, the AIR UNIVERSITY QUARTERLY REVIEW will be an extension of the concepts and doctrines developed at the Air University and which underlie its program of instruction. Articles published in the journal will be confined to subjects related generally to Air Power and its application, and appropriate emphasis will be placed upon the trends of technological development and their indicated effects on military aviation of the future.

"Contributors should bear in mind that articles submitted for publication must represent a significant contribution to present thought concerning Air Power, and that they are not to be merely narrative or anecdotal in form, or devoted to technical matters of relatively minor importance.

"I feel sure that to have an article published in this journal of Air Power will be considered a mark of distinction to the credit of Army Air Forces officers and other contributors."

The Commanding General's statement defined the scope and purpose of the AIR UNIVERSITY QUARTERLY REVIEW. A journal devoted to Air Power, one of the dominant subjects of this epoch, has long been needed, and it is appropriate that the Air University sponsor a publication of this kind.

The first issue has come out during the current academic year in order that students may receive copies before leaving the Air University. It will be possible for them to provide locally a valuable critical response to the publication.

This journal includes not only a principal complement of articles but also other departments containing material of interest to Air Force readers. The latest books on aviation are discussed in *Airman's Reading* and, as it is important for airmen to be informed on world affairs, there are also reviews of new volumes on such subjects as political science, economics, sociology, and international relations. In this issue several books published at least a year ago have been included among the more recent items, in order to suggest to those interested a well-rounded library of post-war material; in future numbers, only current books will be discussed.

Another department features some of the important utterances that have been made about Air Power in the past. In this issue, the emphasis in the *Air Anthology* section is on some notable prophecies; future numbers will present selections from the classics of air literature. An additional department, *Foreign Horizons*, prints examples of some of the latest thinking on Air Power in other countries. In the present issue, this section features a report of recent discussions about the RAF in the British Parliament, discussions carried on with exemplary frankness. Americans will

observe some striking similarities to the problems of their own Air Force.

At present, the QUARTERLY REVIEW is distributed chiefly within the Air University. This does not mean that its intention or its range of interest is parochial. On the contrary, the journal will provide a valuable line of communication between the Air University and the rest of the Air Force. Some of the results of concentrated study at this educational center will, through this medium, reach other Commands--and important Air Force thinking on the outside will be brought into the Air University.

As the reader will observe, both technical and non-technical articles appear in these pages. This journal is equally interested in, say, an article on future plans for guided missiles and one on problems of leadership in an Air Command. The important consideration is significance of treatment.

Members of the Editorial Board thoroughly review all manuscripts submitted. In the process of preparing each number, the Board may be compelled to reject or postpone publication of excellent and normally suitable material in order to preserve a balance of contents.

The problem of keeping in the vanguard of the best military thinking and research and at the same time avoiding dissemination of classified material is a delicate one, but the QUARTERLY REVIEW intends to solve this problem as successfully as other non-restricted military publications have done. Contributors should consider the pertinent paragraphs of Army Regulations 600-700, in regard to security and the standards of propriety and good taste.

Another point which must be made clear is that *articles appearing in this journal reflect the authors' opinions and*

do not necessarily coincide with, nor are they those of the War Department; of Headquarters, Army Air Forces; or of the Air University.

The Editor and the Editorial Board wish to encourage new thinking. Consequently, if the appearance here of articles which may not agree with accepted policy, or even with majority opinion, will stimulate discussion and provoke controversy, an important part of this journal's mission will have been accomplished: to induce airmen to have original thoughts on these matters and to give these thoughts expression.

Correspondence and articles attempting to controvert any of the material published in these pages will be welcomed. The Editorial Board hopes that Air Force personnel, both on active and inactive status, will, as a matter of pride of arms, give the AIR UNIVERSITY QUARTERLY REVIEW the first opportunity to present their original thinking on the subject of Air Power.

In civil life, professors, doctors, scientists, and other specialized experts are proud to have their writings appear in professional journals. It is hoped that, in similar fashion, Air Force personnel will use the QUARTERLY REVIEW as a forum for scholarly discussions of their own significant subject--Air Power.

Response to the current issue will be an important factor in determining the future of this journal. Its readers of today should become its contributors of tomorrow. Certainly an Air Force of this magnitude has enough men of ideas with something important to say, and the eloquence with which to say it: their contribution can help make the AIR UNIVERSITY QUARTERLY REVIEW a journal of global significance.

AIR ANTHOLOGY

Some Prophecies

THE USES of such a Chariot may be various; besides the discoveries which might thereby be made in the lunary world; It would be serviceable also for the conveyance of a man to any remote place of this earth: as suppose to the Indies or Antipodes. For when once it was elevated for some few miles, so as to be above that orb of magnetick virtue, which is carried about by the earth's diurnall revolution, it might then be very easily and speedily directed to any particular place of this great globe.

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It would be one great advantage in this kind of travelling, that one should be perfectly freed from all inconveniences of ways or weather, not having any extremity of heat or cold, or tempests to molest him, this aethereall air being perpetually in an equal temper and calmnesse. The upper parts of the world are always quiet and serene, no winds and blustring there, they are these lower cloudy regions that are so full of tempests and combustion.

– John Wilkins, *Mathematicall Magick* (1648)

For I dipt into the future, far as human eye could see,
Saw the Vision of the world, and all the wonder that would be;
Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down the costly bales;
Heard the heavens fill with shouting, and there rain'd a ghastly dew
From the nations' airy navies grappling in the central blue;
Far along the world-wide whisper of the south-wind rushing warm,
With the standards of the peoples plunging thro' the thunderstorm;

Till the war-drum throbb'd no longer, and the battle-flags were furl'd
In the Parliament of man, the Federation of the world.
- Alfred Tennyson, from *Locksley Hall* (1842)

IF THERE BE a domineering, tyrant thought, it is the conception that the problem of flight may be solved by man. When once this idea has invaded the brain it possesses it exclusively. It becomes a haunting thought, a walking nightmare impossible to shake. And if we consider the pitying contempt in which such a line of research is held, we may conceive the unhappy lot of the poor investigator whose soul is thus possessed. Many of them, either through pride or through timidity, have withdrawn themselves from human intercourse, and thus have found themselves paralyzed attempting to carry on their researches in secret.

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But finally let us admit that the problem has been solved, and let us speculate upon the effects on society. Let us begin with property. Property will be riven with an enormous gap. With the patent insufficiency of enclosure, with intrusion into the privacy of homes - hedges and walls will no longer be of service. The enclosure under the roof will be incomplete. And all this will constitute a curtailment of the privileges of possession, a diminished efficiency of barriers.

What of the collectors of customs and the police in the presence of this new mode of locomotion? What will these officers do when they must watch the air, that immense pathway some four or five miles high? During the day it may be possible to fancy some partly satisfactory surveillance; with a large force, good telescopes, fast cruisers of the air, we might perhaps exercise some control; but at night what is to be done? How can we bar the empire of the air? How can we so much as watch it when opaque fog annihilates the effect of electric reflectors?

With the suppression of the custom-house what will become of revenues and the balancing of the budget? These

disturbances to property, to customs, to the police, are mere bagatelles when compared to the revolution that will result in political matters. All will have to be done over again; the fortifications, the maneuvers, the defenses of the frontiers, strategy, all is reduced to nothing. It will even cause, in a very short time, the suppression of nationalities; and races will be rapidly commingled or destroyed, for there will no longer be efficient barriers, not even that movable barrier which we call an army. No more frontiers! No more insular seclusion! No more fortifications! Will society perish?

As to the procedure that society will adopt to conform to this new mode of existence, I have not the least idea, yet it may be affirmed that society will emerge victorious from the struggle. After the cataclysm caused by injured interests, a period of restored equilibrium will follow; and in the end, at the expense of a time of distress, humanity will enter into possession of the empire of the air.

– L. P. Mouillard, *The Empire of the Air* (1881)

OUR DESCENDENTS will certainly attempt journeys to other members of the Solar system....

By 2030 the first preparations for the first attempt to to reach Mars may perhaps be under consideration. The hardy individuals who form the personnel of the expedition will be sent forth in a machine propelled like a rocket; and equipped with a number of light masts which can be quickly extended, like fishing rods, from its nose. The purpose of these will be to break the impact with which, granted all possible skill and luck, the projectile would strike the surface of the planet.

The great problem which such an expedition will face, however, is the possibility of missing Mars altogether; and, having escaped from the Earth's gravitational field, of wandering aimlessly through space unable to find a planet where they can hope for asylum. Such a fate, indeed, may well overtake the first half-dozen expeditions which set out

from the Earth to reach Mars. But, one day, a few men may arrive alive on the surface of our nearest neighbor in space. It seems unlikely that they can long hope to survive there, far less that they will be able to return to their home on the Earth. The most for which they can hope, will be to send back across the ether a few messages of information concerning Martian conditions; to transmit the results of a dozen accurate scientific observations before they perish. I should not myself be a volunteer member of that party.

The fruit of their messages, and of their death, will be new expeditions, better equipped, better prepared to withstand the physical difficulties of life on another planet, and bearing with them in their flying machines the materials to erect another smaller machine on the surface of Mars. Into this, bearing with them the records of their experiments and observations, but jettisoning the rest of their equipment and apparatus, the survivors of the later expeditions may retreat, and so hope to regain the Earth.

This outline of the exploration of Mars is admittedly fantastic, but can we be quite sure that it is unconceivable? It is typical of the spirit in which the man of science goes to work when he is faced by a difficult as well as a highly perilous adventure. In such circumstances he values his own life no more than an ant. So long as the human race reaches the goal towards which he strives to impel its reluctant inertia, he cares little what happens to his own life and fortunes. He is as altruistic as the first Christian Martyrs; and, it may be suggested without offence, his altruism is calculated to secure even more substantial benefits for his fellow-men. At all events we may be sure that, when expeditions to Mars first become dimly practicable, there will be devoted and highly skilled men prepared to risk certain death in the hope that, by so doing, they can add to the total of human knowledge.

- The Earl of Birkenhead, *World in 2030* (1930)

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FOREIGN HORIZONS

DEBATING THE AIR ESTIMATES

An article redacted from *The Aeroplane* (London), 28 March 1947. (AAF used here represents Auxiliary Air Force; ATC, Air Training Corps.)

DEBATE ON the Air Estimates in the House of Commons on March 17 was shorter than usual and was notable for the useful contribution by Members of the House who served in the Royal Air Force during the War 1939-45.

Mr. P. Noel-Baker, the Secretary of State for Air, in his opening statement said that we were confronted by two unknowns - what new weapons the scientists and technicians might develop, and what the political structure of the world was going to be. Aircraft faster than sound, pilotless aircraft, guided rockets, and homing missiles by which aircraft could attack each other, were all round the corner. The system of collective defense under consideration by the United Nations must affect the general future of the RAF who, if that system succeeded, would play a vital part.

The Air Minister quoted Lord Tedder as having said that the last war was not modern but already out of date, and went on to recall the various phases in that war in which the air arm was the dominant factor. After the Battle of Britain the enemy was forced back from our shores over the enemy's shipping, his ports, railways and factories, until, as a German General said, a decisive battle was fought out over Germany's vital living space. The enemy was strangled for lack of supplies in the Western Desert and then Tunisia, and in Burma Air Power was again the dominant factor. Some days before the D-Day invasion, the railway traffic in France had been reduced by 87 per cent, and soon after D-Day air attacks on the oil industry had caused a loss of 90 per cent. The fact that Air Power could be a decisive factor in defense or offense was no longer a theory but a hard fact.

The present strength of the RAF was 330,000, and would be 315,000 by March, 1948. The money estimate for 1946-47 is £255 million. That includes £80 million on terminal charges and excludes certain services and supplies, particularly aircraft which were not carried on the Air Ministry vote last year. For this year the comparable figure is £127 million. For this money, the RAF is now rendering productive peace-time service to the nation. Sea, rail and road transport has been scarce and air transport has brought many men home for demobilization, and 600,000 displaced persons were returned to their homes within a few weeks of the end of the fighting.

Air Commodore Harvey (Conservative, Macclesfield) asked how many squadrons could be put into the air on an operational basis. The Air Force was our front line of defense, and he hoped that, even under pressure from the other services, the Minister of Defense would see that it got its proper share of funds.

He thought it very unfair that service personnel should have their allowances taxed; £5 8s. 6d. a week was not enough for a technical flight sergeant, a skilled man with a great responsibility. How insignificant a sum was £500 to allot the RAF for languages.

The Auxiliary Air Force was a good investment, and he would like to see 40 instead of 20 squadrons. He would like to know more about the air defense units of the Auxiliary Air Force and the RAF Regiment. More attention should be paid to the ATC, and the officers should do two or three weeks' service every year with a regular or AAF squadron.

The country could not afford the swollen staffs of the Air Ministry - 11,383 to administer 370,000. We do not see the pictures taken by the 70 photographers, nor does the Air Force get much publicity. He considered the meteorological forecasts were consistently wrong. The cost of the Works Staff was £2 million, and accomodation in the Air Force was not good. He would like to know how many airmen's married quarters had been completed in this country; £28 millions for buildings and airfields was a great deal of money, and

he would like to know how many of the war-time airfields would be retained by the RAF. The cost of educational services at £70,000 seemed very small.

He agreed that the RAF uniform, particularly that of the WAAF, needed smartening up, but he suggested that if the bulk of the money was to be spent on redesigning and altering the uniform, this could wait another 12 months because civilians are in desperate need of clothes.

He would like to know what was being done about aircraft types other than fighters, whether the squadrons got enough flying time and the pilots enough flying experience. He thought we ought to get bigger contributions from the Dominions and Colonies for training their people. He would like to see auxiliary squadrons formed at such places as Hong Kong, Ceylon and Singapore.

Group Captain Wilcock (Labor, Derby) criticized the Meteorological Service, particularly the staff of 600 in London, and said that meteorological facilities in Africa are appalling. He thought the Air Force should convey more passengers by air and less by sea and rail. He believed it would be better policy to shorten the tours of duty overseas than to spend money sending families overseas, especially as only five per cent of the married men could expect to get their families abroad with them. What proportion of the £43 million was going towards a new transport aircraft and with what types were the new bomber squadron to be equipped?

He expressed anxiety about the liaison between the RAF, the Fleet Air Arm and Civil Aviation in the matter of supply of aircraft. If the Fleet Air Arm was to continue, he hoped there was no overlapping. He hoped the Minister of Defense would consider whether the RAF should not take over those duties now being done by the Fleet Air Arm.

He recommended that the Air Force should be regarded as two dependent parts. The overseas element should be a mobile, hard-hitting force stripped of everything that would make it immobile and overseas service should be of short duration. The home element should have comfortable quarters for married and single men.

Mr. Gerald Williams (Cons., Tonbridge) said we wanted fighting men and instruments of attack. We must prune out the parasites. If the atom bomb was to be used we must have something to carry it. A real striking force of bombers kept in this country would be the greatest insurance against the use of the atom bomb. Bombers could be directed anywhere that danger threatens and were an admirable weapon against small troubles in distant parts of the Empire. He asked how many squadrons we have now and was it greater or less than at the beginning of the last war. There were plenty of men at the Air Ministry, at Commands and Groups, but what we wanted was men in the air.

Wing Commander Millington (Lab., Chelmsford) asked for encouragement for closer understanding between officers and other ranks and better leadership in the RAF and said that aircrews were given no disciplinary or welfare authority. He recommended a cut in the numbers of the Air Force and more encouragement for the Air Training Corps.

One of the dangers in service life was that when an officer reaches a sufficiently high rank to direct the strategy of the service he tends to pin his faith to the weapon he commanded in the field about 25 years earlier. He spoke of difficulties in co-operation with the Navy, the fine work of the Meteorological Service, the valuable help in famine relief and said, finally, that he hoped the RAF would be the first Service to be used for international police duties.

Mr. Hollis (Cons., Devizes) attacked the Air Ministry vote and said there was an optimum figure beyond which an increase in bureaucracy makes for inefficiency. There should be a drastic comb-out of Air Ministry personnel. He asked for more information about photographers, horticultural advisers, meteorological services, typists and schoolmistresses.

Mrs. Nichol (Lab., Bradford N.), who moved an amendment regarding the WAAF, spoke with considerable knowledge of the Women's Service and took the opportunity to recall the variety and efficiency of their work in a number of trades.

She welcomed the Government's decision to keep the Women's Services as a permanent part of the Armed Forces, but expressed concern that at present there are no terms of service.

Mr. Harold Macmillan (Cons., Bromley) said that because of taxation of allowances, officers were worse off than they were under the old rates of pay. He also asked for details of the training of the Auxiliary, and Voluntary Reserves, criticized the size of the staff at the Air Ministry and was surprised at the cost of movements. He did not see why the Air Force should carry the cost of Polish Resettlement Corps and he thought Transport Command should have only one function, to move troops. He was not happy about the Ministry of Supply, there was a grave danger in separating, in the use of weapons, the user and the manufacturer too far.

Mr. Geoffrey deFreitas, the Under-Secretary of State for Air, said that University Squadrons of the RAF Voluntary Reserve began recruiting last October. Recruiting for ex-pilots for the VR began on March 15 and the first four civil schools start refresher training next month. Recruiting of ex-navigators and other aircrew will begin in May or June. There will be 20 flying squadrons of the AAF, and also ground squadrons and units of the VR. Twenty Auxiliary Air Force Regiment light anti-aircraft squadrons will be formed and linked with the flying squadrons. Ultimately, there will be a place in Reserve Command for every ex-RAF man. All proficient ATC Cadets are now guaranteed entry into the RAF.

The Manpower Economy Committee will be turned on to the Air Ministry when it has finished with the RAF. A year ago 20 per cent of the RAF squadrons were transport squadrons, today 24 per cent are transport squadrons. The clothing requests are only a fair share of the nation's resources. The increased sum for movements is caused by the reintroduction of inter-departmental accounting. We are getting more transport aircraft, the "Valetta," a military version of the "Viking," the "Hastings," a heavier transport, and the "Shackleton" for long-range maritime operations.

Southern Rhodesia is contributing £250,000, men and materials towards training our Air Force overseas. In Japan there are RAF, Royal Australian Air Force, Royal New Zealand Air Force and Royal Indian Air Force squadrons.

A small part of the Air Estimates will be used for an experiment in the peace-time international command of a fighting force.

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A BOOK ABOUT AIR POWER

A book review reprinted from *Royal Air Force Review*, February 1947.

Bomber Offensive, by Marshal of the RAF Sir Arthur Harris.

WHATEVER your feelings before reading *Bomber Offensive* (Collins, 21s.) they are unlikely to be anything but violently partisan when you lay it down. You either agree, or you disagree: there is no middle way because Marshal of the RAF Harris knows no middle way. As dogmatic in his writing as he was bulldog-like in his bombing policy against Germany, he raises controversial issues which we who stand so near to the event cannot see clearly enough to judge. History alone can give an objective verdict.

It is worth while quoting at the outset that "the decision to build a great force of bombers for strategic attack on industries and communications was made long before the war; the prototype of four-engined bombers we used against Germany was designed in 1935, which gives some idea of how long it takes to organize a bomber force. The decision to attack large industrial areas instead of key factories was made before I became Commander-in-Chief."

He believed, and never wavered in his belief, that the heavy bomber was the predominant weapon of the 1939-45 War, both for its wide destructive power and no less for its saving indirectly innumerable lives of our own soldiers, sailors and civilians. He condemns both the Germans and the Japanese

for letting their other two Services control air policy, until "much too late in the day they saw the advantage of strategic bombing," and from this points his moral for the future. "I myself regard the bomber as having had its day in the last war." In the next war, though the broad strategy of which he was the enthusiastic exponent will remain the same, "it will be as fatal to rely on an antiquated weapon as to have no weapons at all."

Fierce in his loyalties and ready to give honor where his admiration lies, Bomber Harris is scathing where he suspects incompetence or the parochial spirit. His comments on particular persons are worth recording. From among others I pick two:

"Portal had great strength, though he seldom showed it. His intellectual powers were outstanding; nobody could be more lucid; nobody could write a better minute. And he was a fighting man through and through, in spite of his quiet and modest manner."

"When it was very properly decided that all Air Power necessary for the invasion should be placed at the disposal of Eisenhower, he, being a wise and immensely understanding man, promptly transferred control to an airman--Tedder." The plan of disrupting the enemy's communications, the most complicated problem of the Normandy campaign, "was entirely the conception of Tedder, who certainly has one of the most brilliant minds in any of the services."

Bomber Harris's story, after three introductory chapters (in which he describes his rise from a bugler in the South African Horse to the heights of a Commander-in-Chief) covers Bomber Command's exploits under his direction from February, 1942, until the end of the war. From Tromso to Turin, from Brest to Berlin, his aircraft struck, attacking the German navy and U-boat pens, breeching the Mohne and Eder dams, fighting the Battle of the Ruhr, giving close support to the Army, battering enemy industries, mining enemy waters.

Airman's Reading

The Social Effects of Aviation, by William Fielding Ogburn (Houghton Mifflin, $5)

Reviewed by
Charles M. Thomas

SOCIETY has been revolutionized several times by the introduction of new transportation systems. The horse, the railroad, and the automobile, each had profound effects upon civilization. Within the lifetime of a single generation the automobile revolutionized transportation, influenced the distribution of population, stimulated new industries, modified national and local governments, affected church attendance, provided means for consolidating school systems, and changed the habits of courtship. Emphasis on speed led to general adoption of the principle that rapid action is of higher value than contemplation. And, as a by-product of the automobile age, the self-starter contributed something toward the emancipation of woman.

Foresight could have mitigated the impact of the automobile on our society. This book attempts to foresee the changes coming because of aviation.

Reliable predictions may not always be possible, but there are some things that can be estimated quite accurately. Life insurance companies have evaluated component factors until they can now foretell how many people will die in a given year. It is likewise possible to determine the additional ton-miles of tomatoes that will be shipped by air express in the United States as the cost of air transportation declines cent by cent.

The author of this book, Dr. Ogburn, is a sociologist at the University of Chicago, where with a small expert staff, financed by an outright grant made by United Air

Lines, he studied nearly every phase of his subject, paying particular attention to its social and economic implications. Only aviation as it affects future wars was omitted from consideration, and this was done because technological developments in that field are surrounded with secrecy.

It is possible to predict many of the economic effects of aviation during the next ten or twenty years with a fair degree of accuracy. The cost of operating airlines at any given future date cannot now be predicted with exactness but the probable maximum and minimum costs can be closely estimated. Having made these estimates, Dr. Ogburn spares no efforts in applying them to the known conditions affecting each major industry in the United States. Some two hundred pages of analyses reveal aviation's probable effect on railroads, ocean shipping, manufacturing, marketing, mining, real estate, newspapers, agriculture, forestry, and stock raising. This book is the only available source for much of the data necessary for this type of planning. The feasible ton-mile air express rate is still the unknown factor for any future year. He who calculates that correctly can fill in the rest of the equations without the use of a crystal ball.

It is safer to predict the economic and industrial effects of aviation than it is to speculate about its influence on religion. It took a sociologist to hazard an estimate of its effect upon the future of the American family, population changes, development of cities, public health, recreation, crime, education, public administration, and international relations. Even a sociologist, however, may be wrong in many of these forecasts. The reader is conscious of the author's own uncertainty when he is dealing with these problems.

Dr. Ogburn and his staff believe that many of the social implications of aviation will remain unfulfilled unless a practical and dependable helicopter is developed. Seventy-one references to rotary-wing aircraft indicate the degree to which the thinking of the social scientists has been influenced by the concept of an airplane that can hover steadily or land vertically.

The one-third of this volume which is devoted to a summary of the development of aviation contributes nothing new by way of interpretation, but is perhaps necessary as an orientation for the lay reader.

A bibliography of recent literature and an excellent index contribute much to the reference value of this study.

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The Air Weapon, 1914-1916 (Vol. II of Winged Mars), by John R. Cuneo (Military Service Publishing Company, $3)

Reviewed by
W.O'D. Pierce

THE air weapon is now a lusty offspring. The growing pains of World War I are over and the vigorous adolescent of World War II has demonstrated the military effectiveness of Air Power. Even the so-called "absolute weapon," the atomic bomb, was delivered by airplane on both occasions of its operational use. The growth of the air arm has taken place inside thirty years, if the date of the first heavy raids over Germany may be regarded as the coming of age of the adolescent. Can such an adolescent have a history? Is the history of value in the study of military strategy and tactics? This book answers these questions in the affirmative by showing the value of a comprehensive and critical analysis of the air arm in World War I.

In fact, we find that the air weapon not only has a history but that it has accumulated a striking mythology with a fantasy life of its own. As the author writes:

> This series is primarily an attempt to ascertain the true rôle of the air weapon in warfare. A search for a satisfactory account has only revealed that most air power books are long on colorful imagination but short on evidence. Bias seems to be the chief basis for the conclusions of various authors. The proof of the assertions is not supported by details but by the authority implicit in the rank or name of the writers...It is the type of writing which apparently impelled the editors of *The Infantry Journal* to express the opinion that some of the air weapon's loudest supporters have not had the scientific integrity required

> to weigh its worth in war. To my mind it is not merely the lack of scientific integrity but the absence of intellectual integrity.

Part I of the text discusses tactical operations over land on all fronts, including the Balkans, during the period 1914-1916. Part II deals with air operations at sea in all major areas during that period, and the third part is concerned with the start of strategic air operations in the bombing of Great Britain and Paris, as well as the reply bombing of Germany. The history of air warfare is integrated against a background of land and sea battles. The development of aircraft artillery, range-finding devices, and the manuals for reconnaissance operations between the primitive air force and land troops are all discussed, revealing the careful detail which the author has used in building up his critical analysis. The bibliography is good and the valuable notes contain some of the best parts of the author's discussion.

Many old theories are reinforced, such as the neglect of the air arm in World War I, which all writers have emphasized. Few writers, however, have shown that even in the area of reconnaissance in which the air arm was accepted by all armies, there was an almost complete neglect of an effective signaling system by which messages could be transmitted from air to land and that few staffs had, until a late date, specialists who could interpret aerial photographs when they were sent in from reconnaissance squadrons. The rejection of the air arm was expressed in this failure to prepare it for an accepted function.

The author has a marked tendency to discount the actual effect of many war developments because of his detailed analysis of the matériel situation, carefully constructed from the study of documents. It does not matter from the point of view of the actual war situation whether there were only approximately 40 Fokkers in action in early 1916, or that the British official air historian is correct in stating that, "good as the Fokker was, and resourceful as were its pilots, its moral effect, when it was in the heyday of its superiority, was far greater than its actual success justified."

Wars are won or lost only because the morale of one side has collapsed. The collapse of morale is generally closely related to military success and failure, even in the effect of a specific battle or campaign. The winning of the war is the basic factor, and the attitude created by a weapon at a particular time and place is the true value of that weapon, no matter what the relative quantities of men and equipment may have been. The facts of the historian are the dead facts of the past and not the live though apparently "untrue" facts of the battle. The issue is always decided by the morale situation which arises out of the struggle. The clear realization of the importance of morale is vital to the American people because of their tendency to assume that victory in war is brought about by technology rather than the determination and will to fight of the human beings who direct or who carry out the application of the technical, military end-products.

It would be quite unfair to suggest that the author neglects the morale factor. He has many striking examples of its importance. But there is a weakness in the book which occurs on many occasions, as when the author says:

> I would have preferred to set down my conclusions without details -- not only are they easier to write but they are easier to read and lend themselves more readily to an orderly exposition of the text. But generalizations without proof are so frequent in air literature that a student of warfare is justified in approaching any book on the subject with suspicion.

It may be suggested that an author's duty is to give the details and the conclusions so that both are available to the reader. It is hoped that this author will start his next volume with a summary of the basic conclusions in the present volume and that he will continue to supply the reader with logical and systematic reviews, as well as his detailed exposition, at regular intervals.

This comment should not obscure the fact that *The Air Weapon, 1914-1916* and its continuing volumes will be required reading in the military colleges not only of the Air Force but of all other armed services where the evaluation

of an integrated air arm must be a major part of the study of a unified war doctrine. It is the great merit of this work that the air weapon is discussed in the total setting of warfare, both on land and sea, and not as an isolated factor. This book is an indication that the mythology and fantasy which developed with this infant are being dispelled so that the real effectiveness of Air Power as one factor in a total war can become apparent. The grim reality of this power is impressive enough to satisfy even the most ardent advocate of the air weapon.

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Mahan On Sea Power, by William E. Livezey (Univ. of Oklahoma, $3.50).

A Guide To Naval Strategy, by Bernard Brodie (Princeton Univ., $2.75).

The Navy's Air War, by the Naval Aviation History Unit; edited by A.R. Buchanan, Lieut., USNR (Harper, $3.50).

The Battle For Leyte Gulf, by C. Vann Woodward (Macmillan, $4).

Reviewed by
Willard J. Suits, Captain, USN

IN these days of emphasis on unity in the national defense, these readable books are logical sources for understanding, and for the indoctrination of the Air Force reader they offer a basic and chronological grounding of the rôle played by the modern Navy. Their coverage extends from aspects of naval strategy, with related national and international applications, down to the tactical methods featured in the greatest sea battle of history.

Mr. Livezey in his new book on Mahan has presented a masterful appraisal of Mahan's ideas and a modernized estimate of their influence upon world events. The author has attained his objective in offering an analytical, critical, evaluative, and impartial treatment of this man who was one of the most important figures of recent times, who was an outstanding navalist, philosopher of force, strategist, expansionist, and publicist-propagandist.

The title of the book may create an erroneous impression as to the scope of Mahan's offerings, since his works were directed to many other endeavors than merely supplying the sound basis for all thought on naval and maritime affairs from 1895 to the present time. He sought to link national policy and national defense and, further, as precessor of Sir Halford Mackinder and the preceptor of Karl Haushofer, he was a geopolitical thinker long before that expression was first coined. Mahan had a definite if somewhat illogical doctrine of power -- a philosophy of force. As the author relates, if Mahan did not deify force, glorify expansion, and make war moral and beneficent, his expression on these topics brings him very close to such views. With reference to Mahan's concepts of international relations, he had this to say on arbitration: "The great danger of arbitration, which threatens even the cause it seeks to maintain, is that it may lead men to tamper with equity, to compromise with unrighteousness, soothing their conscience with the belief that war is so entirely wrong, that beside it, no other tolerated evil is wrong."

The climax of interest for the reader is reached in the last two chapters. Here, the author performs an evaluation of Mahan's navalistic and nationalistic concepts as applied to global events of today. He recognizes the long-enduring concepts of naval strategy, as advocated by Mahan, which will be maintained until the surface ship loses its utility; but he is most critical of the application of Mahan's philosophy of force to global problems. He emphasizes its weakness and inadequacy in preventing global turmoil -- he deprecates its pessimistic nature, which is contrary to the objective of the concerted efforts of the current United Nations instrumentalities. The author advocates, instead, a return to earnest realism.

Mr. Livezey has accomplished a most distinctive work, which will be of absorbing interest to those tolerant searchers for principles of international comity.

The current revision of Dr. Brodie's logical narrative contains a most helpful appraisal of modern naval strategy.

The book analyzes the importance of naval sea and naval Air Power in furthering national policy.

The Air Force reader will be particularly interested in the chapter dealing with the "Air Arm of Sea Power," which treats of the naval airplane not as Air Power compared with Sea Power, but as an air-striking arm of Sea Power which gives to naval operations an effectiveness never before realized. But the author also recognizes that "there is one kind of military force which can legitimately be called Air Power in contradistinction to Land or Sea Power, the kind used in strategic bombing, and that "it is necessary . . . to consider it in the light of wholly new concepts of tactics and strategy." The author sometimes burdens the narrative and obscures the leading features with too broad a coverage but, nevertheless, the book is packed with interesting logic.

Dr. Brodie, with the aid of this much-quoted source-book and his subsequent *The Absolute Weapon* (published by Harcourt, Brace), has acquired a reputation as an expositor of modern naval and national strategy.

The Navy's Air War is destined to become a comprehensive and circumscribing source book on the inception and attainments of Naval Air, for it is compiled from official records by a service activity. It is an excellent exposition on the development of this instrument of Sea Power from pioneer days to the present, when it has taken a dominant position in the team of Sea Power, and an action record of Naval Air in war.

The reviewer predicts that *The Battle for Leyte Gulf* will immediately and enduringly serve as one of the basic reference books for the greatest naval battle of all time. This battle will replace Jutland as a subject of future study and tantalizing conjecture, for its phases were marked not only by instances of classic strategy, clever deception, and reckless sacrifice, but also happenings that verged upon the ridiculous and the astounding. Eighteenth-century tactical maneuvers of Admiral Rodney's day were rejuvenated, aircraft carriers shorn of their air strength were committed in battle as decoys, and a distinctive "jeep" carrier group,

faced with destruction, opposed a Japanese battle force in which was included the heaviest-gunned superbattleship of all time. These are only a few of the inspiring episodes packed into this evaluated and comprehensive narrative.

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The Art of Flight Instruction, by Edward C. Bailly, Jr. (Harper, $3).

Reviewed by
Noel F. Parrish, Colonel, AC

THE flying instructor, unlike the classroom instructor, cannot resort to such phrases as "a broad general idea," and "good background information" to justify time wasted on non-essentials. He must produce results rapidly or terminate the instructor-student relationship. Results depend entirely upon his quick success with trial-and-error methods, aided only by advice from other instructors and a generally accepted system which was also developed by trial and error over the past twenty years.

Though the flying instructor is far ahead of the average classroom teacher in recognizing that a student's mind is an active machine rather than a soaking sponge, psychologists and educators have said very little about his work. Some day they will get around to examining this high-pressure learning process, which bares more of a man's soul than a bottle of Bourbon, and they will derive as well as provide much useful information.

In the meantime Mr. Bailly's sensible survey of teaching in a slip-stream helps to fill a great gap in the basic literature of flying. His thoughtful and sympathetic discussion of the complex problem of emancipating a man from the ground stamps him as a successful student of human behavior who can also remember and explain his observations for the benefit of others. *The Art of Flight Instruction* deals with the most interesting and personal phase -- primary instruction. It was obviously thought out in the air by an instructor of long experience who must have worn a notebook on his knee, and it will interest anyone who is attracted by the title.

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Rockets and Space Travel, by Willie Ley

THIS is a new edition of Willie Ley's standard book on the subject of rocket developments. It contains a great amount of new material which did not appear in the 1944 edition. Besides tracing the history of rocket development, this book relates with brevity and accuracy the principal German, American, British, and Russian achievements in this field during World War II. Willie Ley writes with both authority and distinction, and handles the subject in an interesting manner. Military instructors and students, as well as every officer who wishes to be informed on the latest phases of rocket propulsion, will find this volume a mine of useful reference data.

(Reviewed by M. J. McK.) *Viking $3.75*

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Dials and Flight, by Assen Jordanoff.

THIS book deals with specific popular aircraft instruments, particularly their operation and servicing instructions. It is written in four parts: flight instruments, engine instruments, navigation instruments, and automatic pilots. Seventy-two of its 359 pages are full-page two-tone illustrations, with 200 diagrams and charts. Each type of instrument is discussed generally as to its purpose, location, description, and operation, similar to AAF Technical Orders which give the procedure for inspecting and testing instrument systems. However, a good many of the instruments discussed and diagrammed are already obsolete. The sections dealing with navigation lack clarity. There is an occasional mistatement, such as: "However, as you increase your altitude, and the temperature remains constant, you will encounter reduced atmospheric pressure, which will make it necessary for you to increase your indicated air speed reading in order to maintain your true air speed." Although the drawings have the excellence which always characterizes the work of Assen Jordanoff, this volume does not have the usefulness of his previous books.

(Reviewed by M. A. McK.) *Harper $5*

BRIEFER COMMENT

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The Official Pictorial History of the AAF, by the Historical Office of the Army Air Forces.

ALL Air Force personnel will want to own a copy of this book in the same way that members of a graduating class like to have the school annual: it is a supreme souvenir. This volume is not quite a complete pictorial history of Air Force activities but it does have an amazing coverage; one particularly valuable section contains a pictorial catalogue of American military aircraft since 1909. The chapters about the quaint early days are especially interesting, and the assembly of pictures here is both amusing and useful. Textual coverage of the recent war is skimpy, though there are superb photographs, superbly "played" in the best *Impact* style by former S/Sgt. David H. Stech, who was in the art and typography department of that magazine. The Historical Office should know that General Carl Spaatz has no middle initial.

Duell, Sloan and Pearce $10

Makers of Modern Strategy, ed. by Edwin Meade Earle.

THE Princeton University Press has issued a second printing of *Makers of Modern Strategy*, edited by Edward Meade Earle, chairman of the Princeton Military studies group. A symposium of twenty famous historians, geographers and political scientists, *Makers of Modern Strategy* presents a professional discussion of the concepts of great military writers from Machiavelli to the present. No other volume has been compiled which so forcefully emphasizes the impact of war-making on the national structure, or how the national strategy is related to social institutions and industrial technology. Therefore Alexander Hamilton, Adam Smith, Engels and Marx find a place with Vauban, von Clausewitz, von Schlieffen and Jomini.

Princeton $3.75

All But Me and Thee, by Brig. Gen. Elliot D. Cooke.

THIS book, subtitled "Psychiatry at the Foxhole Level," deals with the problem of the psychotic, the psychoneurotic, and the psychopathic members of our wartime army. It tells what they were like, what happened to them, and what happened to the organizations to which they belonged. The author writes, with broad knowledge, as a layman for laymen. General Cooke displays a keen virile humor which does not detract from the seriousness of the subject matter. Although the objects of study are Ground Forces personnel, airmen will find valuable information in this volume.

Infantry Journal Press $2.75

The War Reports, by General Marshall, General Arnold, and Admiral King.

AMERICA'S top-flight war leaders each made three reports to the Cabinet secretaries above them, outlining the activities under their control during America's involvement in hostilities. All these reports, printed in full here, make a complete official record of our part in the war (mistaken estimates of each officer's earlier reports are corrected in his final statement, which also

includes material previously omitted for security reasons). It is an 800-page book, with chronology, pictures, maps, and an index; unfortunately, the pages do not have "running heads" at the top, and it is difficult to skip around in the reading. The foreword is by Walter Millis, whose prewar volume, *The Road To War*, was, ironically, a kind of bible for pacifists in the 1930's. Many Air Force readers may have copies of General Arnold's reports; here these documents are gathered together in a large volume which gives them an added value by placing them between the Marshall and King reports.

Lippincott $7.50

The 1st Denver Congress on Air Age Education.

AS the proceedings of the second Congress on Air Age Education have not been made public, a brief review of the first Congress, printed by the University of New Mexico Press, is herewith presented. This volume should be of interest to airmen, especially the speech of J. Parker VanZandt, which gives us a new word, *Aeropolitics*. While Mr. VanZandt's speech may not in itself be a new or vital contribution, his subject reaffirms the closely interwoven relationship between policy and national concepts of war. Air-age education, and teaching methods, will determine the public grasp of "Aeropolitics" - and thereby govern the military airman's future mission.

University of New Mexico $2.50

The Future of American Secret Intelligence, by George S. Pettee.

"A FIRST-CLASS intelligence service is essential to our national objectives." Working from this thesis, Professor Pettee takes the operations of secret and strategic intelligence out of the cloak-and-dagger realm, and examines objectively the deficiencies in our present and past organization. The mistakes and successes which marked our prewar and wartime methods are analyzed. A positive program is offered for an efficient organization, including doctrine, to produce and use the information which we must have as a basis for United States foreign and military policies insuring future security. This book is of special interest to intelligence personnel and of general interest to most Americans.

Infantry Journal Press $2

Atlas of World Affairs, by Clifford H. McFadden, Henry Madison Kendall, and George F. Deasy.

THIS recent political-economic atlas is an important illumination of current world problems: it shows the bristling borders of the European nations and the coveted resources of remoter lands. The chart style is chiefly that of Lambert conformal projections, with tables, diagrams, pictographs, and texts pointing up the value of the 135 maps, a number of which are in color. The expert geographers who prepared this volume based it upon the earlier (1940) *Atlas of World Review*, by one of their number, Mr. McFadden.

Crowell $5 (paper, $2.50)

One Damned Island After Another, by Clive Howard and Joe Whitley.

THIS "Saga of the Seventh" is an eye-witness account of the achievement of the 7th Air Force. On the first page, the reader is transported from his easy-chair to one of the countless atolls of the Central Pacific. The strenuous demands of war on airmen are graphically described, with numerous accounts of individual valor.

One Damned Island After Another is a creditable memorial to the effort and ingenuity of those who contributed to the success of our Air Power in the Pacific. The book is an authoritative unit history, a merited record of the mission fulfilled, with particular interest for 7th Air Force veterans.

University of North Carolina $4

Congress at The Crossroads, by George B. Galloway.

THIS is a penetrating analysis of the essential functions of the Congress of the United States since 1789. The Congress that has emerged is neither organized nor equipped for its basic responsibilities of reviewing executive performance, authorizing administrative functions, and determining federal policy. Today, confronted with the gravest problems of foreign policy in national history, Congress stands at a crossroads: it can drift into impotence or it can again become an effective implement of self-government. This competent description of the complex mechanism of our legislative machinery is replete with recommendations for reform.

Crowell $3.50

World War II: A Concise History, by Roger W. Shugg and Lt. Col. H. A. DeWeerd.

THIS volume is the latest version of the book which the War Department Orientation program has been using since 1942. It is straightforward history, with no divagations into the causes of events; it drives straight ahead, recounting the occurrences of war in simple effective narrative. Although hardly more than pocket-size, the volume has 538 pages, including a map section, an index, and ten appendixes that contain operational statistical data as well as reprints of important documents concerned with the war.

Infantry Journal Press $3.75

Command Decision, by William Wister Haines.

THE novelist William Wister Haines, who served in the ETO as an AAF lieutenant colonel, has written a vivid story about the conflict between two generals who symbolize different aspects of the way in which Air Power may be applied. "Casey" Dennis, a single-minded Air Force commander who wants to bomb out the German jet-manufacturing plants without delay, fights the restraints put upon him by his commanding general, the famous old flyer R. G. Kane, who wants to make a good record but at the same time keep his losses down so that press and public will be conciliated. It is an acute problem, and the author handles it shrewdly, working up a series of compelling climaxes, with Dennis's convictions appearing to win out at one moment, and Kane's at the next. The supporting characters all fit neatly into the story, and the atmosphere of a headquarters office at an operational center is vividly depicted. Like Steinbeck's *Of Mice and Men* and *The Moon is Down*, this novel is a "one-set" show--that is, it keeps its focus on a single setting, Brigadier General Dennis' office. It has been reported that Jed Harris is to produce *Command Decision* on Broadway next fall and that MGM has bought it for Clark Gable: it is doubtful whether even the embodiment of stage and film production could make this story any more sharply exciting to Air Force personnel than it is as a novel. This book implies a certain criticism of the AAF, but the AAF is big enough to take such criticism in stride. And Dennis is

certainly a recognizable Air Force type as well as a favorite and enduring American type, the fierce idealist. Dennis is a later-day Mitchell; Kane, portrayed as having been an associate of Mitchell's, has already begun to chill into rigidity and caution. It is an ancient story: William Wister Haines has given it a vivid new treatment.

Atlantic-Little, Brown $2.50

Modern World Politics, by Thorsten V. Kalijarvi and Associates.

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