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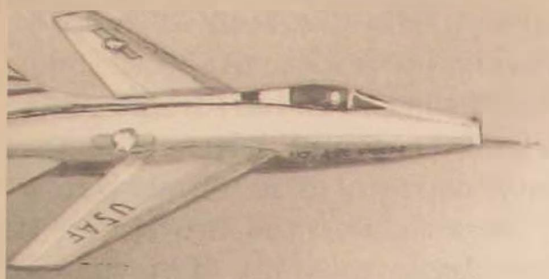
Leadership in the free world's defense against encroachments of militant Communism has led the United States to station its forces in many foreign countries and to rely on our allies for intelligent participation in the common defense. The *Quarterly Review* has asked Headquarters Far East Air Forces to comment on its problems in this regard. Colonel James K. Dowling examines the Japanese resistance to the requirements of nuclear-age defense. Admiral Zenshiro Hoshina, a member of the Japanese Diet, offers one Japanese view of the U.S. military assistance program. Colonel William F. Barns describes the first conversion of a FEAF wing to century-series aircraft. Colonel Donald N. Wackwitz and Mr. Wilbur W. Moeschl summarize FEAF's automizing of intelligence for atomic commanders.



Overseas Air Operations and Public Information

COLONEL JAMES K. DOWLING

LAST year in a public opinion poll conducted by Japan's largest newspaper, half the people interviewed stated they desired immediate withdrawal of the United States Air Forces and opposed the expansion of air bases in Japan. Even more disconcerting, a larger percentage of those polled favored the withdrawal of the air forces than of either the ground or naval forces.

These attitudes are not unique to Japan. Lack of understanding of the needs for aerial defense exists to some extent wherever the Air Force is stationed overseas. Communist propaganda has taken good advantage of this lack of understanding, exploiting and agitating every facet of discontent voiced by the native peoples.

We were practically told to move our base out of Iceland. Several years ago, and even today, "Yankee Go Home" signs are painted in public places in Germany, France, Morocco, and elsewhere. The conduct of American GIs in Germany became a major public relations problem only last year, and even in the country of our stout ally and friend, England, we have public relations problems. A recent article emanating from that country stated that the number-one problem confronting the U.S. Air Force there was jet noise.

These world-wide public relations problems are caused by the inevitable irritation of foreign troops in a land, particularly when these men in foreign uniforms need large tracts of arable land from which to launch A-bomb carriers that seem to be productive of nothing except earsplitting jet noises. An occasional airplane accident over a congested area caps an already tremendous public relations problem. Undesirable as any friction is, the problem does not create operational concern to us unless public opinion is such that the military forces concerned are thwarted in their effort to accomplish their basic mission. This is the present problem in Japan. There is probably no other country in the world, including the United States, where local political and public pressure is having such a direct effect on the operational capability of the USAF units stationed there.

The U.S. Air Force is stationed in Japan with two main responsibilities—to defend Japan against air attack and to train the Japanese Air Force so that it can eventually take over the responsibility for Japan's own aerial defense.

Almost any American man-on-the-street knows that if an air force is to serve as an effective deterrent to attack and, if this deterrent fails, is to successfully defend, it must have the ability to destroy the attacking forces' bomber bases, fuel storage areas, and supply and communications points. FEAF has such offensive forces within its organization and yet is reluctant to call public attention to their presence because a large segment of the Japanese people is opposed to the presence of *any* offensive forces in Japan.

To successfully perform the mission of defense, a commander needs the basic ingredients—men, money, and materiel. Within certain limitations, the manpower and money furnished by our government are sufficient to perform the job, but it is in the general area of materiel—air bases, weapon systems, and weapons—that FEAF is found wanting. This want is not due to failure to provide the materiel but to the failure of the public to accept these things.

In 1952 the U.S. Government asked the Japanese Government, which is responsible for such actions, to procure land for runway extensions at six bases. These runway extensions are needed to operate century-series aircraft, like the F-100, if FEAF is to maintain a modern defense system.

The Japanese Government agreed to get the required land. In spite of conscientious effort by the Government, land for the extension of only one of the six runways has been procured to date because organized segments of the Japanese people have raised

such strong protests to the acquisition of land for this purpose. As a result, there are only four runways in all Japan capable of handling the F-100 under all operational conditions. This is of vital concern to us, but how do our hosts view our requirements?

In one poll 78 per cent of the Japanese people interviewed indicated they had heard or read about the American Air Force needing more land in order to lengthen runways, but only six per cent approved the request. And a most significant fact is that only one per cent of the total interviewed were directly affected by the bases or the extension of them. In other words it was not a personal inconvenience that prompted their disapproval of runway extensions. In still another poll, conducted by a private Japanese organization, 60 per cent said they did not think American military bases in Japan were a good thing for Japan at all.

The fact that the U.S. concept for employment of military forces is based on the use of atomic weapons has been stated many times by our military and Government leaders. At one of his weekly press conferences President Eisenhower stated that he could see no reason for not using atomic weapons in even small or peripheral military actions. Recently Marshal Zhukov stated the Russians will use them. The fact that atomic weapons are now standard military weapons is understood by practically all peoples of the world and accepted and approved by almost all of our allies. But not by the Japanese!

There is a large percentage of Japanese, not Communists nor even left-wing sympathizers, who are strongly opposed to the presence of atomic-capable forces in Japan and to the storage of atomic weapons in Japan. Even a large number of those who recognize the requirement for U.S. Air Forces to be stationed here strongly oppose those forces using atomic weapons. The introduction into Japan of newly developed guided missiles to assist FEAF in carrying out the assigned mission of air defense, as desirable as this might be, is out of the question at the present time because of concern for Japanese adverse reaction.

There was a tremendous and violent public and press reaction, voicing complete disapproval of the inept and unprepared introduction of the Honest John into Japan by the U.S. Army two years ago. This missile has about a twenty-five mile range and is capable of using an atomic warhead. The critics charged that because of its range it was a weapon to be used by forces on the offensive and was not a defensive weapon. As America's mission is to defend Japan, the critics charged that this violated the defense agreement and indicated that the United States Army was plan-

In Japan, where the man-in-the-street has received little information on the harsh realities of the post-World War II battle for survival, where arable land is at such a premium that it is painful to use it for defense purposes, and where the population bear deep emotional scars from the aerial devastation suffered during the war, the requirements for modern defense have met with serious public resentment. When Japanese government surveyors appeared to stake out the land needed

ning to use Japan as a base for offensive action. Some even charged that its atomic capability made it a primary target for an attacker, probably using atomic force. This fact, they reasoned, made Japan a target for atomic attack and would result in Japanese cities and people being destroyed.

The Matador has been stationed in Germany for three years but FEAF is afraid to mention the word in Japan! Yet this missile could play a most important role in deterring possible attack against Japan as well as in destroying enemy air bases. But if the Honest John, with its twenty-five mile range, caused such adverse and violent criticism because of its offensive capabilities, one can imagine what the reaction would be to the Matador with its atomic capability and its range of hundreds of miles!

In summary, the Japanese idea of an air defense force is one

for the extension of the runways at Tachikawa Air Base, five to six thousand white-shirted students and members of the opposition party, led by leftist members of the Diet, clashed with some 2000 Japanese police and police reserves in an effort to halt the survey (left). Another evidence of popular resentment to the extension of the Tachikawa runways is the line of tall bamboo poles (right) that have been placed at the end of one of the runways to harass aircraft attempting to take off.

composed only of interceptor aircraft. They do not want aircraft whose mission is to retaliate against enemy air bases. They do not want atomic bombs, or any kind of bombs, in this air defense force, as this, to their way of thinking, means "offense." Their idea of defense is to destroy only aircraft that are attempting to attack Japan. In their confused reasoning, adequate defense of the homeland does not require the capability to fly hundreds of miles to destroy the enemy's air bases. This same logic applies to guided missiles designed to destroy the enemy's air base and parked planes. This is "offensive" action in many Japanese eyes and therefore has no place in a defensive air force.

Bear in mind that we are not talking about people who are Communists. They want no part of Communism. Their political beliefs are pro-Western, their ideologies basically the same as those

of the average American. A large majority of them recognizes that Japan should have an air force ready to defend its shores.

It is readily apparent to the average citizen of all of the literate countries of the world, and certainly to the average American, that such a feeble air force would not only fail to deter an aggressor nation from attacking but would also fail miserably to repel the attack if it comes.

the political situation

To say that a large segment of the Japanese people is opposed to American military forces in Japan is an understatement. There are two main political parties in Japan—the Liberal Democrats and the Socialists. The Liberal Democrats are presently in power and, with control of the majority of seats in the Diet, their man is Prime Minister. This party is pro-Western and its political beliefs and ideologies are basically those of the United States. On the other hand, the Socialists stand for all things contrary to U.S. policy. In a national election nine months ago the Socialists developed their platform primarily on issues that concerned defense. Their platform was based on opposition to the continued presence of U.S. military forces in Japan, to expansion of runways, to the use of atomic bombs, and to revision of the present antiwar clause in Japan's Constitution.

The Liberal Democrats anticipated picking up enough additional Diet seats in this last election to give them a two-thirds majority. This they needed if they were to be allowed to revise the antiwar clause in the Constitution and permit the legal establishment and further development of the Japanese Defense Force. It was a surprise and a shock to them, and to the United States, when the Socialists gained 14 additional seats out of the 717 in the Diet, making revision of the Constitution more remote than ever.

The Socialists in Japan knew that defense, as the main issue of their campaign, would gain votes, because large segments of the Japanese population are receptive to this type of propaganda. But there is a deeper and more sinister reason. It is obvious that left-wing agitators and outright Communists are using the Socialist Party as a means of exploiting anti-Americanism and of furthering Communist aims. It was also to be expected that for this purpose they would focus their attention on the military, it being one of the main deterrents to Communist aggression in the Far East.

In a speech before the Los Angeles World Affairs Council last year, General Laurence S. Kuter, Far East Air Forces Com-

mander, was discussing the Far East air power picture in terms of U.S. Air Force air doctrine. He stated:

> Air doctrine divides national power into four basic elements, defined as the political, the economic, the military, and the psycho-social. In the struggle for the Far East, all of these instruments of power are being used: offensively by the Communists, and in a counter-offensive by the free world. At present, we have erected a qualitative dam to contain Communist air power, with the result that they must rely for the moment upon their other power instruments to move forward toward their objectives. Thus we find the communists making very intensive use of their economic, political and psycho-social power instruments. This effort is carried on at every social, political and economic level. It is brought to bear upon matters of highest national policy, and also in the local communities where small air units may be based. Invariably, the effort is to exploit economic, political and social strains within the fabric of the society concerned, in order to create issues that can be used to advance communist objectives. And because one of the communist objectives is to undermine and fatally weaken the military forces which inhibit the use of their military power instrument, we of the free world's military forces in the Far East find ourselves in the very center of a conflict in which traditionally the military, until the shooting starts, plays no part at all. That is to say, we are now one of the main targets in a struggle waged with political, economic and psycho-social or propaganda weapons.

causes for Japanese attitudes

The Japanese attitude concerning defense is generally the result of two fundamental causes: fear and lack of knowledge. The Japanese fear that the presence of an atomic-capable air force, based on their homeland, invites attack. They have felt the results of atomic attack and they want no part of such a war. They fear that military alliance with the U.S. invites destruction of their country and hopefully speculate that a position of neutrality will guarantee their safety in an all-out struggle between the U.S. and Russia.

It may seem paradoxical that as a result of having been on the receiving end of more air power than any other nation in the world, of having felt the horrors of atomic attack, and of having seen it end a war, the Japanese should now reject these weapons that are the best available means of preventing a repeat performance. But it is this very experience that has resulted in their feelings being ruled by emotion rather than logic. Communist

and Socialist propaganda has appealed to these emotions and fed on these fears, so that now the Japanese to a large degree feel that the presence of such weapons *invites* rather than prevents attack.

There is also in Japan a complete lack of knowledge of Communist military strength in the Far East, and this has contributed to a complacent attitude toward the necessity for adequate defense. There probably is not one Japanese out of ten thousand who knows that the Communists have more than five thousand combat-capable jet aircraft in the Far East and that they have more than nine hundred light jet-atomic bombers capable of attacking Japan from more than one hundred air bases.

Some months ago FEAF briefed the members of the Tokyo Chamber of Commerce on the Communist air strength and capabilities in the Far East. This was an educated, well-read audience composed of industrial leaders of Japan and yet they confessed complete ignorance of these facts. Some of them voluntarily stated that this was information that should be available to every Japanese.

It is fundamental to human nature that while ignorance breeds fear, knowledge dispels it. If the Japanese fear the presence of the United States Air Force in Japan, it is because they are ignorant of the requirement for it. A few months ago, when the first FEAF tactical wing was equipped with F-100 aircraft, the commander invited leading local citizens to the base for a visit and briefing. After the briefing one of the Socialist members of the local government stated to the commander that he had always been opposed to American military forces in Japan and that he was particularly opposed to the presence of this local base but that as a result of the briefing, the tour of the base, and the courtesies extended on this day, he had radically changed his views.

It is perfectly understandable why the Japanese lack knowledge of the employment and importance of air power in the defense of their country and of the Communist air threat that exists opposite their borders. From whom would they have learned this information? The Japanese military element has not been accustomed, historically, to explaining the whys of its existence. On the contrary it had been in a position in the past where it did not have to explain its actions. For instance, Tachikawa Air Base near Tokyo was built by the Japanese thirty years ago, and yet the first time the general public from the adjacent city ever visited the base was at the invitation of the Americans located there now!

The new Japanese Air Force has not yet fully realized its public relations responsibility, nor does it have the capability to

handle it. Actually, until most recently, it has been completely dependent on us for information concerning Communist air strength, and it is still receiving instructions in the modern methods of defending against it. It also lacks the necessary prestige and stature that would prompt its countrymen to accept it as an authoritative source of knowledge on this subject. At present it has about forty pilots jet-trained and combat-capable. Its public relations program is at a proportional level of development.

How about the U.S. Air Force? The Americans came to Japan originally as conquerors and of course felt they had no obligation to establish a public relations and public information program for the Japanese. Air Force public information directives offer no guidance or direction in this regard. Even the basic Air Force regulation that establishes the mission of public information states that the purpose of the public information program is to keep the American public informed. There is no mention anywhere of foreign publics.

After Japan became a democracy the public information situation changed for the Japanese—and should have changed for the Americans. But the facts indicate that it took the Americans a long time to realize that Japan was now a free and democratic country and that if she was to understand and accept military alliance and military responsibility with the United States, her people had to have the facts on which to base sound decisions. Only about a year and a half ago, when an Air Force public information officer paid a courtesy call to one of Japan's largest daily papers, the editor stated that this was the first American uniform he had seen in his office since one of General MacArthur's colonels had been there some ten years ago "to take over the paper."

These, then, are the most important causes for the present Japanese attitudes—but must the situation remain this way? Can public relations make it possible for the U.S. Air Force to defend Japan with the best and most modern weapons? Can public information stimulate Japan's interest in developing her own Air Force? Can public education minimize the effectiveness of anti-defense and proneutrality propaganda now being used so effectively by the left-wing Socialists and their misguided followers?

what can we do?

Since a fundamental principle of democracy is that "an informed public will make the right decision," a person can only

answer these questions in the affirmative. If one does not believe this, he does not believe in democracy itself. And Japan is a democracy; America helped make her so.

So a year and a half ago FEAF launched an aggressive public information and community relations program. The public information problem and its solution was made the theme of a FEAF Commanders' Conference at that time. This program was initiated even though other American information agencies in Japan were operating under the philosophy that only Japanese Government or military spokesmen should deal with the Japanese public. FEAF agreed that this would be the most desirable method, but evidence indicated that these agencies either were not capable of doing the job or that they did not appreciate the requirement to "get the facts out."

FEAF's public information efforts have not solved any of the major operational problems, but every experience to date has proved the soundness of this approach. Contacts with the Japanese have proved time and again that they know practically nothing about air power or the air defense problem and that they are eager to get the information. And there has been no indication of resentment or prejudice in the fact that they are getting the information from us rather than from their own people. At the same time it became apparent that in one year you cannot reverse a situation created over a ten-year period. FEAF's effort also proved that FEAF, with a relatively small public information staff—a staff that was established to meet the ordinary routine public relations problems of a command—cannot hope to solve a major national problem such as this alone.

One may ask: What about the United States Information Service in Japan? Isn't this U.S. Government agency, operating with the guidance of the U.S. Embassy, responsible for telling the American story to the Japanese? The USIS in Japan is a very substantial organization, totaling some 400 people, including Japanese employees. It maintains regional offices in six of Japan's largest cities, and these in turn supervise the operation of twenty-three cultural centers throughout the country.

The cultural centers each consist of a library with lecture hall facilities. Motion pictures are shown, concerts given, and lectures and study classes are conducted. From these centers, some 800 book collections and some 1600 motion picture projectors are circulated through the many isolated areas of Japan. It is estimated that approximately 20,000,000 Japanese each month see USIS-supplied films. The lectures and discussion programs are

on a variety of subjects ranging from "The Cultural Impact of the East Upon the West" to such practical subjects as "How to Sell in the American Market."

This appears to be a very formidable organization. At first glance one would think it should be completely capable of getting to the Japanese all the facts concerning the requirement for air defense, the mission of air power, and the vital role that air power is playing in maintaining the peace throughout the world, including Japan. But it would be wrong to expect the USIS to take full responsibility and to have the capability for informing and educating the Japanese on the requirements of air power. USIS staffers do not have available to them all the facts or the knowledge of the employment of air power in the jet age. They are not professional airmen and they are not recognized as such.

The American people recognize the requirement for a strong Air Force. It has been the United States military department and Air Force that have shown them this requirement. What this analysis indicates, then, is that the Air Force has the information and USIS has the audiences. Perhaps the solution to this public information problem is for these two agencies to join forces to make maximum use of the particular capabilities of each agency.

Such a proposal has in fact been made; it is presently under study by the various government agencies involved. It sees the establishment of some sort of joint operating office that would be manned by a representative of the Japanese Defense Agency, the American military services, the Far East Command, and USIS. The mission of this group would be to develop and implement a long-range public information program designed to increase the Japanese knowledge of defense and the requirement for it. This program would be aimed at using all the standard means of disseminating information integral to any such information program: direct contact with the public, newspapers, magazines, radio, television, and newsreels. This program also would have our various military commanders throughout Japan working hand-in-glove with USIS field representatives in a strong effort to put across this information at the local level.

At least as far as it concerns the Air Force, this program has great possibilities for success. The modern jet fighter has a tremendous audience attraction in Japan for the reason that the people are annoyed by it—it is noisy, uses a lot of valuable farm land to operate from, and occasionally crashes and destroys homes and people. In Japan this national curiosity has been further stimulated by the fact that although these aircraft have

been seen in Japan's skies for years, there has been little opportunity to examine them closely on the ground or to read firsthand accounts of their operation in the daily papers. Even Japanese editors, publishers, and reporters have practically no personal knowledge or understanding of the air defense operation. They are completely naive on the subject, although their natural curiosity and professional interest are now at a peak. One Japanese editor expressed this situation: "For ten years, Japan has been in a vacuum, as far as the jet air age is concerned." This was proved recently when FEAF invited a few of the editors of Japan's largest newspapers on a short tour of FEAF installations; they eagerly accepted the invitation, and were awed by what they saw. The trip is just one indication of the media's interest, but it serves to illustrate the point that the greatest possibility of getting the air defense story told is by assisting the extensive and varied Japanese media outlets to tell the story themselves.

In Japan there are 188 daily newspapers with a circulation of 30,800,000 weekly; other special papers reach 18,000,000. There are more than 2000 monthly magazines. Japan's 192 broadcasting stations and 12,000,000 radio receivers serve 60,000,000 listeners. Television, instituted in 1953, now has two nationwide public networks and many private commercial stations. The Japanese motion picture industry, the world's third largest, last year produced more than 400 feature pictures. Eight major newsreels are released weekly, including four from America. This extensive network of communications has a tremendous potential that has hardly been touched as a means of telling the Air Force story.

There is every reason to believe that a well-planned and well-implemented information and education program, combining the talents of all the United States public information agencies in Japan, could in the next three years gain acceptance by the Japanese public of air power, air defense, and all the modern weapons that make up such forces. Public relations can do the job, if given the opportunity.

JAPAN is roughly the size of California, with over 90,000,000 of the most highly skilled people in all Asia. Japan is also the most highly industrialized country in Asia and a choice prize for the leaders of the Kremlin, whose goals in the Far East have been stated by one State Department official as the manpower of China, the raw materials of Southeast Asia, and the industrial capacity and the highly skilled workers of Japan. The Communists have the manpower of China. They are insidiously active in South-

east Asia and already have North Vietnam. That leaves Japan.

If Japan were undefended, and thus lost to the Communists, there would be no doubt that all countries of Asia would slide, one by one, behind the Bamboo Curtain. This eventually would increase the Soviet's industrial and economic strength and would immediately leave us friendless and exposed on our Pacific flank, with neither warning posts nor air bases from which to detect and blunt a surprise attack.

The FEAF Commander, addressing his unit commanders, succinctly summed up the situation in this overseas area: "The key to the successful defense of Japan, by the Far East Air Forces and later by the Japanese Air Force, is public relations."

Headquarters Far East Air Forces

U.S. Military Assistance in Japan

ADMIRAL ZENSHIRO HOSHINA

MILITARY assistance has been extended to many countries by the United States, but it has not necessarily been fully appreciated by the recipient countries. If this is a common trend among recipient countries, it is only natural for Japan to have the same attitude, even more so. Even among supporters for rearmament there exist feelings such as, "Did not America itself, in its occupation policy, completely disarm Japan?"

Today's military assistance given to Japan reflects in a way an atonement for America's misdeeds in this regard. If Communists had not obstructed Japan's rearmament and had not the supporters of rearmament been nearly all anti-Communists, stronger anti-American feeling would exist today. In Japan there are numerous antirearmament advocates who are not necessarily influenced by Communist propaganda. Many have been educated during the period of occupation policy. In addition Japan has a unique Constitution that renounces all armament. Hence there is considerable feeling that "American military assistance to Japan is annoying."

Fortunately in Japan there can be found many intelligent, prudent, and realistic statesmen. These people, regardless of the past, are deeply thankful for the military assistance from America. They also believe in the revision of the Constitution, which now prohibits settlement of disputes by force. Under the peculiar conditions existing in our country, we in Japan experience hardships not known to statesmen and intelligent people of other countries.

To give further details, it can be said that the negotiation for American military assistance to Japan was conducted immediately following the occupation. Among those representing America were many military personnel who wielded occupation authority over the Japanese. The Japanese who participated in military negotiations lacked sufficient military knowledge. Also the officials who negotiated for military assistance had been in

power during the period of occupation and therefore were not able to change their mental attitude that they had gained during the occupation. What was the result? From the American viewpoint the negotiations lacked political character, and from the Japanese side there was a military inadequacy—all of which conveyed an impression to the Japanese people that the military program was forced upon Japan by the Americans.

This impression, although based on misunderstanding, cannot avoid being easily exploited for anti-American propaganda as American interference in the domestic affairs of Japan. America officially came to the military assistance of Japan in 1953. Paralleling this action, the reinforcement of defensive power was formulated by the Defense Agency (a 5-year plan followed by a 6-year plan). Although this American military assistance plan and the Defense Agency reinforcement plan became indivisible, the Japanese plan was not supported by the government or by the people.

I would like to cite here the priority reinforcement question of the Ground Self Defense Force. The public opinion of Japan, from the outset, overwhelmingly supported the increase of the defense strength of the air and sea forces but was opposed to the reinforcement of the Ground Self Defense Force. In spite of this the Defense Agency authorities set out to give priority to the reinforcement of the Ground Self Defense Force. The building and the fostering of the defense strength of air and sea are not simple matters, considering Japan's postwar difficulties in economic power, scientific and technical abilities, and the capacity of its defense industry. The early sentiment in Japan was strong for building air and sea strength at the earliest possible date, and great hope was held for military assistance from America to build and foster such air and sea strength.

The Japanese people believe that Japan's Defense Agency authorities did not by themselves have sufficient judgment to provide the proper forces, because they did not have sufficient information as to the changing military situation of the world to plan for the defense program. The people were under the impression that the Defense Agency authorities received considerable instruction from the Pentagon and from the American military advisory group. Although the priority reinforcement scheme for the Army had been planned by the Defense Agency, the people began to conjecture that it had been directed by the Americans. The people speculated that the priority reinforcement of the Army was forced upon the Defense Agency by the Americans rather

than having been independently requested, and, therefore, the Defense Agency was censured for being under American domination.

Whether this speculation is right or wrong, there must be a reason for the Americans to desire priority reinforcement of the Ground Self Defense Force in preference to the air and sea arms. This reason is not too hard to guess at. For our country the excessive weakness of the air and sea defense forces has been very painful to bear. The Liberal-Democratic Party has endeavored to increase Japan's defensive power against the bitter opposition of the Socialists, but the defense program still had to gain support from the people. Even though much of our defense effort has been undertaken in the name of Japan-American cooperation, it will have very little meaning and could end in failure if it appears unreasonable in the eyes of the people. Our people have been told of the build-up of a 160,000-man Ground Self Defense Force, yet it becomes more and more difficult to reinforce the Ground Self Defense Force at the sacrifice of air and sea arms when no support can be given for such a program within our own Party. Under such a condition, if Japan attempts to follow the American request for priority of the Ground Self Defense Force, the impression of "American mercenaries" will be all the stronger among our people. Anti-American propaganda could brand Japan as a colony of the United States. This is very detrimental to Japan itself and to Japanese-American cooperation.

To overcome this situation, Japanese-American defense problems should be treated from the broadest possible viewpoint. Our defense reinforcement program, which forms the basis for American military assistance, should receive approval not only from the Defense Agency but officially from the government. The government must discuss this important problem fully with the majority party, the Liberal-Democratic Party, and treat the matter from a firm and broad political viewpoint.

It is undesirable for the government in dealing with Americans to leave the matter of negotiations entirely to subordinates. Casting aside the technical and specialized fields, when defense matters relate to the statecraft of the nation the finishing touches on all negotiations should be given by the military level on our side and the ambassadorial level on the other. The negotiations conducted between vice minister or directorial level on our side

and the military advisory group on the other side will lose broad political views, since the aims of officials on this level are very likely to be limited to a narrow, practical scope. In this regard greater care should be exercised in conducting negotiations with such a country as America, since its negotiations are complicated by enlarged political and diplomatic structures. On the American side, its policy for military assistance abroad may have been decided from the general diplomatic and political situation, and the administration of the program decided from the military point of view. The same cannot be said of a receiving nation like ours. The problem exists as to how to reinforce our ground, sea, and air defense forces, which generates problems of budget, industries, and equipment.

The peculiar stature of our Constitution poses numerous delicate political problems. The problem of building defensive strength for our country is a major national issue and requires the most careful handling. Since the Japanese situation has no parallel in the world today, Americans find it extremely difficult to understand, and on our part it will require extra effort to make Americans understand.

Japan will require large military assistance from the United States for some time to come. We must get maximum results from this military assistance. It is of vital importance to us to make sure that the American military aid program does not fall victim to an anti-American movement. We have shouldered such responsibility without waiting for the revision of the Constitution. The build-up of our defensive forces is restricted by our Constitution on the one hand, while on the other hand under the mutual security agreement Japan is constantly urged by the United States toward greater action. Our government therefore is held in a dilemma between the two—national sentiment and our diplomacy with the United States. Should not both countries, therefore, restudy the mutual security agreement with this thought in mind?

Tokyo, Japan

Korea—
An Opportunity Lost

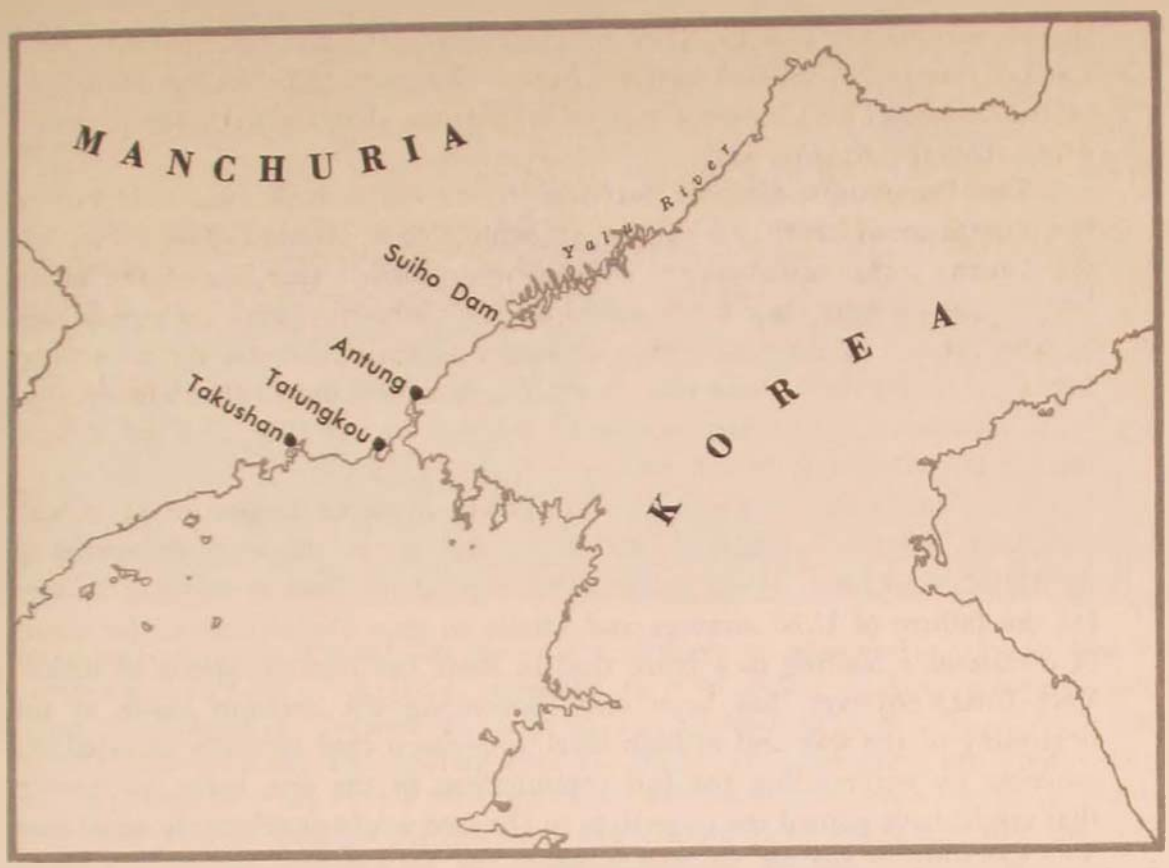
A Quarterly Review Staff Brief

At 1601 hours on 23 June 1952 a combined aerial task force of over 500 combat aircraft was launched in the biggest single U.N.C. strike of the Korean war. The target was the North Korean power system, of which the principal element was the Suiho plant. This huge installation supplied electric power not only to parts of North Korea but also to important industries in Manchuria and was vital to the Communist economy. On the east bank of the Yalu River, Suiho is some sixty miles north of three huge Communist airfields in Manchuria: Antung, Tatungkou, and Takushan. One half hour before the U.N.C. air armada arrived at its target approximately 250 MIG-15's were sighted on these three airfields. U.N.C. pilots on route to the target watched MIGs taking off. Less than one hundred Communist interceptors remained on the airfields thirty minutes later as the last wave left the target. Not one intercept or pass was made on the U.N.C. fighter-bombers.

The failure of the Communist air force to attempt to stop this strike, or at least to blunt it, has been much discussed. Many reasons have been advanced, perhaps the least valid of which was the presence of over 100 Sabrejets as escort.

This is only one instance of Communist failure to employ their air forces offensively in actions that, at least from a tactical point of view, would obviously have been to their own best advantage. There was the failure to launch a massive end run and catch the two F-86 wings huddled on their cramped bases. There was the failure to use their air forces in support of their ground forces, even in the early days of Communist intervention when Allied forces were within easy reach from Manchurian bases and when aerial firepower might have turned this U.N. disaster into a catastrophe.

In addition to speculating on what the enemy did *not* do, we can also ask why he persisted in doing what he *did* do—confine his air effort to MIG Alley, continuing to appear over this corner of North Korea in spite of the mounting losses in precious jets that this rather fruitless show cost him. The frequently voiced theory that he did it to give his new units combat experience is doubtful in view of what it cost him for what he gained. For this as for the other questions posed, there are many strategic and tactical reasons to be advanced, showing various factors that inhibited his use of air



power. Most of them are valid and many of them are important. Certainly the U.N.C. air forces did all they could to confine enemy air activity.

But this was a limited war, the first for the U.S. against the Communists in which the U.S. actually committed forces in the field. In retrospect it appears that there may not have been sufficient attention given to one primary characteristic of a limited war—the evaluating of what elements of his strength the enemy is willing to put at risk. Of course this was done in the tactical sense that target folders were drawn up and decisions were made as to what targets to hit. But how much attention was paid to it in the strategic sense of deducing, on the basis of the items that the enemy withheld from risk, what his principal vulnerabilities really were—where he could have been hurt the worst with the least effort?

The true reason, it is believed, stems from the nature of the Chinese Communist participation in the war and the political ramifications involved. The Chinese Communists were tolled into the war by the Soviet Union with the promise of materiel support. The most prized portion of this aid, because of the prestige attendant on its modernity and size, was the rapid expansion of the Chinese Communist Air Force. Of all his elements of strength, this was the one the enemy was least willing to put at risk. This fact must be obvious from the Communist conduct of the air war. Pinned to the Yalu River by U.N.C. air power, the Chinese Communists committed sufficient effort only to appease the Kremlin bosses and made no real attempt to carry

the air war to the U.N.C. (During the course of their participation, there was not one single air raid by the Chinese Communists below the main line of resistance.) The Chinese Communists wanted that air force for purposes other than the Korean war.

The Communist Chinese reaction to the Suiho strike was evidence of the lengths to which they would go to protect their aircraft. Those that left the Antung complex during the strike flew to bases farther inland and hence better protected by their early warning radar screen. There they remained for the balance of the war, using the forward facilities as staging bases only. What protected them there was, in reality, not the Communist defenses, but a decision made in the first months of the war by the U.N. and the U.S. to restrict the air war to North Korea.

This limitation on the use of air power involved thousands of U.N.C. casualties and the loss of U.S. and U.N. prestige to the aggrandizement of the Communist bloc. Much has been written on the Korean war, the reasons for the failure of U.N. strategy and tactics to gain the objective, the causes of a stalemate leading to a truce that in itself has offered aspects of defeat. Very little, however, has been said concerning the decision made at the beginning of the war and at high level, a decision that virtually dictated the outcome by withholding the full commitment of the one force, air power, that might have gained the objectives of the free world at relatively small cost. The prohibition against air strikes across the Yalu denied to the U.N.C. air forces those targets the destruction of which would have taken the most pressure from the friendly ground forces. This meant, in a sense, that a premium was placed on mass and that sheer weight of numbers of men, Communism's most expendable commodity, gave the initial advantage to the Chinese Communists.

Before considering this decision that hamstrung the U.N. military effort, it may be well to recapitulate the background of the conflict. The post-World War II division of Korea at the 38th parallel resulted from the Yalta Conference, where the agreement was reached to occupy the north and south portions with Russian and U.S. troops respectively. Hindsight tells us that this was the first open evidence of Communism's intent to take over the

Debate can only be academic as to how much shorter the wars or more desirable the peace terms in our recent past might have been had these wars been fought by an air strategy rather than a surface strategy. But it is a query that must occur to the minds of airmen from time to time. This is particularly true of limited wars. As much as the influence of air strategy on military actions, there is the question whether many of the political decisions that "limit" a limited war might not have been different had the policy-making echelon of government understood more comprehensively the nature and attributes of air warfare. The editors of the *Quarterly Review* offer some of the more puzzling aspects of the political decisions on both sides of the Korean War as they affected employment of air forces.

Smug and secure just inside its political sanctuary of Manchuria, this is how the Communist airfield at Antung appeared to F-86 pilots looking wistfully down across the Yalu at it. Colonel Harrison R. Thyng, writing in the Quarterly Review *in 1953, described how the sight affected the pilot: "Imagine patroling up and down the Yalu, watching the enemy form up only three miles away on his field at Antung. From one end to another the place is just loaded with aircraft which one good strafing run would put out of commission forever." In this photograph some 120 aircraft were visible, only five of them in revetments. One atomic bomb on target could have destroyed a sizable fraction of the total Chinese Communist air force.*

whole peninsula. To Stalin the establishment and existence of a free nation in Korea must have had about as much appeal as the existence of a Communist state on the Florida peninsula would have to the U.S. In any event history shows that from the time of the initial occupation until their withdrawal in 1949 the Soviets were actively engaged in building and training a sizable offensive force, equipped with Soviet weapons, tanks, and aircraft. All that was lacking was the opportunity to strike. This was afforded by the fact that the U.S. had trained numerically inferior South Korean forces for no larger action than border patrol or internal security. Their heaviest weapon was the 81mm mortar.

While the Soviets were building a strong North Korean force vis-à-vis the South Koreans, they were also shaping the Chinese Communist army into a force patterned on their own. The strength was centered on the wealth of manpower available, the tactics on the "human wave" mass attacks so often used by the Russians. Modern firepower and equipment were supplied, as well as logistic backup for training and preparation. The equipment furnished was modern; jets—the MIG-9 and later the MIG-15—were first seen over Shanghai in the spring of 1950, though in small numbers. During and because of this build-up, the Chinese Communists had succeeded in driving the

Chinese Nationalists from the mainland to Formosa and were free of any continental threat by hostile forces.

By the spring of 1950, then, Soviet Russia had modernized and molded the military forces of her two newest satellites into potent weapons of aggression. These armies were not national so much as Communist—integral parts of the over-all Communist force facing the free world. Furthermore they were directly controlled from Moscow, completely dependent on the Kremlin for materiel and logistics. It is inconceivable that any aggressive commitment could have been undertaken without prior approval from Moscow.

What prompted the Communist attack on South Korea on 25 June 1950 is open to question. It is safe to assume, however, that the decision was made in Moscow, not in Pyongyang. The most startling factor in the situation was not the decision to attack but the miscalculation on the part of the Communists concerning the willingness of the free nations of the U.N., and particularly the U.S., to enter the conflict to halt the aggression. Miscalculation alone can explain the failure to supply to the North Koreans a strong air arm, instead of a feeble, ineffective force of some 150 obsolescent Soviet piston-engined planes.

Having failed in their initial attempt to drive the South Koreans and the hastily deployed U.N.C. forces into the sea, the North Korean army disintegrated and their air force ceased to exist. U.N.C. ground troops reached the Yalu River in some places in their advance but were caught overextended and unprepared by the sudden attack of the Chinese Communists in late October. The ebb and flow of the ground battle until the main line of resistance was finally stabilized near the 38th parallel is history that needs no retelling. The entry of the Chinese Communists will bear some examination, for with their commitment a new war began. The North Korean military forces had been defeated and the country occupied. A new enemy was about to appear.

What prompted the Chinese Communists to throw their forces into Korea? One reason advanced is that they feared the U.N.C. forces would not stop at the Yalu River but would overrun Manchuria and destroy Communism itself in China. This reasoning would appear to have little basis of probability. The history of lack of active support of Chiang Kai-shek by the U.S. during his losing fight with the Communists, and the divided opinion, both public and official, in America after World War II concerning the merits of the Kuomintang would point to no such likelihood. Finally, the wording of the U.N. Security Council resolution, which requested that members "furnish such assistance to the Republic of Korea as may be necessary to restore international peace and security in the area," indicated that world opinion was aroused about the Korean problem, not about Communism per se.

A more valid conjecture is that such cerebration as occurred took place in the Kremlin, not in Peiping. It is likely that, because of the original miscalculation, Stalin saw that with the disintegration of the North Korean forces Communism was on the point of receiving a serious setback and defeat in an area where prestige and "face" were all-important. Correctly gauging the temper of the U.N. and America and confident of the limitations that

would be self-imposed on the free-world forces, he bribed the Chinese Communists to pull the Soviet chestnuts from the fire. The bribe consisted of full logistic and materiel support and a new and powerful air force to be supplied in increments as the Chinese Communists became able to absorb them into their military structure. Public and official discussion had made the Soviets aware of the free world's fear of the holocaust of a World War III. It was not too big a gamble to count on this fear as a deterrent to U.N.C. attack beyond the Korean borders, especially as the free world knew that since 1949 it no longer had a monopoly of the atomic bomb.

Within two months of the entry of the Chinese Communists into Korea, the U.N. (and the U.S.) had reaffirmed that the war would be limited to Korea and that the atom bomb would not be used. The Soviet gamble had paid off. This must have inflated the myth of Stalin's omniscience among the Chinese in Peiping. With the certain knowledge that all they could lose was human lives, not real estate, the Chinese Communists proceeded to put large forces of their ground troops into the struggle.

It was at this point that America and the U.N. were given the opportunity to exert the full weight of their convictions and capabilities. This opportunity continued in decreasing validity down to the time an armistice was agreed to by the Communists. At this point in history the free world, with the USAF as its central force, had a clear chance to discourage—perhaps once and for all to do away with—Communist aggression or its threat. A clearly stated ultimatum to Communist China to withdraw her forces from Korea or suffer the loss of her military might wherever it might be found in China, backed up by the determination to use the full weight of available weapons and delivery systems required for the proposed destruction—such a threat could have stopped the Chinese Communists in their tracks.

Considering the facts as they existed at that time and the factors involved, the risk of triggering off World War III appears remote. Past history has shown that the Soviets will not move until they are ready, and, conversely, all the evidence points to the fact that when they are ready the Communists fully intend to attack and destroy the free world. Since World War II the deterrent has been the relative superiority of the USAF over the Communist air forces. The Soviets did not intervene with their own forces when the North Korean forces evaporated because the state of the art of her air power did not permit it. They were not ready, and would not have permitted themselves to be dragged into a world conflict for the sake of a satellite. Communism has never indulged in such quixotic emotions as loyalty. Good faith is not part of its creed.

At the time the new war started—October-November 1950—the Soviets had had the atom bomb for little over a year. How many they had at that time is open to question, but it could not have been a large stockpile. There were in the Soviet inventory two atomic air delivery vehicles, the obsolescent TU-4 (their version of our B-29) and the IL-28, a subsonic jet light bomber with a combat radius of less than 700 nautical miles. The state of their all-weather and night-intercept capability was relatively weak, and there was

very little indication that they had an operational airborne intercept radar. In the face of the relative strength of the USAF forces of SAC and ADC the Soviets would not have dared to broaden the conflict into World War III. Combat radius of their aircraft alone denied the possibility, unless one is to believe in the scare stories of mass one-way suicide missions by the ancient TU-4's. Even these would have had scant chance of success, since the free world would have had the initiative and been on the alert. The commitment of the preponderance of the air strike force on a one-shot, no-recovery mission would have appealed not even to the most fanatical of leaders.

What reaction would the Chinese Communists have had to such an ultimatum? Very possibly one of disbelief, because of the vacillation and softness shown them before. This state of disbelief would have dissolved into a hasty "agonizing reappraisal" upon the loss of an airfield, perhaps Antung just across the Yalu, as the first token U.N.C. strike backing up the determination to destroy the Communist Chinese military might. The loss of the object of their military pride, their shiny new air force, would have been too great a price to pay for what they could gain in Korea. In addition there was still too much resistance at home to risk the loss of their military strength upon which they relied for control of the masses. Communist China could not have risked a defeat within her own borders, a defeat that could not have been hidden from her subjected people. Judicious use of pre-strike psychological warfare emphasizing that the targets were military, not civilian, would have enhanced the nature of the repercussions. The Communists would not have dared invite defeat at home.

What would have been the costs to the U.N. in terms of casualties and loss in materiel and prestige? It can only be concluded that they would have been small in all categories. The Chinese Communist air force never was able to assume the offensive during the entire conflict. Defensively its posture was weak; in daylight, even near the Yalu River, it was ineffectual in intercepting our fighter-bombers. Their night capability was almost non-existent, except under optimum conditions of moonlight and contrails. In short they could not have stopped a determined attack. For the first time the U.N.C. would have had the initiative, with all the benefits that accrue from it.

It can be conjectured that the Chinese Communists would not have resisted too wholeheartedly in the air in any event. The Suiho airstrike already described will serve to illustrate this point. This incident occurred well over eighteen months after the first Communist jets had been committed and battle-tested. The state of the art and the frame of mind in 1950 could have been no better.

Would the air strikes, if needed, have caused the U.S. to lose the goodwill of the world? It is extremely difficult to follow any reasoning that holds that this would have been the result. Such action would have been in pursuance of the U.N. resolution "to restore international peace and security in the area." The strikes could have been directed at military, not civilian targets, and ample warning could have been given the civilian populace. It would have enhanced our prestige in Asia, and the propaganda that the

U.S. is only a "Paper Tiger" would not have been so effective in Southeast Asia. Finally, a firm and courageous stand would have cut short the current Communist tactic of probing the free world's weak spots. Because of the failure to stand firm in Korea, to make known irrefutably and irrevocably the intention to place our whole might against any and all Communist aggression, the Communists—and we ourselves—still do not know to what limits they can go before we call their hand. The danger of a miscalculation triggering World War III in this situation is infinitely greater than that which existed in the fall of 1950.

Air University Quarterly Review

Unlimited Confusion over Limited War

COLONEL EPHRAIM M. HAMPTON

"What's in a name? That which we call a rose
By any other name would smell as sweet."

STATEMENTS frequently emanate from high military and civilian sources in the national government to the effect that the likelihood of total war in the foreseeable future is rather remote and, therefore, the prospect of limited war is more likely. These statements have indicated the necessity of exploring just what is meant by the term "limited war," what is the likelihood of a limited war that will involve U.S. forces in active combat, and what the role of the Air Force should be in such a conflict.

Although the prospects of a World War III appear to be receding, existing world tensions and conflicts are opening the way for other forces to come into play. It appears therefore that the world is most likely to be confronted with a period of revolts, civil wars, guerrilla wars, wars between smaller nations, and wars between big nations and little nations. It has become fashionable to label all such wars as limited wars, and to attempt to arrive at some sort of magic formula for coping with them. There are many who hold the view that it is most unrealistic and dangerous to attempt to categorize and cope with war on such a basis. The arguments they offer in substantiation of such a view are pertinent to the subject of this article and will now be presented in detail.

The Argument Against Categorizing War

If war is viewed in its broadest context, there is no such thing as limited war. It does not exist in fact; it is at best a hope and not a reality. In actual fact there is only one condition of war, which is—war. War is war: a condition of combat, and it is potentially total at all times. There is no assured method of

keeping it limited. Armed conflicts between modern nations inevitably involve the risk of mutual annihilation. Perhaps war's potential of totality is not crystal clear in all circumstances, but the fact of this potential will become increasingly clear with each new advance in weapons and technology. This is so because whenever a nation resorts to war as the "other means" that Clausewitz speaks of, it is inherent in the term "war" that military forces, without specific definition as to degree or intensity, will be used. There is always a possibility that all available forces (total force) will be brought to bear.

Despite the ineluctable facts of the nature of war, we have fallen into the habit within the last few years of talking about war as "total" or war as "limited," much as though it is possible to control the intensity of war like water at a faucet, turning it off and on and otherwise regulating it at will. There is much evidence to indicate that this habit may be an escapist device—a case of candy-coating the bitter truth.

Is it logical to proceed on the assumption that any major nation in the nuclear age could be assured of conducting or sponsoring a war with enough control to exercise absolute restrictions? The answer must be a categorical "no." There are some very sound reasons for this emphatic negative.

Consider for instance how unrealistic it is to attempt to predetermine the degree or intensity of force that is to be applied in war, when it is not possible to predict the precise form, scope, location, significance, and scale of the combat actions that will be involved. One very cogent reason for the unpredictableness of warfare is the possibility that a combatant confronted by the prospect of a tactical disaster, or a complete defeat, may take actions that increase the intensity of combat or broaden its scope far beyond any limits thought of in the beginning as enduring restrictions.

This being so, is it not realistic to ask, *Who is it that can*

In recent years, especially since the Korean War, there has been increasing speculation on the nature of future struggles with Communism. The term "limited war" has become familiar in the military lexicon. Starting with the term itself, Colonel Ephraim M. Hampton, Deputy for Evaluation, Air War College, examines the question: What is a limited war? Can armed conflict with an aggressor ever be relegated with confidence to the category of the "limited"? Resort to arms always carries a potential for sudden, violent expansion to all-out war. To think otherwise is to deny military facts of life to a dangerous, even fatal, degree.

invariably limit a war? Because if war can be limited only occasionally, or only when some special set of circumstances prevails, then there is, in fact, no such thing as a general category of "limited war." There are only specific instances when, for reasons that may be different in each case, military force was not utilized as fully as it could have been. As long as it is possible for antagonists to expand a limited war, how can we have a satisfactory degree of control? How can we, by predetermined military means, actually limit what may happen?

Looking at the question from another point of view, it is interesting to observe that United States forces operate under no statutory basis for sectionalizing war in any such categories as "total" or "limited." The Functions Paper, which assigned responsibilities to the military services, does not instruct any of the services to prepare for two kinds of war—"total or limited." It makes no such distinction. It states (in Section II, Common Functions of the Armed Forces) that the military forces have the responsibility of (a) prosecuting war, and (b) meeting emergencies. It is pertinent also that the National Security Act does not make a distinction between "total" war and "limited" war. Irrespective of the views one may hold concerning the allocation made by these documents of functions to the various services, it is interesting to speculate about this matter, particularly concerning the impact such a categorization might have had on the division of the functions among the services. For example, had such a distinction been made in the documents mentioned, it is not too difficult to suppose that three functions might have emerged for the services, i.e., the function of developing and employing total-war forces, the function of developing and employing limited-war forces, and the function of developing and employing disaster relief forces, with each service having a primary responsibility for one of these functions. Those who hold that war is war oppose such division of functions as unrealistic and absurd, whereas those who consider that war must be categorized into "total" and "limited" classifications must to be consistent accept some such functional breakdown.

Consideration keeps coming back to the fact that war is always potentially total. Some may hold the view that this position is rendered invalid by the fact that low-intensity or small-scope combat may occur from time to time. But this basis for its validity or invalidity is not necessarily sound. It is correct that there may be recurring instances of less than total war, but it is also a fact, as most of the experts agree, that continued intermittent aggres-

sion against the free world could in time be as destructive as massive attack. If in practice we, as a nation, could be disposed of by war conducted at a lesser intensity than "total," then differences in method are of no particular consequence. The end result is the same. If this is so, then it is possible to ask, *What is the precise designation of the point at which the war of lesser intensity would stop being "limited" and become "total"?*

Where exactly to draw the line between "limited" and "total" war is a key difficulty. It must be solved in specific terms if the limited-total categorizing of war is to have any real meaning in the programing of forces, the planning of strategies, and the formulation of national policies.

What then *is* the answer? The answer is that in all the widespread use of the term "limited war" and discussions of what it constitutes there is to be found no completely satisfactory answer. The question cannot be answered satisfactorily. Every situation is different. There can be an infinite number of combinations of circumstances. The purely military aspects of limited war cannot be realistically blueprinted in advance. They can only be generalized, and it is this generalization that complicates in the extreme the job of military planners, because they, in order to do their work, must deal in specifics.

Considerations Involved in Categorizing War

Having presented the thoughts of those who view the question of war in its broadest context and who believe it unrealistic and dangerous to categorize "war" on the basis of "total" and "limited," let us now turn to a more specific consideration of what is involved when war is so categorized. To do this, it is essential that we examine the predominant factors which generate limitations on full utilization of existing capabilities of forces engaged in war. However, before proceeding with this examination, since public thinking and usage have now firmly established the term "limited war" in the lexicon of the military, it is essential to define the two categories of war—total and limited.

Anyone who has given any thought whatsoever to the problem of defining these terms is immediately aware of the difficulty and danger of the attempt. Nevertheless, no meaningful conclusions are likely to be reached unless there is some common agreement as to what these terms mean. Modern instruments of power

provide such great destructive force that national extinction is a very great possibility in an international conflict. In view of this we may, I think, define "total war" as conflict in which the national survival of the U.S. and U.S.S.R. as sovereign nations is the issue of the war.

When we come to defining "limited war" the task is more complex and difficult. Today the term has come to mean many different things to different individuals, ranging across the whole belligerency spectrum from a major war with the U.S.S.R., but not involving nuclear weapons, down to minor police actions against small nations. For the present and the immediate future we will live in a bipolar world of power blocs in which the U.S. and U.S.S.R. are the leaders. As long as this international situation obtains I think we can for all practical purposes define "limited war" as any war however large or small, regardless of the geography, objectives, weaponry, or strategy, in which the national survival of the U.S. and the U.S.S.R. is not at issue. The term "total war" as defined is intended to include such terms as general war, unrestricted war, all-out war, etc. The term "limited war" as defined is intended to include such terms as local war, small war, brush war, etc.

What are the predominant factors of limited war? They are the objectives for which the war is fought, the nations engaged, the geography involved, and the weaponry used, i.e., type of weapons, yields, and force pattern.

Objectives

The objectives for which the war is fought, and here we open Pandora's box, are first and foremost of these factors. Are the objectives of the war limited primarily because of political considerations? It is argued that it is impossible to make a distinction between political and military considerations as related to the objectives of the war. This view is based on the contention that these considerations are too closely meshed to admit of a clear-cut distinction between them. It is believed that the acceptance of such a view has in the past complicated the task of the military in waging limited wars and will continue to do so in the future if its validity is not contested. Since the objectives for which a war is fought set the pattern for everything that is done in the war, it is essential that the *political* objectives be clearly set forth and understood by both the political and military leadership of the government prior to the time decision is made to wage a specific limited

war. However, the futility of attempting to be specific concerning the *military* objectives for which limited wars may be fought, in advance of any knowledge concerning what the specific political objectives are to be in the war, is obvious.

Wars of the past have been fought with the attainment of at least one or more of the following general objectives in mind:

a. To attain specific economic or political goals.

b. To cause a hostile force to cease and desist from military action in which it is engaged.

c. To restore the status quo that existed prior to the outbreak of hostilities.

d. To bring about complete and unconditional capitulation of enemy military forces in the field.

Within the framework of any of these four objectives, one can visualize an infinite variety of combinations and circumstances that would result in the establishment of specific and lesser included objectives. The establishment of the first three of these generalized categories or their combinations as objectives of a war serves to generate limitations on the full utilization of existing capabilities of the forces engaged in the war. Only where the objective is to bring about the complete and unconditional capitulation of enemy military forces in the field does the existing potential and capability of the military really become the determining factor. In all other cases the objectives themselves establish the limitations on the forces engaged, and very definitely circumscribe the extent to which the military is free to capitalize on existing military capabilities and potentialities. For this reason the policy maker and the military planner are severely handicapped in their efforts to assess in advance the impact that limitations arising from objectives may have upon the course of a war, the strategy being employed, and the forces to be used in such a war. It is almost trite to say that the advent of nuclear weapons has changed the whole complexion of war. Having stated this change, however, the question still must be answered as to exactly how the manner in which war is waged has been changed. One thing is certain: whereas in the past peoples and nations could wage wars of extermination, the means available to them for such action were, relatively speaking, primitive and time-consuming when compared with the means afforded by nuclear weapons. The nuclear weapon has placed in the hands of mankind the capability of exterminating his fellow man in a minimum of time. *But the existence of such a capability does not presuppose that it will be exercised in full measure on all occasions or that restrictions which have been tacitly accepted and followed*

in wars of the past will necessarily be abrogated in wars waged during the nuclear age. It is this thought more than any other that makes the current talk of limited war so worthy of examination by the politician, the diplomat, and the military man.

A limited war involving the overt participation of United States forces would probably involve Soviet support of our enemy in the form of weapons and materiel. Such a war would involve the struggle for the attainment of certain objectives that each side considers of sufficient importance to warrant engaging in the adventure. How vital one side, U.S. or U.S.S.R., considers these objectives to be will determine the self-imposed limitations in waging a restricted war. It seems inevitable that if these objectives are of *transcendent importance* to one side or the other, a situation would ultimately be reached when that side must decide to utilize whatever military effort it considers necessary to achieve its objectives, and total war is likely to follow. If the objectives are not considered vital, then either side or both sides may decide to stop short of all-out effort and, accordingly, sacrifice the attainment of the initial objectives. If this line of thinking is valid, then all limited wars involving U.S. and U.S.S.R. resources must end either in what amounts to preservation of the status quo or must expand into total war. It therefore follows that we could only "win" a limited war if our objective is the maintenance of the status quo. Or said another way, I think we must consider that all limited wars will have to end in what amounts to a rather limited victory or limited defeat for one side or the other or in a stalemate, or else expand into total war.

Earlier I defined limited war as war in which the national survival of the U.S. and the U.S.S.R. is not at issue. This definition deliberately ignores what will happen when the possession of nuclear weapons ceases to be in effect a monopoly of the U.S. and U.S.S.R. When this situation obtains, I believe the definition will still hold. As long as the U.S.—U.S.S.R. have in effect a monopoly of nuclear weapons they, by virtue of this fact, are in the position of being the arbiters or umpires, if you will, of any hostility less than total. In other words, as long as this monopoly situation exists, no nation in the world, however great or small it may be, can engage in war except by consent of the U.S. and U.S.S.R. The truth of the foregoing was amply demonstrated in the recent Suez crisis.

Once nuclear weapons become available to nations not now possessing them, the picture will change. Then the ability to absorb all a potential antagonist can deliver and still survive will

become the determining factor. The degree to which the belligerents are willing to risk putting to the ultimate test of total war their assessment of their ability to survive while pursuing the attainment of their objectives, will in the final analysis determine the scope of limited war. The physical size and power of the U.S. and U.S.S.R. will continue to give them the edge in this matter, even though their nuclear monopoly ceases to exist. Accordingly, not until a nation or coalition of nations approximating their size and power appears on the scene to oppose either of these great powers will they lose their ability to umpire a limited-war situation. Once the world is confronted with this tripolar situation, it may reasonably be asked who then becomes the umpire? Who then is in a position to determine and enforce limitations on the scope and weaponry of a so-called limited war? I think the answer is obvious. There will be no one. And when that time comes mankind will indeed be in a much more precarious situation, if such is possible, than it is today.

The Nations Engaged

Let us now examine the second big factor that must be considered in any discussion of limited war—the nations engaged. Earlier it was mentioned that a continuation of a limited war was only possible at the sufferance of the U.S. and U.S.S.R. If this is a valid statement, and I think it is, we can dismiss the unilateral war actions of all other nations as being controllable to the extent the U.S. and U.S.S.R. consider it expedient to control them. The main considerations in limited-war actions then revolve around the actions and intentions of either the U.S. or the U.S.S.R., or both.

An examination of U.S. treaty commitments around the globe reveals the U.S. is obligated to intervene in cases of overt Communist aggression against any nation on the periphery of the Communist bloc, except Afghanistan, India, Burma, Sweden, and Switzerland. Similarly Soviet Russia has mutual defense pacts with all her satellite nations and Red China. If the United States and Soviet Russia see fit actually to discharge in full their treaty obligations, it appears unlikely that limited war in these periphery areas could long remain limited. Thus the same factors that tend to deter total war also have a profound effect in deterring limited war. It would therefore appear more likely that both the United States and the Soviets would recognize the danger of the conflict expanding to proportions of total war, possibly with disastrous consequences to both, and that each would propose alternative

solutions rather than engage in military actions which could lead to this eventuality.

The world has become so polarized between the Communist bloc and the U.S., with the balance of power between the two blocs becoming so fine, that the loss of even a small nation or geographical area could have significant impact on this balance. Each side is so enmeshed in a tangle of treaty obligations that any realignment in orientation of the nations involved is likely to precipitate a chain reaction. Just where such a reaction is likely to start or end is impossible to predict. If this analysis of the existence of a polarized condition is valid, any action in these periphery areas that threatens to upset the balance and precipitate the chain reaction might constitute a threat and probably would be construed as a threat to the national survival of either the U.S. or the U.S.S.R. Total war would be more likely to be the result in such a situation than limited war.

One exception to the foregoing analysis could occur. There is a rather remote possibility of a limited war with Red China should she embark on armed aggression on her own or with only the tacit approval of the Kremlin. In such a situation it is conceivable that the Soviets might deem it to their advantage not to intervene with their armed forces in the event the U.S. reacted strongly. The Soviet objective in this case might be to cause the U.S. and China to expend significant resources in a war, which expenditure could have great long-range strategic significance if the participants, as a consequence, suffered an appreciable degradation of military strength.

Such a conflict would fit the definition given for a limited war. However it would appear much more likely that Soviet Russia would do everything in her power to prevent China from embarking on a venture of this nature unless it fitted the Communist time schedule for an attack on the United States.

Our national policy requires our military planners to concede to the U.S.S.R. the initiative of striking the first blow in a total war. Such initiative should be and probably is considered as a priceless jewel by the Soviet military, and it is not likely to be jeopardized or thrown away via the medium of a limited war that involves their forces and ours directly or indirectly and that gradually expands into a total war. If one is willing to discount completely the possible occurrence of the exception discussed, then the foregoing, I believe, adds weight to the premise that general war (total) is a greater threat than limited war. However, the value of this "priceless jewel" will decrease in almost direct proportion to

the security of our total-war deterrent force, that is, to our ability to decrease its vulnerability to surprise attack. Its value is practically nil when a condition of invulnerability is attained for our retaliatory force and the foregoing premise is correspondingly compromised.

The United States is less likely than the U.S.S.R. to act swiftly in the umpire role in limited-war situations by direct action on a unilateral basis. The Soviets never exhibited much concern for the attitudes and views of their satellites. The United States contrasts sharply with its greater desire to give due consideration to the views of its allies and its desire to strengthen and enhance the prestige of the United Nations Organization by acting through it rather than outside of it. At present the United Nations is little more than a forum for international debate. Until it attains a basic strength for decision and action, which it does not now possess, the influence that we permit it to exert upon our capability to take swift and direct action is significant and dangerous. The restraint our allies are able to bring to bear on our acting unilaterally is of equal import. Here our widespread system of alliances, embodying as it does nations of many gradations of economic, political, and military strength, makes it almost axiomatic that our actions will always reflect the views of our allies. The views, in the main, will reflect the lowest common denominator.

Geography

Let us now turn to the third predominant factor that must be considered in any discussion of limited war: the geography of the war. This factor includes consideration of such subjects as "sanctuaries," nature of the terrain, physical size of the area of conflict, and the presence or absence in the area of the facilities that can be used for the conduct of limited-war operations. Such aspects of the problem confront the military planner and complicate his generally already complicated job of planning limited-war operations.

Political rather than military objectives will exercise the greatest influence on the determination of those areas that antagonists will seek to establish and have honored as sanctuaries. I think this was true in the Korean situation and will be equally true in the future. The area that offers the greatest geographical opportunity for successful results from military operations may well be the one that is denied to the tactician or strategist by the political element of the government. This points up the manda-

tory requirement, previously mentioned, that the political elements of the government establish and clearly state to the military, *in advance* of the initiation of hostilities, the political objectives for which a limited war is to be fought. Unless this is done, the military will be unable to ensure, commensurate with these political objectives, the most efficient and effective utilization of their forces and the geography available to them for the conduct of operations.

Certainly the physical size of the area of conflict will have an increasing impact on air power operations. Advances in modern technology, which continue to result in ever-greater speeds in air vehicles, complicate in the extreme such problems as those associated with the honoring of sanctuaries under "hot pursuit" conditions, where the area of operations is relatively small in relation to the speed of weapons operating in it.

Of no less significance is the ability to support logistically with the greatest efficiency and least cost a force equipped with modern and complex weapons. This ability varies inversely with the size of modern forces engaged and the distance of the area from the source of modern logistical support. The larger the size of the modern forces engaged and the more primitive and rugged the area of operations, both as to terrain and available resources for logistical support, obviously the greater the problem of logistically supporting such forces and operations and the cost associated with them.

The Weaponry

The fourth and last predominant factor that requires attention in any examination of the subject of limited war is the weaponry. I shall use this term as embracing such considerations as the possible use or nonuse of conventional or nonconventional weapons, the force pattern, and the size of the forces required.

Everyone is familiar with the controversy that continues to swirl around the question of when and where to use conventional and nonconventional weapons. The mere fact that so much has been written and said on the subject is indicative of its highly political nature.

That nuclear weapons will be used in total war I think goes without saying. With the power that nuclear weapons place at their disposal the United States and the Soviet Union have a relatively simple task of blueprinting strategy and doctrine for such a war. In fact the type of forces and the strategy each will employ become almost self-evident.

The war in its most fundamental aspects becomes one of national survival with no holds barred and the utilization of the most powerful weapons against the enemy, with the sole objective of threatening his national existence to the extent necessary to cause him to lose the will and capacity to wage war or offer effective opposition. Our NATO allies have accepted the use of nuclear weapons as vital for the defense of West Europe in the event of total war. What the attitude of our allies is likely to be concerning their use in limited-war situations is far less clear.

There are those who strongly contend that any use of nuclear weapons in limited war will "inevitably" expand the war to total proportions. Since war is potentially *total* at all times, there is certainly great cause for concern, and such a premise is worthy of the closest examination. Whether the element of "inevitability" is an ever-present ingredient I doubt. The conditions that could generate a limited war in this nuclear age will in the majority of cases be far too complex to permit such a positive view.

The factors bearing on the problem of limited war which have already been discussed serve to emphasize the foregoing statement. Such a premise has implicit in it the view that all that is required is the decision not to use nuclear weapons and all will be well. Could we be sure that, under all conditions that are likely to arise, agreement could be obtained by *all* belligerents to follow such a course of action, then and only then would we be safe in planning to wage limited war by conventional means only. To state the proposition is to deny its possibility. How could we ever be sure an enemy possessing nuclear weapons would keep his agreement not to use them? Were he to break his agreement, how could we punish him except by resort to the use of nuclear weapons ourselves? To believe or to assume that belligerents possessing nuclear weapons will not use them in limited war, should such use appear to be to their advantage, is, to say the least, dangerous and foolhardy.

Common sense dictates that we *must* assume that nuclear weapons will be used in limited war if those nations possessing them consider it *expedient* to do so. It certainly would seem advantageous from the Communists' point of view to be able to continue to wage limited wars in which nuclear weapons are not used—enjoying as they do a tremendous superiority in manpower and probably a like superiority in conventional weapons. The course of events in Korea and in Indo-China emphasizes the advantages that accrue to them under such terms. The Communist propaganda against the use of nuclear weapons undoubtedly has as its aim the retention of this advantage. Irrespective

of the foregoing there will undoubtedly be situations where the characteristics of the nuclear weapon are such as to make it the least desirable and effective weapon for the task at hand. In my view the key determinant will be the extent to which a belligerent possessing nuclears considers that its vital interests may or may not be affected by the use or nonuse of nuclears. What his antagonist may or may not do in this regard will certainly enter into his considerations, but it will not be the final determinant.

Any discussion of using nuclear weapons raises the issue of the morality of their use in war. The whole history of weaponry has been one of ever-increasing efficiency and destructiveness. History is replete with examples of newly developed weapons whose use was deplored as being uncivilized and inhuman; yet without exception, if they proved efficacious in furthering victory in war, they inevitably became a part of the arsenals of military forces the world over, replacing completely less efficient weaponry. (Some will cite the nonuse of gas in World War II as an exception to the foregoing. I think it is generally conceded that gas was not used in World War II simply because it was not to the advantage of either side to use it—it simply was not the most suitable or best available weapon.) There are many, both in and out of the military, who feel that history will repeat itself in this regard as concerns nuclear weapons—that far from remaining "unconventional" they will become the "conventional" weapons of the future. Perhaps this "future" is already with us.

From the standpoint of absolute morality, killing is immoral and the means by which killing is accomplished must also be immoral. Human nature being what it is, it seems unlikely that humanity will reach the millennium of nonviolence during the nuclear era. This being so, it is more rational to say that the morality or immorality lies *in the manner in which weapons of destruction are used rather than the weapons themselves.*

Only conventional weapons were used in Korea, yet the destruction wrought could hardly have been greater had nuclear weapons been used, and certainly the misery and suffering sustained by troops and the Korean people were dragged out over a period of years. If the use of nuclear weapons can bring a quick decision in war and thereby shorten it, even though initial destruction and casualties may be high, who can argue that such usage is more inhuman and immoral than a war of conventional weapons that drags on and on, piling casualties upon casualties, destruction upon destruction, and misery upon misery?

Because of budgetary considerations the British have recently

decided to revamp their defense structure—placing major reliance on nuclear-equipped forces. There is evidence that others of our allies are likely to do the same as soon as they are able either to produce or obtain nuclear weapons. The implications, for the U.S. and its allies, of such a revamping of defense forces, on considerations of the morality of using nuclear weapons are most significant. Once this change in their defense structure is accomplished, our allies are less likely to oppose the use of nuclear weapons in limited war than is now the case. Indeed they will hardly have a choice in the matter. Further, the accomplishment of this change by our major allies will suggest, I believe, the desirability of our ultimately reaching an agreement with them whereby they assume the major responsibility for the maintenance of the free world's limited-war type of forces and thereby reduce to a minimum the necessity for the United States to maintain them. Under such an agreement the U.S. could provide the bulk of the free world's total-war deterrent forces, and its allies could provide the bulk of the free world's limited-war forces. The reduction in defense expenditures for all concerned which could result from such an agreement makes its attainment both possible and attractive.

Earlier mention was made of the polarization concept and the possibility of a chain reaction from an upset of the present alignment among nations of the world. It must be assumed that Soviet Russia and Red China have also recognized this concept. The Communists therefore might conceivably attack an unprepared area in such strength and with such speed that their objectives would be gained prior to any attempts to block them. The U.S. would then find itself in the position of declaring war if it wanted to wrest the captured territory from the Communists. Obviously such a situation would be most unsatisfactory for us. Under such conditions neutral nations or those friendly to the West might feel that the West could not protect them, thus causing a chain reaction to align with the Communists. It therefore appears that reaction time may well play as decisive a role in limited war as in total war. Selective and discriminatory use of nuclear weapons affords the United States the best means of accomplishing decisive results with a minimum of reaction time and, for reasons already mentioned, may well be the "morally right" weapon to use. Contrary to opinion that exists in some civilian circles, the ability to use nuclear weapons on a selective and discriminatory basis, i.e., with correct yield for a particular target, does not present a problem that the military cannot satisfactorily handle.

Before leaving the subject of conventional versus nonconventional weapons it might be well to remember that the advent of atomic weapons seems to have caused the military to focus its attention on the use of nuclear weapons of varying degrees of killing power to the exclusion of weapons that have the capability to neutralize but not to kill. Certainly weapons of neutralization, such as certain chemical and biological measures, have a place in limited war for purposes of neutralization or denial and cannot logically be objected to on moral grounds.

Force Pattern

This brings us to a consideration of the force pattern of weaponry. I should like to enter this facet of our subject by posing a question: *Does limited war generate a requirement for specially developed limited-war forces?*

Discussion of this question centers on two divergent viewpoints. It has been postulated that if we prepare adequately for total war, then we can handle limited wars in stride with the forces so created. Opponents to this idea raise certain objections:

(1) Total-war forces cannot efficiently perform limited-war tasks (using a sledge hammer to kill a gnat).

(2) The utilization of total-war forces in a limited-war situation will, because of their massive destructive potential, inevitably and unacceptably increase the risk of enlarging the conflict into a total war.

(3) The utilization of total-war forces in limited-war situations will degrade our total-war capability, thus lessening our power to deter total war and increasing the probability that total war will occur under conditions least favorable to us.

The reconciliation of these arguments seems to lie in policy and doctrine. What the proponents of both viewpoints are really trying to say is that we must always maintain an adequate total-war force in such a state of readiness and security that its availability is ensured under any circumstances. We thus preserve its deterrent effect and its ability to prosecute the total war if this deterrence fails. If we should have forces in excess of this requirement, they can be used in limited-war situations. The extent to which national resources are devoted to the creation and support of these excess forces must not be allowed to influence adversely the amount of national effort required for the support and maintenance of the total-war deterrent force. The use of the total-war

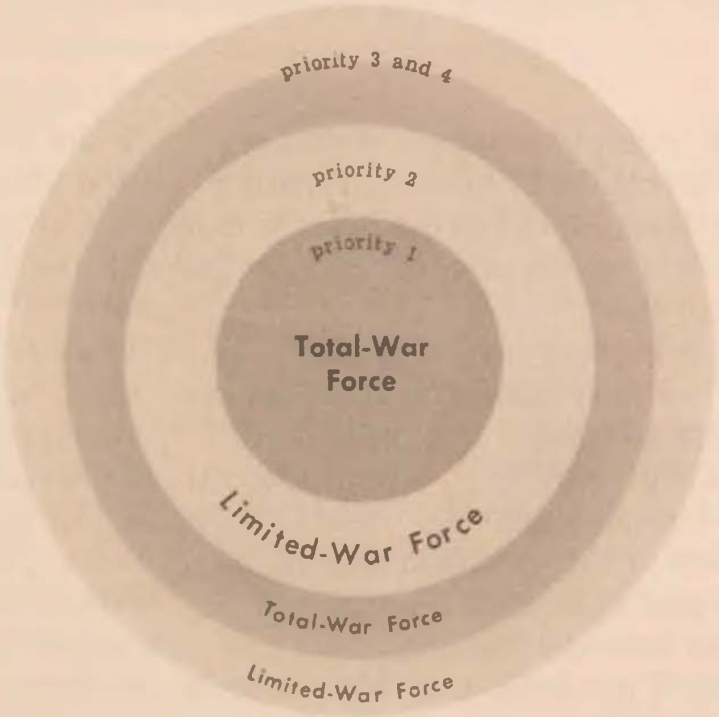
deterrent force in limited-war situations must always be such as to permit its rapid reorientation toward total-war tasks in the event this becomes necessary.

Careful consideration of all the aspects of the limited-war problem raised in this article indicates, I believe, the necessity of weaponry that provides for:

1. Maintenance by the free world of a "hard core" total-war deterrent force constituted of secure strategic air power.
2. Maintenance, at least for the present, by the free world of limited-war "cushion" forces. The composition of these "cushion" forces must be such as to prevent the Communists from gaining something for nothing whenever they probe free-world defenses.

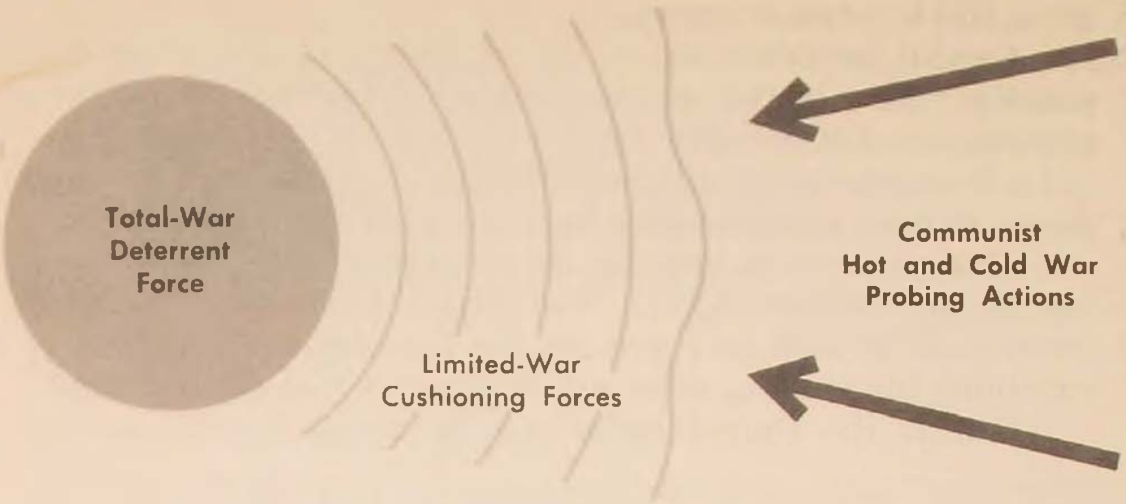
Neither the United States nor the remainder of the free

Building Military Power



First requirement in building free-world forces is the adequate and secure total-war deterrent force, the hard-core essential. If forces in excess of the deterrent requirement can be afforded, they can be added for limited-war situations. If additional resources become available, priority might next be given to a further strengthening of the deterrent force, or to further increment for limited-war forces, or some division between the two categories.

Peripheral Resistance



Cushioning action of limited-war forces against the backup of a hard-core total-war deterrent force. It is not necessary to match the Communist aggregate limited-war forces to test the weight and determination behind probing actions or to prevent them from attaining their objectives without cost. (Total-war deterrent force remains ready for commitment if required.)

world need attempt to match *in the aggregate* the Communists' limited-war strengths in order to obtain a cushion effect sufficient to force the Communists to disclose the extent of their determination in each probing action and/or prevent their obtaining something for free.

In the foregoing we have the crux of what is almost exclusively a military problem that can and must be solved by military men and need not await a clearer delineation by the statesman of the impact of certain political considerations on the conduct of limited wars. Yet there is much lack of agreement as to the answer to this problem and to the question posed among the services and wide divergence of opinion between the military services as to how the United States can and should prosecute a limited war. The Army and Navy appear to believe that U.S. participation in a limited war would be, in general, along the lines of World War II operations on a reduced scale. In the Air Force, on the other hand, there appear to be two schools of thought. One school seems to believe that in limited-war situations air power can establish conditions that would either be decisive in themselves and thus preclude the need for surface

operations or that would establish conditions so favorable as to make successful exploitation of results by surface forces a foregone conclusion. Such a premise makes the role of air power forces a decisive one and that of the surface forces a secondary consideration. The other school seems to believe that in limited war the role of air power forces and specifically the Air Force should be one of primarily supporting surface actions and exploiting surface operations. The premise of this school would require that the Air Force give greater consideration to the development of tactical-type forces than we are presently doing. Certainly when one considers the various factors relating to limited war discussed in this article, it is evident that there is no magic formula that can be applied, and the views of the services on this matter cannot be labeled totally right or totally wrong. Determination of the force size and composition is at the heart of the military part of this problem.

Generally speaking, the longer a war lasts the greater the requirement for large numbers of men and materiel and the greater will be the losses in blood and treasure for both sides. The speed and dispatch with which a war is brought to an end may well spell the difference between the winning of a clear-cut victory and the winning of a Pyrrhic victory.

The child who asks a parent how high is up is asking a question no more difficult to answer positively than that confronting the military planner faced with determining what size forces the nation needs for waging limited war. Although the Korean war is classed as a limited war, with the connotation in the minds of many that it was a small-sized war, a study of history will reveal that as far as size of forces engaged, casualties, and destruction and devastation accomplished in the war area are concerned, the war was not small in size by any historical standards. Certainly the prospect of a series of limited wars such as Korea is not only grim but unacceptable. The differences of opinion that exist concerning what yardstick is to be used in determining how much and what kind of forces are essential to meet our requirements for limited war will continue to confuse the picture.

Summation

However confused the situation concerning limited war is or may become, we must not fail to take due cognizance of the

following when determining and meeting U.S. force requirements for the nuclear era:

1. The greatest threat to our national existence lies in a sudden and devastating nuclear attack on this country. The strategic air force required to deter such an attack or to defeat the enemy should we fail to deter him is the *sine qua non* of any force structure we have today and must have in the future. This deterrent force must continue in the future to have number-one priority on our resources. We must under no condition diminish the strength of this force below the level required for the destruction of the enemy should total war be forced upon us.

2. Budgetary considerations, if nothing else, make it impossible for the military to have all the forces it would like to have. This being so, the military will always have to settle for less than the military planner would like to have in forces. Compromise and calculated risk will continue to be the order of the day. The ever-increasing complexity and cost of weaponry dictate the urgency and necessity of determining those weapon systems that will give us capabilities commensurate with the risks we are willing to assume. We cannot be strong everywhere, nor can we continue to pour vast sums into every type of weaponry just because someone thinks this weaponry will do this or that, or that it would be desirable to have such a weapon or system. Compromise and calculated risk must be the criteria to be followed in determining the amount and type of forces the nation should have for limited-war purposes over and above the deterrent force.

3. The ever-increasing emphasis on the horror of nuclear war has generated in the United States and elsewhere in the free world an atmosphere of dread and fear—almost a psychosis that peace at any price is preferable to nuclear war. This feeling has given rise to a growing climate of political opinion against any use of nuclear weapons in limited wars, however selective and discriminatory their use might be. Thus the military stands in danger of being confronted with the paradox of possessing a weapon system *designed to give it an advantage* over possible adversaries and yet unable to capitalize on the possession of such an advantage. The Soviets cannot be blind to this situation nor fail to see in it ever-increasing opportunities for the nuclear blackmail of the Western world. The recent threatening statements directed by the Soviets to certain Scandinavian countries concerning Soviet possession and use of nuclear weapons serve to underscore the truth of this statement. As long as this political

climate exists in the United States, and in the remainder of the free world, our military forces must possess a conventional nonatomic capability to wage limited war but should not under any circumstances relinquish or diminish their efforts to develop and maintain a superior nonconventional nuclear capability for waging limited war, for the nonconventional of today is the conventional of the morrow.

Evaluation Staff, Air War College

The Shape of Aerodynamics

WALTER T. BONNEY

IN A not-too-far-distant tomorrow supersonic commercial air travel will have become commonplace. Hardly more distant is the time of hypersonic flight—velocities exceeding Mach 5, perhaps speeds as high as 6500 mph—by piloted, rocket-powered "boost-glide" military aircraft. No less assuredly, although the timing cannot be stated as confidently, one forecasts the day when the first explorers will lock themselves inside a rocket and venture into outer space.

Also the day may be at hand when *aerodynamics* no longer will be considered a word adequate to describe the science that is the foundation upon which we build our aircraft. Perhaps *aerothermodynamics,* first suggested by Crocco in 1931, will come to be preferred. Be that as it may, in this essentially nontechnical presentation of a few of the problems facing the aeronautical engineer, *aerodynamics* will be used in an inclusive sense.

To appreciate more fully what needs to be accomplished if we are to reach our performance goals, it is necessary to examine the long-term development of the art and science of aerodynamics. Sir Arnold Hall, one of Great Britain's foremost aeronautical engineers, has said that the broad science on which aerodynamics —the mechanics of fluids—is based was largely complete before the Wright brothers flew in 1903; "Such men as Newton, Reynolds, and Mach had seen to that." As early as 1810 Sir George Cayley clearly had expressed the idea that sufficient lift for flight could be secured by moving inclined surfaces in the flight direction, granted that sufficient mechanical power was provided to compensate for the air resistance, or drag, that hinders this motion.

In the years before 1903 there had been considerable experimentation—empirical effort as distinguished from the theoretical work of the mathematicians and physicists. As early as 1871 Wenham in Great Britain designed a wind tunnel. In 1884 his countryman, Horatio Phillips, built an improved version and learned

that curved airfoils, patterned after bird wings, had better lift/drag characteristics than flat plates. By 1910 wind tunnels were being used in France, Germany, Italy, and Russia.

Many pioneer air scientists attempted to learn the secrets of flight by studying birds, the masters of the art. Also there were some who reasoned that the bodies of fish might provide useful clues to the proper shape of a wing (Sir George Cayley's sketch of the cross section of a trout is virtually the same as that of a modern, low-drag airfoil section developed by the NACA). There were still others, including Sir Hiram Maxim, who doubted the wisdom of slavish imitation of nature. Sir Hiram is quoted as observing that "the successful locomotive was not based upon imitation of an elephant."

The work of Wilbur and Orville Wright was a happy combination of skillful experimentation and sound engineering practice. Although they were familiar with the attempts of others—Lilienthal, Langley, and Chanute—to solve the problems of mechanical flight, they became disillusioned about the correctness of the findings. Using gliders and employing their own wind tunnel, the Wrights produced their own aerodynamic information, sufficient in accuracy and scope for them to succeed where all others had failed.

In the two decades that followed scientists were developing a body of mathematical knowledge, based on the mechanics of fluids, that would lead to rational theories of lift and drag. Of the many early scientists who made contributions to aeronautics, three stand out: Lanchester, Kutta, and Joukowski. Frederick W. Lanchester, a British automotive engineer whose mathematical competence was largely that of a gifted amateur, was a genius in his wonderful physical insight. In later years Prandtl said he felt that "Lanchester's treatment [on the mechanics of fluids] is difficult to follow, since it makes a very great demand on the reader's intuitive

Progressively surmounting the problems of flight, man faces anew further barriers in the hastening science of aerodynamics. After his big success in getting off the ground, his perseverance in engineering and wind-tunnel research steadily increased his air speed and performance. Then, as his flight breached the speed of sound, the hitherto ignored compressibility of air loomed in check. While the discovery of the "area rule" brought this barrier tumbling down, formidable problems of directional stability and aerodynamic heating arose. Tracing the conquest of the air environment, Mr. Walter T. Bonney, Assistant to the Executive Secretary, National Advisory Committee for Aeronautics, writes an authoritative account of the spiraling cycles of knowledge and know-how in the science of aerodynamics.

perceptions," but conceded "we were able to draw many useful ideas from his book" (published in 1907). The German mathematician Wilhelm Kutta sought to explain why a horizontally positioned, curved wing produced positive lift when it moved through the air. As early as 1902 he was publishing papers about his work. In Russia, Nikolai Joukowski, 1847—1921, a professor of mechanics, worked independently to develop mathematical foundations for the theory of lift.

It was not until after World War I that it was recognized that the essential phenomena which determine lift and drag had already been expressed in practical mathematical form by Ludwig Prandtl, whose work at Göttingen extended over the first half of the 20th century. This achievement, the expression of modern subsonic wing theory in terms that could be understood by working engineers, was one of Prandtl's two monumental aeronautical accomplishments. The second was his theory relating to the boundary layer, the thin layer of fluid next to the surface of a body against which other layers of the fluid slide when the body is in motion.

Now it became possible, and profitable, to concentrate on obtaining the necessary mass of detailed engineering information to exploit the new aerodynamic theories. For years there had been an increasing awareness of the importance of the Reynolds number, a correction factor especially useful in measuring scale effect, the differences between data accrued from tests of small models in wind tunnels and information obtained from flight test of full-size airplanes. In 1922 the National Advisory Committee for Aeronautics (NACA) built a wind tunnel designed around a new concept in which the pressure could be increased until the data obtained with small models was equivalent to actual flight conditions.

In the years that followed, the NACA built other facilities of radical design. The systematic work accomplished using these new research tools contributed greatly to the improvement of airplane design. The development of the NACA cowl for air-cooled radial engines, for example, resulted in speed gains of as much as 15 per cent without additional power. Learning the importance of locating engine nacelles, with proper fairing, into the leading edge of the wing was a similar advance resulting from wind tunnel investigations.

With further development of the boundary-layer theory,* to

*[The boundary layer is a thin layer of air next to an airfoil, distinguishable from the main airflow by flow characteristics of its own resulting from friction. A laminar boundary layer is characterized by nonturbulent airflow, made up of thin parallel layers, about an airfoil. When laminar flow breaks down the boundary layer becomes turbulent.]

which Sir Geoffrey Taylor and Theodor von Karman made significant contributions, turbulence of the boundary layer became a matter of great interest. In the words of Sir William S. Farren, "laminar and turbulent boundary layers passed from the purely scientific to the engineering field, and 'separation' of the flow from the streamline aircraft became recognized as the simplest expression of failure. The shape, although it might look right to some, was certainly not always right, for the air refused to cling to it."

At the NACA's Langley Aeronautical Laboratory in the late thirties a group of workers led by Eastman N. Jacobs began an intensive search for ways to extend the laminar flow as far back on the wing as possible. By thus delaying the onset of turbulent flow they hoped to reduce materially the parasite drag (*total drag* is the sum of the *induced drag* necessary for lift and the wake or *parasite drag* which is independent of lift). In this effort they required the more precise data that could be obtained from the newly constructed, low-turbulence wind tunnel.

In 1940 the NACA announced "discovery during the past year of a new principle in airplane-wing design [which] may prove to be of great importance. The transition from laminar to turbulent flow over a wing was so delayed as to reduce the profile drag, or basic air resistance, by approximately two-thirds . . ." First military application of the wing was on the North American P-51 Mustang. Before the end of World War II numerous other fighters, including the Lockheed P-80 Shooting Star, were using improved laminar-flow airfoils.

Because the changes of density and those caused by compression or expansion of the air at moderate speeds are very small, scientists generally had long considered air incompressible, even though they knew it to be otherwise. This practice had made much easier their task of formulating workable theories. At about this point, however, aerodynamicists were forced to accept the fact that air is a compressible fluid. (In research on propellers, the tips of which had earlier been approaching the speed of sound, concern about compressibility already had been expressed.)

As the speed of airplanes approached closely the velocity of sound, there was an alarming increase in drag. The speed of sound (760 mph at 60° F) is the speed at which pressure is transmitted or propagated. What was happening was that the speed of the airplane itself was coming so near the speed of sound that the flow of air around the wing or even over portions of the fuselage was reaching sonic velocity and a shock wave was forming. Instead of moving forward and passing into the air in front of the air-

plane, the sonic pressure impulses were piling up on the surface of the wing to form a barrier that distorted the normal flow of air over the wing or around the fuselage.

When an airplane accelerates until part of the airflow is supersonic, it may be said to be flying in the transonic speed range, where rapid and severe changes in the airplane's behavior occur. These may include sudden change in trim, deterioration in the effectiveness of the controls, and vibration affecting various parts of the structure.

"I well remember this period when designers were rather frantic because of the unexpected difficulties of transonic flight," von Karman recalls. "They thought the troubles indicated a failure in aerodynamic theory. I thought we had to expect compressibility effects, since the air has always been compressible. It is rather remarkable that we could go as far as we did with a theory based on the assumption that air can be treated as an incompressible fluid."

Since then, of course, the frightening aspects of the transonic speed range largely have been dispelled. The fact remains that the best way to deal with the area where subsonic and supersonic flow patterns exist side by side is to pass as quickly as possible into the supersonic area beyond.

It was only ten years ago that Major Charles E. Yeager became the first man to achieve supersonic flight. His airplane was the Bell X-1, which had been designed and built especially for use in exploring the transonic range. Partners in that program, in addition to the USAF and the contractor, were the NACA, the Navy, and several airframe and engine manufacturers including Douglas, Northrop, Convair, Curtiss-Wright, and Reaction Motors.

Over the past decade the aeronautical research program has provided, in addition to the most important demonstration that the "sound barrier" was no impenetrable wall, a great mass of aerodynamic information that has been incorporated in such aircraft as the USAF's century-series fighters and in their Navy counterparts. Last year, after flying faster than man had ever gone, the Bell X-2 crashed and its pilot, Captain Milburn G. Apt, was killed. (Although the Air Force has never announced the speed, the nation's press has confidently attributed to "authoritative sources" reports that the X-2 had exceeded Mach 3—beyond 2000 mph.)

Now under construction by North American is still another of the high-speed research airplanes, the X-15. It will be powered

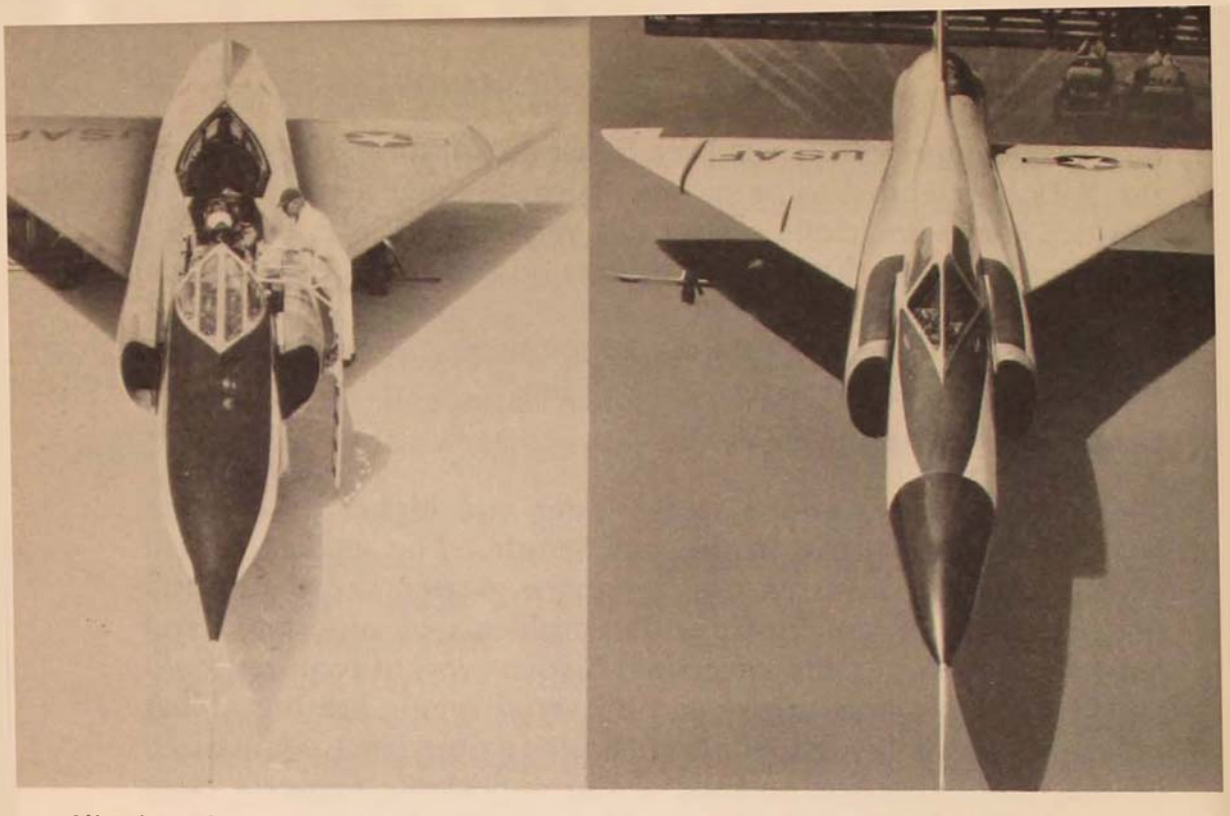
by rocket motors constructed by Reaction Motors. How speedy the X-15 is intended to be has not been disclosed except for the guarded comments made earlier this year that it "will go considerably faster" than the X-2 and that its mission will be "to obtain data, particularly with regard to heating, stability, control, and the problems of re-entry into the atmosphere, . . . to apply to designs of hypersonic airplanes and missiles."

MAN'S efforts to fly faster and higher have never been more intense than in the past decade. The success of such efforts largely depends on our gaining a greater knowledge and understanding of the fundamental problems of supersonic and hypersonic flows. At the same time further work is required both on the transonic flow theory and on aerodynamic heating. That rapid progress is being made has for some time been emphasized by the improving performance of our supersonic fighters. Now there is the added emphasis provided by the flights of our first supersonic bomber, the Convair B-58. The rapid progress in development of a variety of high-performance guided missiles is still further indication of what is happening.

Dr. H. L. Dryden, Director of the NACA, once said that the research information gained today would be reflected in the aircraft built four years from now and that it was being produced using facilities built four years ago. It is to be suspected that were he to repeat his statement today, if anything he would increase the time lag between construction of research facilities and construction of aircraft designed to incorporate the research results.

Consider for example the "area rule," which reduces very appreciably the power needed for supersonic flight—or, conversely, makes possible supersonic flight by airplanes which without its application would remain subsonic. This principle was conceived and perfected in 1951-52 by Richard T. Whitcomb, a research scientist at the NACA's Langley Laboratory. In essence the new concept was that if a wing-body combination could be shaped so that its cross-sectional area, taken progressively from nose to tail, was similar to that of a smooth body of revolution with the highest possible fineness ratio, the abrupt drag rise near the speed of sound would be greatly reduced.

Whitcomb's discovery was the result of painstaking, experimental research. It was possible because he had available the world's first transonic wind tunnel, completed late in 1950. For years research on transonic problems had been hampered by the



Slipping through the barrier. The early version of the F-102 interceptor (left) was a sharp disappointment: it would not break through the sonic barrier. Salvation came in the form of the "Whitcomb area rule"—a revolutionary method of tailoring aircraft wings and fuselage to minimize interference drag in the critical transonic speed range. Aircraft flying at low speeds push air ahead of them, but the resistance of the air thus compressed is negligible. As the aircraft approaches the speed of sound, the air compressed by its passage forms a shock wave that is forced back along the body. The pinched waist of the area-rule fuselage gives the compressed shock wave a chance to expand; this reduces the drag on the aircraft. The resulting large improvement in aerodynamic efficiency allows an aircraft like the F-102 or the B-58 to "slip" through the sonic barrier instead of needing considerably more thrust in order to "bust" through. It is regarded by the NACA, the armed services, and the aircraft industry as a major key to supersonic flight.

lack of a means for studying transonic flows under the closely controlled laboratory conditions that a wind tunnel affords. Unfortunately until the NACA's John Stack—who has been credited with having earlier conceived the idea of the research airplane program—and his associates devised the "slotted throat" principle, the phenomenon of "choking" in the tunnel test section had made impossible such careful study of flows at the speed of sound. It was in 1946-47 that initial design and construction was begun on the Langley transonic wind tunnel that Whitcomb used four years later with such spectacular success. And it was 1953 before the first airplane to incorporate the area rule was test-flown.

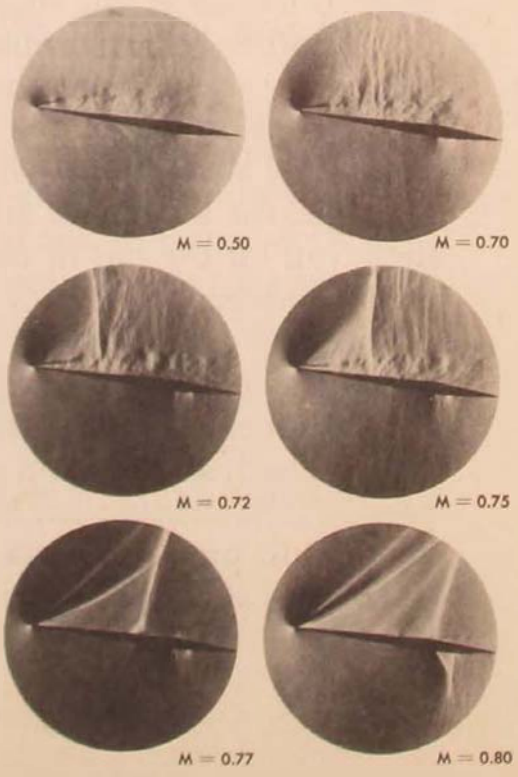
Ironically the essence of the area rule had been suggested

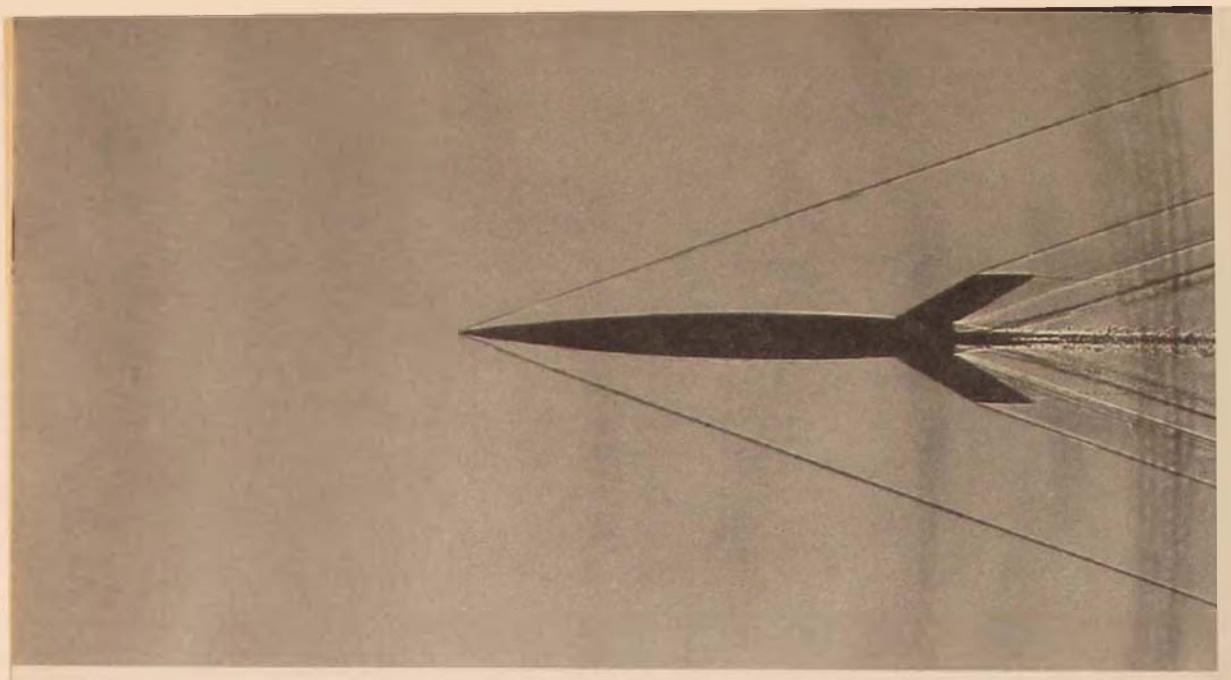
several times in the literature on linearized supersonic flow theory. But because of the limitations of the theory at transonic speeds, the mathematical expressions pointing to the area rule had been disregarded as being of little significance. It remained for a perceptive experimentalist, working with a sharp new research tool, to succeed where others had failed.

"Many of the major problems of the aircraft of the future are old problems in new dress," Dryden has said, noting that "the problems of stability and control of current and future aircraft are describable in the same conceptual framework . . . which Hunsaker applied in NACA Report No. 1 [published in 1915]. There are, however, great changes in the superstructure, in what Bryan described as the approximations to air pressures to which the planes and other parts of the machine are subjected. For our future airplanes we must assure stability not at speeds of 40 to 90 mph, but at speeds extending from 100 to 1000 mph or more . . . ."

One of the major problems faced by designers of supersonic

Jet-age aeronautical scientists must assure stability in aircraft over a wide range of speed. Above, using a high-speed research model built for special studies in the 300-mph, 7x10-foot wind tunnel at NACA's Langley Aeronautical Laboratory, scientists evaluate stability characteristics in subsonic flight (e.g., during landing and takeoff) of an aircraft capable of supersonic flight. Automatic recording devices in the adjacent control room measure forces exerted on the test model. The series of spot photographs below, not related to the above test, show the effect of increasing speeds on the shock-wave patterns over a supersonic airfoil.





A missile model "streaks along" at more than 2500 mph in an NACA Supersonic Free-Flight Wind Tunnel at the Ames Aeronautical Laboratory, Moffett Field, California. This vivid shadowgraph shows shock lines streaming back from the model's needle nose and tail surfaces. During sustained flights at such high speeds, aerodynamic heating could raise the missile's surface temperature to more than 600°F.

fighters is the decrease in directional stability that occurs as speed increases. Conventional lifting surfaces tend to lose their effectiveness as the Mach number increases. The positive directional stability of an airplane may be so diminished that it becomes unacceptably low. High-speed wind tunnels big enough to provide large-scale data are virtually indispensable in studying the onset and seriousness of this phenomenon as it affects a particular design.

Another vexing problem affecting both airplanes and missiles is interference at supersonic speeds. Design engineers always have had to consider carefully the aerodynamic interference that occurs when flow around one part of the airplane disturbs another. For example, the flow fields around the wing in level or maneuvering flight can hit the tail in such fashion as to reduce the effectiveness of the rudders or elevators. In the case of subsonic airplanes the problem of avoiding such interference effects has over the years become a reasonably straightforward and easy task.

In supersonic flight the problems of aerodynamic interference grow in both severity and complexity. As Mach numbers increase, pronounced changes can occur in the patterns and strengths of the flow fields, producing marked changes in the aerodynamic effectiveness of surfaces immersed in these flow fields. A clear understanding of the nature of these flows is of course imperative if an

airplane or missile is to fly acceptably throughout the range from takeoff to maximum speed.

In the case of the airplane especially, the streams of hot gases from turbojet engines can cause serious interference effects in addition to those resulting from flow over the airframe components. For example, as operating altitudes increase, the flow pattern of the jet exhaust may also change. A jet exhaust that caused no harmful interference at 20,000 feet could very possibly produce a flow pattern at 60,000 feet that resulted in serious interference. Again the problem is one requiring large amounts of "tunnel time" in which the designer can study the problem as it affects his proposed airplane or missile throughout its entire operating range.

Still another stability problem manifests itself in that frightening experience now generally termed "inertia coupling." Today the airplane fuselage is being lengthened and at the same time, wings are growing smaller and thinner. Weight is being concentrated along the centerline. When an airplane of this configuration is put into a rapid aileron roll, centrifugal forces tend to swing the nose and tail outward and the airplane begins to yaw. If a full roll revolution is completed in less time than a single yaw oscillation, large centrifugal forces outweigh the stabilizing influence and a violent, uncontrollable yawing and pitching motion is likely to occur. This complicated reaction can impose loads sufficient to destroy an airplane. Since the phenomenon was first experienced in 1954, much research in wind tunnels, in flight, and by theoretical studies (often employing analog computers) has provided a better understanding of the problem and has enabled practical design solutions.

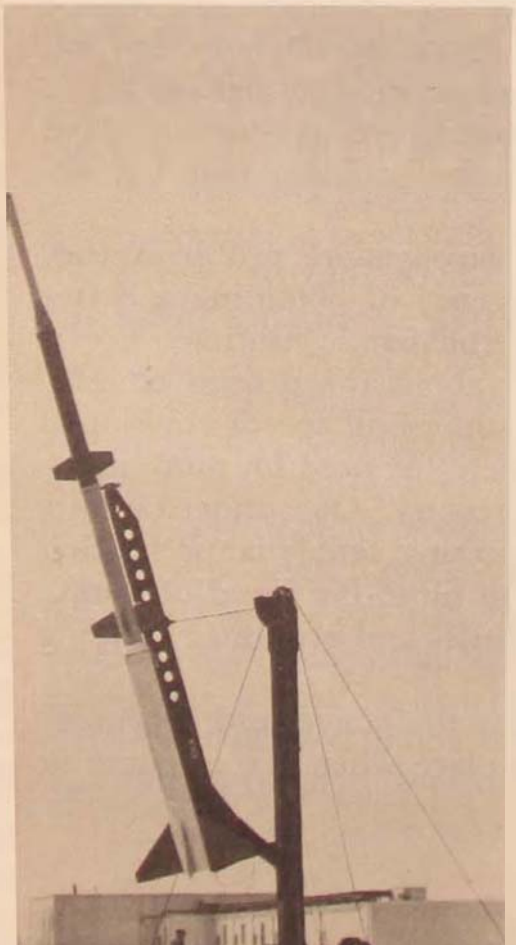
Important and severe as are such aerodynamic problems, they are perhaps overshadowed by the urgency of obtaining a better understanding of the mechanics of aerodynamic heating. To be sure, much has been learned already about the process of aerodynamic heating at the relatively low supersonic speeds envisioned for conventional airplanes, but even here the need for more information about the problem is most pressing. Our understanding is still imperfect, to say the least, respecting aerodynamic heating in the higher speed ranges of about 10 times the speed of sound, at which intercontinental ballistic missiles and even man-carrying hypersonic gliders may fly.

In essence aerodynamic heating is the conversion of kinetic energy into heat energy which takes place when the airplane or

missile streaks through the air. This conversion occurs in the area of the shock wave and in the boundary layer where the air velocity is slowed as it approaches the body. The temperature increases as the square of the velocity. At a speed of Mach 3, about 2000 mph at altitude, the temperature would be about 660° F. At Mach 20, about 13,000 mph, the temperature would be above 20,000° F, far hotter than the surface temperature of the sun.

The heat energy that is generated by high-speed flight first appears in the boundary layer. Then it is transferred through the boundary layer into the aircraft structure. Since the heat-transfer rate for a laminar boundary layer is considerably lower than that for a turbulent boundary layer, it is vital to maintain laminar flow to the maximum extent possible. At the same time that heat energy is being absorbed by the aircraft structure, radiation is dissipating some of it. In stabilized flight a balance between heat input and outgo will be achieved. The desired goal, of course, is a temperature balance low enough so that the aircraft structure will not be destroyed.

In conventional aerodynamics the atmosphere is considered to be composed of stable molecules of the various elements in air.



Packed with a mass of telemetering equipment to record and transmit information about aerodynamic heating, this NACA-developed, four-stage, rocket-propelled research missile in its first firing exceeded Mach 10 (6600 mph at high altitude) and penetrated more than a million feet into the sky. Propulsion was by four rocket motors, fired in sequence. As each of the first three burned out, it dropped free. The fourth motor, the smallest, was a part of the missile itself. Motor firings were sequenced so that the missile coasted upward briefly after each rocket was exhausted. Thus maximum speed and altitude were attained without danger of excessive temperatures due to aerodynamic heating from friction with the dense air at low altitude.

To study shock-wave formations at the very low densities that missiles would encounter at extremely high altitudes, NACA scientists use a nitrogen afterglow technique. Nitrogen instead of air fills the wind tunnel. The nitrogen is electrically charged, causing it to glow. Brightness of the glow increases with density and reaches its greatest intensity at the shock-wave location. This model is being tested at Mach 3 in an atmosphere equal to an altitude of 30 miles.

At the velocities where aerodynamic heating becomes a serious problem, however, the molecules in the air no longer behave in the orderly way postulated in the "ideal gas" laws. At relatively low temperatures, molecules move about in three-dimensional space; the higher the temperature, the faster their straight-line movement. At temperatures above 500° F, the molecules begin to vibrate. At temperatures exceeding 5000° F, a part of the heat energy within the molecules is changed into chemical energy. Some of the molecules dissociate or split apart into free atoms. New molecular combinations appear, notably nitric oxide.

At temperatures approaching 20,000° F, ionization, or electronic excitation of the atoms and molecules, occurs. In the thermodynamic studies already made, some 40 reactions among the molecules and the atoms and their components have been noted. Although only a dozen or so are believed to be of great significance, accounting completely for even these 12 reactions is an enormously complex problem, and useful solutions will require the efforts of many talented workers using both theoretical and experimental techniques.

WAYS TO fly faster and yet survive the effects of aerodynamic heating are required with overriding urgency. The problems faced are new and complex. And yet it is impossible to forget or to neglect the old problems of aerodynamics that refuse to remain "solved." With each advance in speed, such familiar bugaboos as

flutter, turbulence, stability and control, and aerodynamic interference rise again with new virulence.

Today, as always in the history of aeronautics, the magnitude of the problems faced is surpassed only by the immensity of the future possibilities. Those possibilities can and must be transformed into actualities. This can come first within the realm of the nation that makes the greatest effort in manpower and equipment.

National Advisory Committee for Aeronautics

The Officer Retention Dilemma

A Quarterly Review Study

Dr. Eli S. Flyer *and*
Dr. Abraham Carp

DURING the past few years a large proportion of AFROTC pilot training graduates have left the service at the earliest opportunity. This loss of highly trained personnel, affecting all Air Force commands, is rapidly becoming critical. The continuous need to program large numbers of pilot trainees as replacements for pilots separating after three- and four-year tours of duty has imposed a large drain upon the economic resources available to the Air Force as well as affecting current effectiveness. Research was initiated more than two years ago by ARDC to identify factors associated with career attitudes among AFROTC pilot training graduates and to devise methods that might be used to increase their retainability within the Air Force.

The retention problem among pilot training graduates has been brought to the forefront by two changes in Air Force policy. The first change was an increased emphasis and reliance upon an "on-board" striking force, rather than upon a reserve component.

The second change was in the procurement source for pilots. Until a few years ago aviation cadets, with higher retainability than AFROTC officers, provided the major source for pilots. During 1954 the Air Force began to rely upon the AFROTC program as the major source for pilots. The change in procurement source was based to some degree upon the belief that AFROTC student officers with four years of college training provided a more highly qualified pool for career officer selection than had been available with the aviation cadet population. Unfortunately, however, a college education appears to be related negatively to Air Force career interest (for aviation cadets as well as AFROTC student officers), and recent survey data indicate that less than 20 per cent of AFROTC officers trained as pilots intend to make a career of the Air Force.

A minimum of two years is required to send a pilot trainee through the various phases of training and on-the-job performance to develop an acceptable proficiency level for an operational assignment. Since AFROTC officers enter training committed to a three-year tour of active duty, it is apparent that training accounts for two thirds of the time that the AFROTC pilot must remain in the Air Force. From the current Air Force standpoint of an "on-board" fighting force, the unfavorable ratio of time spent in training to

time on the job has not been compensated for by the number of AFROTC graduates sufficiently interested in an Air Force career to extend their original duty commitments.

In recognition of this problem a requirement was introduced during 1955 that graduates from Basic pilot training who desired to attend Advanced (combat crew) training would have to extend their tours of duty through specified-period-of-time contracts (SPTC) to an over-all period of five years. Under this condition only 25 per cent of AFROTC Basic pilot training graduates volunteered for Advanced flight training. Graduates who did not extend their tours of duty were often sent into other types of training where their flying skill either could not bring a full return or was not used at all.

Noting the lack of popularity of the above program after a six months' try-out, the Air Force reduced by one year the extension period (SPTC) required to attend Advanced training. Under this policy about 29 per cent of AFROTC officers became eligible for Advanced training by contracting for a four-year tour of duty. Recently the assignment process at the end of Basic pilot training was again revised. Officers are now encouraged to enter an indefinite status (career reserve) that requires a minimum four-year tour of duty. An incentive to become indefinite has been provided by permitting indefinite (and regular) officers, rank-ordered in terms of flying and academic proficiency, to select desired flying assignments from a list of openings furnished the Basic flying schools by higher headquarters. After the indefinite (and regular) officers complete their selections, the remaining officers, again rank-ordered, select from the assignments still available.

While the new program has not been in effect long enough to appraise it with any great degree of confidence, it would appear that about 50 per cent of AFROTC pilot training graduates are sufficiently interested in an Air Force career or in choosing their assignments to sign indefinite contracts at the end of Basic pilot training. It appears that assignment, in addition to career interest, may be a major factor in entering indefinite status.

Research Studies in AFROTC Pilot Retention

Specified-period-of-time contracts or indefinite status at the end of Basic pilot training have generally been used as the criteria of Air Force career interest. While not a completely satisfactory measure of career intention, SPTC or indefinite status provides an acceptable intermediate criterion of Air Force career interest. Very few officers who do not "go indefinite" will become career officers. In addition, whenever data have been available through special surveys, direct statements of interest and disinterest in an Air Force career have also served as criteria for retention research.

A wide variety of data has been evaluated to determine the type and extent of differences between AFROTC career and noncareer student pilots: performance in training, attitudes prior to training toward flying and military life, socio-economic and educational background, aptitude factors, and many other variables. Data of this nature were collected during sophomore

and later college years, during Preflight and Primary training, and at the completion of Basic pilot training. It will not be possible to discuss in any great detail specific investigations that have been completed. The material to be presented here represents a distillation of AFROTC retention research and the major findings that have occurred to date.

Attitudes toward military life and flying before training. This area has been investigated more intensively than any other because of its implications on selection prior to training. Of interest here was whether or not attitudes toward flying and military life were stable over a time period. These attitudes are measured by scales that cover such topics as interest in flying various types of aircraft, reading interests, interest in adventure, attitudes toward taking risks, attitudes toward discipline, and interest in travel. The findings, well documented by numerous research studies, show that interest in military life and in flying measured during the sophomore year of college relates positively to Air Force career interest three and one half years later—at the end of Basic pilot training. The college sophomore who expects Air Force life to be attractive and who indicates interest in flying is more likely to make the Air Force a career than the sophomore who expects Air Force life to be unpleasant and who has little interest in flying. Considering the number and type of experiences intervening during the three-and-one-half-year period of time encompassed here, the stability of interest and attitude measures assumes real significance for selection programs. Significant too is the fact that very few individuals with initial negative attitudes later become positive, while many who are originally positive do become negative.

Educational background. While the Air Force of the future will require increased technical skill among officer personnel, it is now evident that many AFROTC officers with highly specialized technical backgrounds are not going to remain in the Air Force after their first tour of duty. Engineers trained in aeronautics, electronics, and other specialties have a lower retention rate than AFROTC officers whose college majors are in "soft" fields. In one investigation, for example, engineers constituted 14 per cent of the total group studied, but made up only 10 per cent of the career officers within that group. Education majors, on the other hand, accounted for 8 per cent of the total group and 19 per cent of the officers interested in an Air Force career. These findings suggest that as AFROTC officers are integrated as regulars the present composition of the regular Air Force (where about 40 per cent of officers with college degrees received their academic training in engineering) will undergo substantial change. As the Air Force's needs for technically trained officers increase, it appears that the proportion of officers with technical skills will be decreasing.

Aptitude factors. With the exception of pilot aptitude AFROTC officers intending to separate from the Air Force possess somewhat higher aptitudes than careerists. The differences between the two groups are not large and may well be produced by the low retainability of engineering majors, a group known to possess relatively high aptitude levels. Regarding pilot aptitude career officers are somewhat superior to noncareer officers, but the difference

between the two groups appears to be more a function of interest and background measurements included in the pilot stanine* composite than true aptitude factors. Spatial aptitude, for example, which is weighed into pilot stanine scores, does not differentiate between career and noncareer officers.

Socio-economic and cultural background. A large number of biographical items have been evaluated to determine whether or not career and noncareer AFROTC officers differ in terms of civilian background. Results from these analyses have shown that student officers extending their tours of active duty are different in some respects from officers who expect to leave the service at the end of their contracts. For example, career officers appear to have had more experience and achievement in sports and to have served more often as leaders of groups than noncareer officers. Amount of mechanical experience and civilian flying instruction has also been found to relate positively to Air Force career interest. Income level of the family does not appear to become relevant to career interest except at the highest levels; if the AFROTC officer's father makes over $14,000 a year, there is little likelihood that this officer will be retainable. Correlated with this factor is the father's profession; only among officers whose fathers are business managers or owners is any negative relationship found with Air Force career interest. On the other hand AFROTC officers whose fathers are in skilled trades are somewhat more likely to be interested in an Air Force career. Urban-rural differences are negligible so far as career retention is concerned.

Performance in training. Estimates of student flying proficiency obtained during flight training from instructors and check-pilots have not been found to be related to Air Force career interest. It is interesting to note, however, that self-estimates of flying proficiency at the end of Basic pilot training distinguish between career and noncareer officers. In one investigation about 50 per cent of the volunteers for Advanced pilot training (SPTC) rated themselves above the class average, a claim made by only 34 per cent of the nonvolunteers.

Interview Data

Analysis of interview data for over 400 graduates from pilot training suggests that there are three factors that are highly relevant to career retention among AFROTC pilots: interest in flying, interest in military life, and job expectancies in civilian life. These factors also emerged in a peer-nomination study, in which AFROTC officers evaluated each other for Air Force career interest and justified their choices with detailed reasons.

Attitudes toward flying. As might be expected in a group of officers obligated to spend a large portion of their military life in flying assignments, attitudes toward flying are highly interwoven with career attitudes. Some officers appear to develop highly negative attitudes toward flying and these officers prefer to have as little to do with Air Force flying as possible. Many other officers, however, describe their flying experiences with enthusiasm and indicate that they would rather fly than do almost anything else.

*A composite score derived from a battery of aptitude tests and indicating the predictive aptitude of an individual.

Attitudes toward military life. By the end of Basic pilot training, attitudes toward military life appear to crystalize for many AFROTC officers. Others believe that military experiences during training are not representative of Air Force life in general and reserve judgment. Interview data suggested strongly that AFROTC officers tend to be dissatisfied with military life during training. Varying from specific charges directed against training to diffuse feelings of discontent about the program, the training atmosphere appears charged with negative attitudes toward military life.

In addition to having negative attitudes toward training conditions, many AFROTC officers believed that the Air Force in general was not attractive. The primary stated reason for not making the Air Force a career was the loss of independence and choice of action associated with military life. By and large, noncareer officers indicated strong needs to determine for themselves where residence would be established, frequency of moving from one geographical area to another, and types of occupational activities in which to be engaged. A general impression expressed by many AFROTC officers was that the Air Force was capricious, that job assignment, duty location, and movement from area to area were determined without regard for the individual's interests and needs. For those who preferred to captain their own ship, life in the military appeared to be unthinkable.

Job expectancies in civilian life. The third broad group of reasons for being career- or noncareer-oriented related to job opportunities in civilian life. During the period following graduation from college and prior to active duty status many AFROTC officers obtained jobs in occupational areas allied to their college specializations. Considered by college major grouping, job opportunities varied considerably. Engineers and business administration graduates apparently had the least difficulty in obtaining short-term positions in industry. Officers with backgrounds in education were at a disadvantage in locating teaching jobs, since few could expect to complete a school year.

The intense competition for business and engineering types was reflected in the willingness of industry to offer short-term positions to AFROTC officers with appropriate educational backgrounds. The motives behind these job offers were not concealed. For insurance purposes many corporations offered seniority benefits that would accrue during military service, and some offered "retention pay" to compensate for the decrease in salary that resulted from military service. Added impetus for leaving the Air Force in as short a time as possible was provided by stipulations by these corporations that tour of duty extensions would result in loss of seniority rights.

Most of the variance in AFROTC career decisions at the end of Basic pilot training, therefore, could be accounted for by the three factors that have been discussed: attitudes toward flying, attitudes toward military life, and job expectancies in civilian life. The factors are probably not unrelated; officers who like flying are probably more accepting of military training conditions, and officers who enter the Air Force committed to a position in civilian life are probably more likely to seek, and find, conditions in military life that are unacceptable.

Patterns among the three factors appear to be highly related to Air Force retention. AFROTC officers possessing negative attitudes toward flying are not likely to make the Air Force a career, regardless of job opportunities in civilian life and attitudes toward military life. Officers with positive attitudes toward flying and military life are likely to make the Air Force a career, regardless of excellent job opportunities in civilian life.

Increasing the Retainability of Air Force Pilots

Since Air Force career interest is highly related to attitudes toward flying, military life, and job opportunities in civilian life, these relationships imply that greater Air Force retainability would be realized as motivation to fly is raised among pilot trainees, as attitudes toward Air Force life are made more favorable, and as job opportunities within the Air Force become more comparable to those that would be found in civilian life.

Two methods are available to accomplish these changes: selection procedures that have a direct influence upon the types of individuals accepted for training, and changes within Air Force life. The application of these methods and their probable effects in terms of the three factors that have been identified as relating to Air Force career interest will be discussed here. It should be pointed out that the authors do not necessarily recommend one method over another. Alternative procedures have to be viewed and evaluated in terms of considerations in addition to those presented here.

Selection procedures. Increased retention of Air Force pilots would result if applicants for pilot training were selected on the basis of their likelihood to make the Air Force a career. Three selection procedures are particularly applicable for this purpose: (1) screening applicants for pilot training by tests predictive of Air Force career interest, (2) recruiting applicants from personnel sources known to produce officers with high retainability, and (3) changing requirements for entry into training so as to provide increased opportunity for self-selection on the basis of Air Force career interest.

Earlier, measures of interest in flying and attitudes toward military life were described that predicted Air Force career interest over considerable periods of time. Use of these measures would permit rejection of applicants for training who are low in these factors. This would affect directly the level of career interest among applicants accepted for pilot training. The difficulty in this is that opportunities for career selection have been limited by utilizing the AFROTC as a primary procurement source for pilot trainees. After screening for aptitude and physical qualifications, there are about as many qualified AFROTC applicants for training as are required to fill the AFROTC quota for pilot training. Additional screening would mean failure to meet the present quota; thus there is little opportunity for career selection.

One solution for the retention problem would be to reduce the quota allocated to AFROTC, relying more on other procurement sources with higher retainability. One source that would satisfy not only retention con-

siderations but could result in monetary savings is the group of trained pilots who have left the Air Force and desire recall to active duty. The total number of individuals of this type has not been determined but, since each officer of this type would be worth over $150,000 to the Air Force, it would not take many to effect a very large savings in training costs.

Aviation cadets also are more highly career-motivated than AFROTC pilot trainees. Since there are many more applicants for training in this category than there are spaces available, career selection would be highly feasible for this group. Pilot training quotas for aviation cadets, and other procurement sources described below, can be raised without sacrificing the quality of the pilot trainees. Aptitude stanines of the Air Force Officer Qualifying Test provide a method for controlling quality, ensuring that individuals are selected who are capable of learning and performing the complex skills required in the Air Force. Ample evidence exists, for example, to show that pilot training success is far better predicted by the pilot stanine than by the amount of education individuals possess.

Air Force career interest among Officer Candidate School graduates is very high, surpassed only by Annapolis and West Point graduates who enter the Air Force. Since many OCS graduates apply for pilot training, consideration might be given to an expansion of this program so as to increase the over-all percentage of pilot trainees from this source.

There are some officers within the Air Force who are anxious to obtain rated status. Many of this group are AFROTC graduates who entered the Air Force during 1953 and 1954 and have found Air Force life attractive. Present procurement policies are such that relatively few pilot training vacancies are available for this potential career group. With each successive year many of them pass beyond the age requirements of pilot training.

Another method to increase the retainability of pilot trainees is to increase the period of duty required of each pilot training graduate. Relatively few individuals without career interest will apply if they are obligated to five or more years of active duty. Self-selection processes in terms of Air Force career motivation play an increasingly important role as entrance requirements are raised. It is not likely that increasing the tour would solve the retention problem for the AFROTC; current quotas could not be met. A lengthened tour in conjunction with an increased use of other manpower resources and decreased AFROTC quota would alleviate the problem.

Changes in Air Force life. Recommendations for selection that have been made and inferences that have been drawn are dependent to some extent on the status quo being maintained insofar as Air Force life is concerned. It is possible that changes could be made to make the Air Force more attractive as a way of life and thereby increase the number of pilots with favorable attitudes toward an Air Force career.

Consideration will be given first to the development of increased interest in flying among pilot trainees. Many AFROTC student officers felt that the training they received was part of a pressure program, "dog eat dog" as one officer put it. Serious thought could be given to methods that might reduce

the amount of tension felt by students while learning to fly. Flying instructors might be evaluated for their ability to inspire confidence and interest in flying among their students. Instructors unable to control their own anxiety in teaching students could be replaced. There are indications that the situation may grow more serious in this respect. Current methods for assignment out of Basic flying schools appear to have led to some poorly motivated and marginally proficient student graduates being assigned as Basic instructors. The interpersonal relationship between student and instructor, in the air and on the ground, appears to be an area needing study and improvement.

Favorable attitudes toward military life may be developed by changes in the treatment accorded officer trainees. Methods that might be applied here are suggested by the approach used by industry to influence the vocational interests of AFROTC officers prior to active duty. Motivated perhaps by a tight labor market in certain technical skills, many companies have extensive indoctrination programs geared to making the new recruit feel so much at home within the organization that he will return as soon as military obligations are satisfied. In one company, management trainees were taken around to each department in the organization, introduced to the key people, and welcomed as co-workers. Various aspects of the business operation were pointed out so that the trainee would have some idea of the requirements demanded by his new role and its importance and relationship to the overall mission of the organization. This approach led trainees to feel that they were accepted as individuals by the company and respected for their potential usefulness. If the Air Force is to compete successfully with industrial indoctrination programs, similar methods may have to be adopted. Progress in this regard is observable within the training program and, in time, the Air Force should improve in this competitive situation.

The most serious objection toward military conditions voiced by AFROTC officers in training is that student officers are not accorded responsibilities and privileges associated with officer status. To evaluate this criticism in its proper perspective, it is necessary to consider that in the past aviation cadets provided the major source for pilot trainees. Military aspects of the pilot training program were oriented toward indoctrination and regulation of predominantly young, unmarried students who were being trained for officer as well as rated status.

The introduction of large numbers of officers, many married, into a training program whose methods were geared to aviation cadets increased the number and type of problems associated with military training. Training methods oriented toward keeping an immature high-school graduate in line were not apt to be well-received by college graduates with wives and children. In effect pilot training organizations were faced with the question: Were AFROTC pilot trainees aviation cadets with officer's pay or were they officers in training? Examination of current training policies suggests that the question has been answered—AFROTC student officers are now officers.

Over the past few years many changes have been made within the training program to make it more acceptable to student officers. In the future it

is quite possible that the vestiges of the aviation cadet program will have disappeared, removing many of the sources for AFROTC unrest. Base commanders require student critiques of the training program and make use of this information to effect positive changes in military life during training. The outlook is favorable that disenchantment with military life, as a function of conditions within training, will be reduced considerably.

Many of the objections to a service career held by AFROTC officers will not be affected by changes in military conditions during training. These objections go to the very roots of service life. Self-determination is a prominent consideration with the bulk of AFROTC officers entering the Air Force within the last few years. These officers want a large measure of responsibility in the determination of duty assignment, geographical location, and frequency of change in station. While the authors of this report are in no position to evaluate the effects of changes of this nature upon current Air Force policy and Air Force capability, they can point to this area as one that is critical so far as retention is concerned and that is in need of additional study. Some interesting points bearing on this problem emerged from AFROTC interviews and are worth mentioning at this time.

There are AFROTC officers who do not care particularly what type of assignment they receive; there are other officers for whom assignment is of extreme importance. There are AFROTC officers who are career-oriented because of the excellent opportunities to travel; there are other officers who are not career-oriented because they have no desire to travel. There are some AFROTC officers who want to be stationed on the west coast and some who want the east coast. There are officers who want to locate near the Rockies, in France, in Japan, and so on. Any method designed by the Air Force to permit increased use of individual preference in assignment, mobility, and location would probably have a positive effect upon career retention.

Up to this point no mention has been made of pay as an incentive to AFROTC officers to stay in the Air Force. During interviews with AFROTC officers an impression was formed that, with some exceptions, additional duty time could be purchased if the price were right. Even among some of the officers who were most bitter toward the Air Force, statements were made that increased Air Force pay might lead to reconsideration of career planning. Very attractive to some noncareer officers was the possibility of short-term contracts with severance pay. This suggests a method for retaining pilots during the period when they are most useful.

Also unmentioned so far is the relationship of patriotism to career retention. Appeals to patriotism under current international conditions apparently would have little effect upon Air Force career motivation. Although detailed evidence is not available, an impression was received during AFROTC interviews that most AFROTC officers anticipate no general war within their lifetime. Indoctrination that is oriented toward changing AFROTC perception of current international conditions might increase the retainability of some officers.

Changes in promotion policies that would provide increased rewards for

initiative and ability would seem to have direct implications for Air Force retention. While many officers anticipate somewhat lower pay on return to civilian life, this is often viewed as a temporary state of affairs. Many officers believe that in ten years' time they would be at appreciably higher salary levels if they chose a civilian career field. This suggests that many self-assured officers may leave the Air Force in order to realize their ambitions for rapid advancement.

THE TWO methods that have been described in terms of their implications for increasing retention among Air Force pilots—selection and changes in Air Force life—should not be viewed as mutually exclusive. A combination of elements from each approach would probably be most desirable. Selection would bring into pilot training individuals with higher career motivation than is presently the case; changes in Air Force life would contribute toward keeping career interest high.

There may be some question regarding the implications of the findings and the conclusions reported here for nonrated officer groups, particularly those with critically needed skills. With the exception of interest in flying, factors identified here as relevant to Air Force career interest are probably applicable to nonrated officer groups. Interest in military life and job expectancies outside of the Air Force should be highly related to career motivation regardless of the officer's assignment. Similarly the techniques that have been suggested for increasing career retention among pilots should be applicable for nonpilot groups as well, excepting, of course, those techniques involving motivation to fly.

Air Force Personnel and Training Research Center

Jet-Speed Intelligence

Part I: Tools of Command

COLONEL DONALD N. WACKWITZ

THE TIME: the mid-1950's. The place: the Meiji Building, downtown Tokyo, then the home of Headquarters Far East Air Forces. The scene: tension, weary faces, people coming and going around the clock. This is a FEAF-conducted war game.

After a month's preparation Black and White are slugging it out with all the reality accompanying a stimulating preparatory period. The entire Black and White military structure is in motion. Ships, carriers, submarines, troops, aircraft, all churning and pitting their strengths against their respective targets. In Black and White control centers, individuals are working at top speed, often fighting hard to keep on top of a highly dynamic situation that changes with lightninglike rapidity. The mass of data constantly moving into and through each center is so great that both sides at best can only approximate the requirement for rapid and accurate digest of data. It is strictly an accounting problem, accounting for thousands of aircraft sorties, aborts, losses, damage assessments—all with accompanying communications bottlenecks, contributing to a state of near pandemonium. Operational planning must often be based on "guess" rather than "fact." Planning must be done and the decisions shaped by planning must be made—facts or no facts.

With this barely controlled bedlam, how was it possible to exercise the judgments associated with generalship, with command? This remains a moot question. It should not be inferred that decisions were not made. Decisions were made; but the decisions did not and could not reflect accurate information on friendly and enemy forces at the time they were made. This lack of timely information on friendly and enemy forces could be costly in major atomic conflict. It could spell the margin of difference between victory or eventual defeat.

What brought about such a situation? Were the individual

officers improperly trained or unprepared to cope with the problems associated with a major exercise? Had retrogression or loss of know-how set in following World War II and the Korean conflict? These are but a few of the questions one could ask in an effort to identify what appeared to be a major soft spot.

Examination of the problem unequivocally indicated that the character of modern war was primarily responsible for the problem areas encountered within the control center. Both the weapons and the speed with which these weapons could be delivered to the target had undergone such startling development in the years since World War II that the control center could no longer cope with these new and expanded dimensions. The control center had not undergone a comparable development. Let's take a closer look at the situation.

operational facts of life

The first striking feature concerns the forces of destruction. Consider the thousands of years of history reflected in the evolution of weapons: axe, spear, catapult, crossbow . . . up to and including the two-thousand-pound "block-buster" of the last war. Now, suddenly, in a fleeting moment of history, a few odd years, we are dealing with forces of such a magnitude that it is possible for a single fighter-bomber, in a single sortie, to deliver more firepower on a given target than was expended cumulatively by all participants during the entirety of World War II. This then is fact one: Big atomic wars in the future will present a situation in which opponents are dealing with destructive forces millions of times greater than heretofore experienced in human history. This reflects a major technological breakthrough approaching decisive proportions.

Faster delivery speed is the second significant feature tending to alter the science of modern warfare. Consider for a moment the evolution of speed as it applies to warfare. Before the advent of radio, when the diplomatic prelude to war required months in its formal play and even more months for build-up periods, weapon delivery was largely limited to the speed of a man on horseback. For all practical purposes this condition prevailed until the eve of World War I and changed but slightly then. Large-scale employment of air power, with its significantly increased delivery speed, awaited World War II for broad utilization. It is the present, measured from World War II, and even more properly the handful of years confronting us in the im-

mediate future, that is likely to be recorded as the period of significant technological breakthrough. From today's emergence into transonic aircraft speeds we are about to enter into the era of the transcontinental supersonic missile with speeds that dwarf those of World War II—or even those of today. Fact two, then, is that in wars of the future immense destructive power can be delivered at hitherto unknown speeds. Closely related is the fact that attacks may be dispatched with little or no warning.

This leads us to conclusion number one: Implicit in this new look of warfare is the conclusion that correctness of decision has taken on staggeringly new proportions. Future wars offer the possibility that attacks of such magnitude and such speed can be launched that if either opponent is caught off guard even momentarily a decision might be forced against the defender in a matter of hours. Here generalship assumes new proportions. Unfortunately even the genius of a Napoleon, Nelson, Gustavus Adolphus, or Scipio Africanus would matter little in the heat of battle unless sufficient facts were available and a fairly accurate picture of the friendly and enemy situations were in hand and up to date.

the crucial problem: control

Let us turn again to our problem. It is apparent that one of the primary reasons for control failures—and this is fact three—is that control environment has not kept pace with the requirements posed by weapon developments and the increase in speeds of weapon delivery. In the past, when relatively diminutive forces were brought to bear on an enemy at a rate approaching slow motion, it was often possible for a general to command and direct important battles with very little intelligence other than that obtained through his own eyes. This was true of Nelson's sea battles, the melees of Genghis Khan's Golden Horde, Napoleon at Austerlitz, or, to a degree, even Montgomery at El Alamein.

One could hypothesize that the control system in effect in the American Civil War was more responsive to the control requirement of its day than the system in effect during the exercise mentioned at the outset of the article. Outside of the development of the grease pencil and acetate, the two systems had much in common. While teletype transmits information faster than foot runners or telegraph key, teletype still deals with words, and whatever advantages accrue are largely neutralized by the ever-increasing requirement for "mountains of reports." Both systems require a series of human links from the reporting cycle through subsequent

processing, transmission, and reprocessing. Human links finally translate the reports and data manually to graphic display. Yet the picture presented during the Civil War era probably reflected a more timely, more up-to-date appraisal than would be possible in many instances in today's environment.

Control in this recent exercise required an up-to-date knowledge of actions taking place in a major portion of the Pacific Ocean area and extending deep into the Asiatic mainland. A requirement existed for an intimate up-to-date knowledge of bomb damage assessment (BDA), relating to friend and foe. World War II BDA, with its associated time lags, might have historical value but could hardly satisfy the requirement for control in today's and tomorrow's war, especially when we consider the new weapons and delivery systems with their speed and destructive power.

The underlying new requirement for timely and total accounting of vital resources, friendly and enemy, poses an accounting problem of the first magnitude. Big weapons dictate this requirement. Employment of big weapons attains objectives not only against the primary target but often against important bonus targets as well. Radiological fallout will often have either direct or indirect effects of significant proportions. These serve to magnify the already complex problem of data processing and accounting.

These factors, vital to the commander's decisions, lead us to conclusion number two: Current resources inventories, friendly and enemy, must be accurate and up to the minute. It is no wonder that the communication problem has become seriously aggravated. Who has participated in any exercise within the last few years in which the "communications problem" was not aired during the critique? The conclusion generally reached was that communications proved incapable of keeping abreast of the wordload imposed by the exercise. The trend of current reporting calls for more and more detailed reports, often duplicating other reports required at the same time.

When we apply fact three—that control has not kept pace with its environment—to the recent exercise, we see that the participants who fought the control problem in that exercise are exonerated. The fact is that they were highly competent as individuals; they tried their best to do a good job, and did—to the extent that their resources permitted. But they were the victims of a system that was outmoded, for control environment has not kept pace with the requirements of more powerful weapons and

faster delivery systems. As a result we now face fact four: The commander no longer possesses the tools of command essential to cope with the dynamics of today's (and tomorrow's) war. Strangely enough, this situation, which we might liken to creeping paralysis, developed so gradually that few individuals were alerted to it.

what is needed

At the conclusion of the recent exercise, concrete action was taken to examine the control problem from the viewpoint of effecting improvements. The Comptroller and the Deputies for Operations and Intelligence were represented in this effort. As a result of their probing study it became readily apparent that many things could be accomplished, varying from the simple to the highly sophisticated. It was generally recognized that, in order to effect improvement, certain "musts" were in order:

- Reporting time must be reduced to near zero, regardless of volumetric requirements for data inputs.
- Simultaneously, pertinent information must be instantly and appropriately displayed in the control center in either graphic or tabular form.
- Data must be capable of being stored and retrieved in a manner that will permit instantaneous digest of accumulated data for the purpose of preparing situation summaries and other papers essential for sound operational planning.
- BDA must be accomplished instantaneously on a computed basis for purposes of operational planning. After-the-fact photography will confirm results obtained.

It is clear that the present methods of performing these tasks are not tuned to the requirements of the times. And yet it is equally clear that these tasks must be performed in a more satisfactory manner so that the commander can have the vital tool of intelligence at hand when he must shape his decisions. Technological advance, which has forced this requirement upon us, has also provided us with the solution: high-speed electronic data-processing machines, machines that can perform these tasks faster and more accurately than a battalion of harassed clerks. This becomes conclusion number three: A proper system of mechanized data reporting, processing, and storage can restore to the commander the vital tool that the lag in control development has stripped from him.

The problem as FEAF saw it was twofold: First, as a long-range objective, to establish a requirement for a control system designed specifically for the task, employing methods and equipment compatible with the best the state of the art affords. Second, to take immediate, forthright action to improve the control capability by better employing the resources currently available to the command.

For the long-range goal a "qualitative operational requirement" was formulated, establishing a requirement for a computer system within the control center environment. This would have to automatically display pertinent data, in either graphic or tabular form. The concept envisions data translation at point of reporting origin and digital data transmission, all integrated into the computer system that would become the nerve center of the command's control structure.

The other step taken was the formation of a working group, representing Intelligence, Operations, and the Comptroller, to attack the more immediate aspects of the problem. This group has been active since late 1955 and has made considerable headway. An early effort was the examination of operational reporting. One of the first dividends from this study will be the publication of new reporting directives as FEAF regulations, which will introduce digital coding as a part of the reporting requirement. It is hoped that publication of these regulations will coincide approximately with the installation of FEAF's 650-series IBM computer in late 1957. This will give FEAF a capability reflecting increased data transmission, immediate data storage and retrieval, textual breakout where appropriate, and immediate data input to the combat operations center (COC).

It should be emphasized that the underlying concept reflected in the group's activities is twofold: to eliminate men in cases where they are competing with machines and to reduce reporting and data processing from hours or days to seconds.

Obviously the emphasis on codification of operational and intelligence data is absolutely essential to the longer range program and calls for highly sophisticated equipment. Formation of the working group tended to bring this requirement into sharp focus, as it did the requirement for an interim computer system, the IBM 650.

In summary, this recent exercise alerted FEAF to the requirement for new and vitalized tools of command. This requirement was brought about as a result of the new character of "big war."

Technological breakthroughs in weapon development and in weapon delivery speeds left the commander with an outmoded control system. Corrective action has been initiated. A qualitative operational requirement calling for a highly sophisticated integral computer system and display capability in the COC is now in the USAF development cycle. A working group is addressing itself to actions that FEAF can take with existing resources to better the effectiveness of control. Significant problem areas have been identified, particularly as regards computer requirements, reporting, and coding systems to make possible their operation.

Part II: Datamation

Wilbur W. Moeschl

KEEPING the commander informed is achieved by producing an efficient output. Output has its building blocks—data input. This is a logical progression from "what happened" to "what it means." What the commander must know may be reduced to a relatively small bundle of information. The volume of data required to produce this may be immense. To produce an efficient output, the data handling system must provide rapid and effective recording, processing, storage, and utilization of collected input data. From the receipt of collected information to the dissemination of intelligence products to the commander this includes, but is not limited to, recording, translating, collating, coding, analyzing, indexing, filing, storing, updating and retrieving information, the preparation of intelligence estimates and target materials, and the presentation of information.

The human mind has inherent limitations in its ability to collate, assimilate, and integrate great masses of data. An effective data handling system will not remove *all* the human elements of intelligence production. Many human functions are integral and vital. Rather we wish to establish a system that provides the maximum assistance to the human elements in the production of useful intelligence. This system must incorporate the optimum of human and mechanical capabilities for rapid collection, evaluation, and display of the essential information needed to conduct an air-nuclear campaign.

Mechanization and automation immediately bring to mind the conservation of manpower—machines replacing humans. Manpower is critical in the Air Force today, and nothing seems to indicate that this situation will improve substantially. Automation *may* conserve manpower, but *time* will be the prime economy. The rapid retrieval and evaluation of stored data with the instantaneous presentation of the vital facts will provide the commander and his staff with the tools of command compatible with the demands of the jetomic age. Delays in correlation of data and presentation of the essential facts concerning the tactical situation, unavoidable with the present methods and systems, cannot be tolerated if the commander is to succeed in his mission. A loss of minutes in estimating the tactical situation could result in immeasurable losses to the command. Saving of time is also an

important objective in the management of our resources. With our present data collecting and processing systems, the inventories and analyses presented for the commander are often so out-dated that effective utilization of these tools is impossible.

The conservation of manpower that could result from automation would show itself not so much in size of organization as in giving opportunity and perspective for judgment. A machine can store, remember, sort, and retrieve data. The human mind can think. By using the capabilities of both, we unclutter the human mind and open it to new vistas of thinking more clearly and more precisely.

The philosophy in choosing a medium for automation should be in consonance with modern scientific warfare. We would not think of scrambling a Piper Cub to engage a supersonic jet fighter. We must match the speed of the jetomic age with its superior in speed—the electron.

So far we have indicated the need for keeping the commander informed. We have established our goal in generalities. Now let us get down to specifics: "What does the commander want to know?" In simplest terms, the mission of intelligence is to determine the capability and the vulnerability of the enemy and to weigh it against the capability and vulnerability of the U.S. and its allies. Reaching a conclusion regarding the enemy's strength and making recommendations on how to counter these strengths demand a support effort to request, collect, analyze, interpret, and disseminate information that serves as a foundation for the entire intelligence operations process. There are several essential questions that the intelligence process must answer:

Who is the enemy?

What are his objectives?

What are his strengths?

What are the strengths he is using, or may use, to do things objectionable to us?

What and where are the resources comprising these strengths?

What are his decisions or intentions for using any of his resources?

How can we make optimum use of our air power to neutralize or destroy his objectionable strengths?

How can we make optimum use of our air power to further our objectives?

Which of our resources are most objectionable to the enemy?

What is the vulnerability of these resources?

How may this vulnerability be reduced?

What are the strengths of our allies?

What actions are they taking that may be favorable or detrimental to the mission of this command?

To know the true strength of the enemy we must consider his strength in terms of air, ground, and sea forces in being and in reserve. We must also consider his political, economic, logistical, psychological, and sociological forces. These strengths must be constantly watched to detect any indication of intention to initiate hostilities. Having determined the various strengths and identified the resources that comprise these strengths, we can then determine the optimum use of our air power by targeting the enemy in terms of individual physical and over-all systems' vulnerabilities.

We are still speaking in generalities. This represents an output. Output involves input. In FEAF's approach to this problem, we have considered certain specific data to be of paramount importance as input (see accompanying outline).

Thus far we have discussed the need for production of intelligence generated in response to the command mission. We have also developed the mandatory need for an ability to use this information at the speeds demanded by modern warfare. FEAF has considered the possibility of using electrical accounting ma-

Categories of Input Data

1. Enemy capability
   - a. Military
     - (1) Air facilities
     - (2) Air order of battle
     - (3) Antiaircraft artillery order of battle
     - (4) Radar and electronic order of battle
     - (5) Command centers and military headquarters
     - (6) Communications
     - (7) Transportation
   - b. Industry (logistic support)
2. Enemy vulnerability (potential targets)
   - a. Military worth
   - b. Target materials
   - c. Reconnaissance requirements
3. Enemy intentions
   - a. Radar tracking
4. Friendly resources
   - a. Aircraft
   - b. Aircrews
   - c. Weapons
   - d. Air facilities

chines available in Statistical Services to automate intelligence data processing—*datamation.*

In considering the scope of datamation the command proposed two major types of information for machine processing: raw intelligence information collected by FEAF in response to the collection plan or to a specific request for information and finished, forecasted intelligence reports and studies produced by FEAF and other members of the intelligence community.

Let us trace the flow of the raw report from the time it enters the data processing stream—at the field collection unit—until it reaches the stage of an International Business Machine (IBM) punched card in its final form at FEAF. Step by step this is the general procedure: a raw report comes into the field collection unit and is put on a Form 112. It is given a preliminary evaluation as to reliability of information and source by the reporting officer. The information is then screened to eliminate reports irrelevant to the FEAF intelligence mission. All information contained in pertinent reports is indexed, catalogued, and coded and prepared for IBM processing. These IBM cards, each representing a *single item of information,* are then incorporated into a master IBM basic data deck. The Form 112, meanwhile, is sent to the appropriate analyst in FEAF who will evaluate the information against his *composite current status file.* This file is maintained by machine. In the event that the Form 112 provides new status information, the analysts will request that a new composite IBM card be punched to reflect this change in status. The old composite card is filed in the historical deck, and the new card goes into the current status deck.

The difference between the two types of decks of IBM cards is that the basic data deck represents an inventory of all that has been reported about a *particular item.* The current status deck represents the evaluated current status of a particular composite subject, e.g., air facilities, air order of battle, etc.

IBM cards punched from current intelligence input form one part of the FEAF intelligence library. Another part of the library is composed of IBM cards made up from the table of contents or index of finished or forecasted intelligence studies or reports. This will be a broader index, with less detail, than that covering raw data. In a sense it will be a "mail-order-house" catalogue listing available or soon-to-be-available finished intelligence information.

Indications intelligence will be an integral part of our intelligence library. Such information will be maintained on separate decks of IBM cards, one deck to form a part of the master basic

data file, another deck (the current status deck) with data pertinent to the strategic warning system. The incorporating of indications intelligence information into the library ensures a complete file of *all* available intelligence information.

The application of IBM principles provided work simplification for another intelligence function—answering the specific request for information (SRI). There is always a twofold problem in the SRI program: first, to determine whether information is already available to satisfy the requirement; second, to screen all incoming material for information relevant to the SRI. In the FEAF datamation system, where all input is carded, it is a very simple procedure to screen all available information automatically against any given SRI.

With all current raw intelligence being fed into one central library in the form of IBM cards, there is a definite need for standardization of format and codes. We should be able to use any or all cards to come up with answers to any question we may ask. To do this, there must be a common denominator—predetermined specific data—common to all cards. With this common to all cards, any slice along any line can be made through any or all cards in the IBM library of intelligence information.

Considerable effort has been concentrated on developing a machine language to encode the information for IBM processing. Information subjects were broken down into logical component bits. The problem could be conceived as a mathematical approach to linguistics—translating textual data into numerical equivalents. The initial phase was devoted to the development of a "vocabulary" with efforts concentrated on the "nouns"—the various subjects to be machine processed, e.g., "air facilities," "aircraft," etc. The second phase will attempt to complete the syntax with the addition of verbs—what these nouns can do; adverbs—modifications of the action; and adjectives—differentiation of the nouns. In other words, in the initial operation, the information will be primarily static—an inventory of intelligence nouns. The second phase will change this to dynamic—these nouns are delineated, act, and are acted upon.

The basic questions of what to card, how to card, and where to card give rise to another problem: What is the current machine capability available to FEAF? At present it is completely confined to electrical accounting machinery. Within the near future this will be extended to electronic data processing equipment, the IBM 650. Electronic accounting machinery is looked upon as primary on-the-job training, the electronic data processing equip-

ment as the secondary stage. Serious consideration is being given to more sophisticated types such as the IBM 700-series equipment.

Intelligence is but one cog in our FEAF machine. It must be meshed with materiel, manpower, communications, and operations in a blueprint for ensured peace or an assured victory. The Operational Reporting Coordinating Group, referred to in the previous article, was set up to do battle with a three-headed monster—reporting, data processing, and display of information to provide the commander with instantaneous and complete answers to "What do I have to do?" and "What are my resources?" Once hostilities begin, these questions will persistently recur as mission after mission is sent out and returns. The answers will have to take all things into consideration. They must be answered in one control center. Time lost in asking myriads of questions of a multitude of people and correlating the partial answers into the complete one might well lose us the war.

The Group has begun by setting up a reporting system that will assure that vital information will be dispatched without duplication and with conservation of communications time, both in peacetime and in hostilities. The reporting system must be in being now, not in a state of incubation awaiting D-day. The formats for reporting are being published in the form of FEAF regulations, consonant with immediate machine-processing capability. Much of the problem of data processing can be solved by applying the techniques and experience gained in the datamation of intelligence.

Reports can be streamlined to essential elements of information. The most sophisticated computer can take the information and run it through its entire spectrum of computations. It is still not in digestible form for the commander. Planned output must be programed. The commander does not want all of the information in the machine at once. He wants the assurance that such information exists to substantiate the answers he is given. He needs a cockpit-panel type of displayed information that he can scan to see what is going on and how well *and see it as it is happening.* He needs operational information. He is not interested in past history.

Considerable effort has been expended in FEAF to plan for the application of datamation. The machines are produced without the information already built into them. Type of output determines type of input. Intelligence and operational information have variables and facets that must be taken into consideration. To provide a store of information for the machine to handle

requires a breakdown into logical component parts, conversion into numeric codes, storage of formulas—all in terms of maximum input. What we do not need today may be critical tomorrow.

We believe our approach valid. First, the "divide and conquer" solution was applied to the input, where the vast quantity of information was broken down and coded in machine-digestible bits. Second, we can put these bits together in almost any pattern because they are mutually compatible: airfields can be matched with aircraft and air order of battle, etc. The system has provided increased speed, increased flexibility, increased efficiency.

Headquarters Far East Air Forces

In My Opinion...

WHAT IS AN AIR POWER?

COLONEL JAMES S. SMITH

FROM the day at Kitty Hawk when Orville Wright wheezed a contraption into the air a few feet, exponents of flight have been trying: first, to agree on the elements of air power and, second, to agree on a definition of air power.

These ofttimes frantic efforts have generally been aimed at one central point: to get public appreciation, understanding, and support. Yet, as is generally recognized within the Air Force, there actually exists a considerable misunderstanding in the public mind today.

This lack of understanding cannot be blamed on lack of definitions, for since the days of General Giulio Douhet and "Billy" Mitchell definitions have been produced by the dozens. The public has been showered with explanations, positions, charges, counter-charges, areas of interest, agreements, missions, traditional responsibilities, new concepts, global concepts, etc., beclouding an already hazy area to the point that misunderstanding and resistance is the norm.

The effort to gain understanding is still under way. Last November, speaking in New York before the American Society of Mechanical Engineers, then Air Force Secretary Donald A. Quarles called the nation's B-52's "the foremost expression of air power in the world today." (It is interesting that he called the B-52 an "expression" of air power. He did not refer to it as "air power" per se.) Here was an attempt to use what is perhaps the nation's best known aircraft to extend to the general public an understanding of one element of air power.

What is sought by most authors and definers is a clean, concise, tightly drawn definition. Their failure to produce such a definition arises from many causes, one of which is that their subject is inherently so vast and contains so many intangibles (referred to by General Laurence S. Kuter, in the *Quarterly Review*, Spring, 1956) that it defies all efforts to throw a noose around it and squeeze out the essence. It never remains in status quo long enough to be closely defined.

In all this struggle to crystallize air power into solid definition, the idea has been that if we could find this pearl we would have short-cut the way to public understanding. It is only a slight exaggeration to say that some have felt that if we could distill the essentials of air power in a few well-chosen words, we would have an open-sesame that would have the public beating a path to our door. We have not had notable success in this venture, and even if we did succeed I do not share this optimism as to its effect on public consciousness.

Like any form of national power, air power is an abstraction. It is not an absolute like, say, a vacuum, where you either have it or don't have it. It is highly relative—to world conditions, to the state of the art, to time, to the strength of other air powers. Thus to find its concrete definition is like pursuit of will o' the wisp. Then too I think this preoccupation with pinning down and isolating the elements of air power has blinded us to the larger question of what is *an* air power, rather than what is air power. It is on this level that real public support must come and in the last analysis it is likely to be on this level that the winner of any future air war may be decided. If the people of a nation become convinced that the international, political, economic, and military future of their country is dependent on a certain form of power, they will nurture it and support it.

The lack of public understanding today, although rightfully a cause for concern, is not a cause for alarm. Public understanding can only come from experience, from awareness, and from direct effect on the individual. There is substantial public understanding, for example, of other forms of power. Fundamental religious concepts—an integral part of American society—are based on the power of faith. People understand the power of nature not only by her benefits as typified in the grain fields of Kansas and the citrus groves of Florida but also by her destructive moods

One of the most frequent, and sometimes one of the most embarrassing, reminders of the historical youth of the air age is the steady but confusing flow of definitions of air power. What is the distillation, the essence of this new dominion of man over his world? Colonel James S. Smith, Chief of Personnel Planning Division, Hq Air University, suggests there may be more profit in describing what makes a nation an air power than in attempting to define an abstract term. In examining land power and sea power, he finds definition not always necessary when terms of reference are clearly understood. Against this background he looks at modern nations to identify those on the road toward becoming true air powers.

in floods and hurricanes. It is personal experience and observation that provide the basis for understanding.

If we are to see how this understanding operates and then attempt to apply it to our problem of air power, let us take a look at a much older form of power, sea power. Old as maritime history is, I doubt that many citizens could offer a good definition of sea power. Indeed I am not sure that the Navy could offer one. But let's look at a classic case of a nation that uncontestedly was a sea power—Great Britain—and see if we fare a little better in describing what this meant to the country involved.

It would probably be most enlightening if we could slip back to England during Sir Francis Drake's time and ask that famous admiral to define sea power. He'd sputter on about frigates, having the wind "gage," two gun decks, and end up by pushing us out of the way while he sailed off to have at the Spanish Armada.

His ideas, however, would be much more clear-cut than those of the general public. For public understanding of sea power would have been practically nil.

If the next chap we would ask to define sea power could be Lord Nelson, who appeared a couple of centuries after Drake, the answer would probably be much different. Techniques for using sea power had improved. The hero of Trafalgar would talk about maintaining control of the seas, colonialism, and the life lines of the British Empire.

A talk with the man-in-the-street during Nelson's time would be more enlightening than any such conversation when Drake was striding the quarter-deck. For the citizen's appreciation and understanding was increasing as sea power made its impact and importance felt on each and every Englishman. The standard of living was improving, the Empire was expanding, and things in general were on the up side.

The over-all effect of sea power during the years spanned by Drake and Nelson was covered by Captain A. T. Mahan in his book *The Influence of Sea Power Upon History, 1660-1783*. Mahan produced a critical analysis of the role sea power played in the development and downfall of nations during that period of time. It may be significant that Mahan did not produce his analysis until the 1890's, some one hundred years after the actual events took place.

Mahan, from his tactician-historian standpoint, only put into words those things regarding sea power that were quite generally recognized by the public. For by the time Mahan produced his book England stood out as the epitome of sea power. Although

English troops fought many land battles, the fundamental power of the nation was, as the man-in-the-street recognized, its sea power.

Any summary of the rise of British sea power would have to show that over the span of centuries the definition of that sea power was constantly changing. While, in retrospect, the understanding and appreciation of sea power by Britons—and the world—progressed from a lack of knowledge and interest to a deep and sincere understanding.

The basic provocation for such an understanding on the part of the British subjects, and millions of others, came from experience, from awareness, or from some direct effect on the individual.

The British people, of course, were not the first to understand sea power. Greeks, Romans, Turks, Egyptians, and many others had learned to understand it centuries before as nations along the shores of the Mediterranean arose and fell. A few experts could have related the experience and history of those nations to the people of England during Sir Francis Drake's time, but it would have made little impression. For the Englishman's understanding and appreciation of sea power had to be gained from personal experience, as peoples before him had to gain understanding from experience.

Unquestionably a similar case study could be drawn for land power. It could be shown how the inhabitants of the Middle East and even southern Russia and western Europe gained an understanding of land power when the Mongols scimitared their way out of the East. The people of the civilized world today have an understanding and appreciation of land power through their association and experience with two massive conflicts, World Wars I and II, which were basically land power encounters.

What seems to be often overlooked in examining the question of public understanding is that such understanding goes well beyond the narrow military aspects. England's naval captains, for example, are not acceptable symbols of sea power. In actuality the appearance of the captains only meant that England was determined to apply force in protecting a destiny which lay with the sea. The military represented but a portion of many elements of a country that was a sea power nation and for a period of time was *the* sea power in the world.

To be entitled to the name of a sea power, a nation does not simply maintain a strong fleet for a generation or win an occasional Trafalgar or Battle of the Nile. It comes as an accolade for many years, perhaps centuries, of intelligent and persistent exercise of a

nation's maritime resources. In this sort of long-term effort there is only one reason for a nation to make such a sustained effort. In England's case a vigorous island kingdom sought markets for her goods and raw materials for her industries. The nature of her goods and the raw materials she needed drove her far over the seas in search of them and led her to colonize an empire to produce the raw materials and to stabilize and guarantee the flow of them. First the economic thread, then the political, then the merchant ships, and then the navy thread were woven into the rope of British sea power.

Another example of military overemphasis is the use of Germany's Prussian officers as symbols of land power. The appearance of the Prussian officer only meant that Germany was determined to apply force in protecting a nation that was basically dependent on the continent of Europe for its national growth. Germany's military might was created to protect and expand a land power. Germany never severed her umbilical tie with the land. As Rome centuries before could have been called *the* land power of the world, so Germany for a brief time in history could have been called *the* land power of the world.

It is apparent that as a country develops its natural capabilities as a sea power or a land power its people begin to recognize and understand that power and become an element of that power. It is unquestionably safe to say that no nation has reached the ultimate as either sea or land power without possessing public understanding and appreciation as an element of that power.

The next obvious field of inquiry is: What of air power? Misunderstanding, we know, exists today. It is also evident that the lack of understanding cannot be removed by the overly simple expedient of producing a definition of air power. As has been shown in the case of sea and land powers, the rise of a nation to the status of an air power must have public understanding as a part of that power.

Whether any nation today is an air power in the same broad context that England was a sea power or Germany, and Rome before her, were land powers is quite debatable. This is a field of inquiry that needs extensive investigation. But some cursory conclusions may be drawn from our brief experience with air power. No nation today has a destiny linked by geography to the air as England's destiny was linked to the sea or Germany's to the land. Also no nation today has an economic system whose heartbeats are controlled by the air as England's were by the sea and Germany's by the land.

But there are signs on the horizon. So far at least sea-power nations have shown a greater affinity toward development as true air powers than have land powers. The United States, so long a self-sufficient nation in raw materials, is an industrial nation whose continued economic health is rapidly becoming more dependent on foreign trade and the import of raw materials. This trend seems destined to continue. Transatlantic air passenger traffic already exceeds that going by ship. The next decade may well see cargo aircraft that can compete or better the ton-mile costs of surface transportation. Thus year by year the economic sinews that could bind our nation's destiny to the air are strengthening and multiplying.

Many nations possess varying amounts of the many elements that would comprise an air power. England, for example, produced some of the first air power zealots, particularly Lord Trenchard. However, that nation's lack of natural resources, its geographical location, and the inclination of native abilities and desires of its people have constantly retarded England's development as an air power. Germany, as another example, was one of the first to employ the air as a civil instrument and as a military force. Although Germany may have possessed some natural capabilities to become an air power, it was unable to force itself away from the type of thinking that produced a natural land imprisonment and restricted it to a land power position.

Many nations today are moving along the air power path. This path is new and indistinct. No nation has trod it before. No experts are available to relate past history, experiences, and developments of other nations that were once air powers. For such history does not exist.

Two nations, the United States and the Soviet Union, perhaps dominate the search for the true path in becoming air powers. The Soviet Union, by virtue of its geographical location, tremendous land mass, numbers and capabilities of its peoples, and its governmental structure, can be considered as having the fundamental characteristics of a land power nation. The United States, on the other hand, by virtue of many natural and developed attributes, could perhaps be considered as fundamentally an air power nation. This is not to say that it is an air power. Nor does it deny the existence of many elements of an air power. From present appearances, however, many things seem to be lacking, one of which is public understanding and appreciation. And strangely enough, such support is actually an element of that intangible, air power.

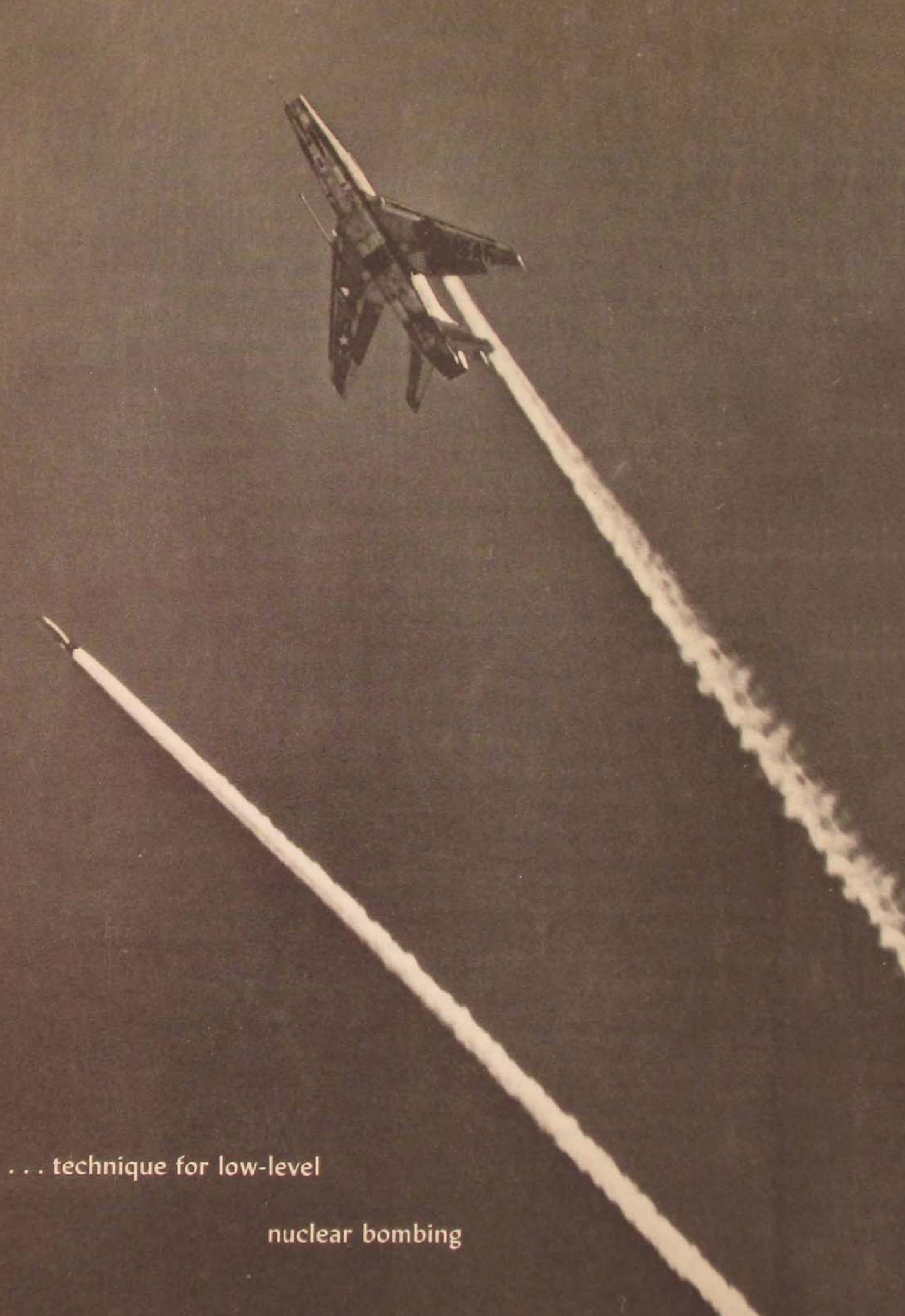
Some public comprehension and participation is developing as everyday effects continue to multiply. It must be remembered that the public's first encounter occurred but a few years ago when eccentric daredevils flopped around ball parks draped inside of a conglomeration of cloth, engine, wire, and struts that, assisted by a prayer booster, would fly. At the end of World War I, men stepped out of their planes to become public heroes—not so much for what they contributed to winning the war but for their courage and audacity in fighting in a new and peculiar fashion. These heroes did one thing, at least: they contributed to public knowledge. The mid-twenties increased that knowledge still further with the barnstormer, his Jenny, his parachute, and his wing walker. They boosted it to the point where a few foolhardy nonaviators actually paid for rides, without benefit of special insurance. By the time regularly scheduled commercial flights became a reality, the public had accepted the airplane as "here to stay." Dynamic air developments, however, have crammed into a mere half century progress from the powered glider of yesterday to the intercontinental ballistic missile of tomorrow.

A few men have possessed the vision to see what it meant to their country to become an air power. Like most men with vision they were generally scorned and then later revered. General Mitchell suffered a court martial. General Douhet was imprisoned.

Such men as these, and a few exist today, truly understand the nature of a nation becoming an air power. They seldom try to define it, however, for their concern is not in producing a crutch for public understanding. They recognize that public understanding and appreciation are elements of the very thing to be defined. Their concern, rather, is to develop and employ the other elements of that power so that public understanding arrives through individual experience, awareness, and direct effect.

The fact that full public understanding will eventually come and take its proper place as an element of an air power is as certain as the fact that no magical definition can ever bring that understanding.

Headquarters Air University



. . . technique for low-level

nuclear bombing

LABS

LIEUTENANT COLONEL JOHN A. RYAN, JR.

THE introduction of the nuclear weapon as a new parameter in the kinematics of warfare has produced many original and attractive solutions to ancient and timeworn problems. During the period of its first employment man was so overwhelmed by its magnitude relative to the weapons in his textbooks and previous experience that he reacted rather like a remote tribe suddenly confronted with the white man's magic. Soon, however, students of the military art were back to business as usual.

This new dimension in firepower was so large that scarcely a single aspect of warfare was unaffected. Defensively, targets had but few basic alternatives: spread out to lessen total loss; harden to reduce the damage; destroy the attacking nuclear vehicle. Offensively, the obvious advancements still to be made were to increase the lethal radius to include larger target areas, to increase the power and penetration to destroy harder targets, and to modify or invent delivery techniques. The LABS—Low Altitude Bombing System—was one effort to meet this latter offensive requirement.

Nuclear weapon development brought increased yield and decreased weight and size. Weapons could be made small and light enough for compatibility with fighter-bomber aircraft, yet the yield of these same weapons could be large enough to take care of any anticipated target conditions. But this was the solution to only half the problem.

Fighter-bomber pilots always sought to drive home dive-bomb attacks close-in to the target. This meant they had to respect the lethal radii of their own or adjacent aircraft's weapons. Calculations and experience brought about operational minimum release ranges and other delivery restrictions. With World War II weapons these restrictions were quite small compared to the maximum capabilities of the delivery system.

With the logarithmic increase in lethal radii introduced into the old problem by the new weapon, the fighter-bomber became so potent that, like the famous kiwi bird, it almost devoured itself. Use of dive-bomb techniques of World War II for nuclear delivery meant greater and greater release ranges. The fighter-bomber was pushed not only beyond the instrumental capabilities of the dive-bomb sight but also beyond even sufficiently accurate manual release.

Simple geometry shows that if a dive-bomber wants increased release range it must increase its release altitude. Here was a problem that promised to be a main obstacle to realizing an acceptable nuclear capability for fighter-bombers. In Germany, for example, during a large percentage of the year the fighter-bomber flying at the required minimum release altitude would have cloud cover between itself and the target. This would preclude visual aiming. There appeared to be only two straightforward approaches to the

problem. The first was to give the fighter-bomber a radar-bombing capability. The second was to discover a method of remaining below the cloud cover for visual release of the weapon and yet increasing the distance between the delivery aircraft and the weapon at burst time.

The first of these alternatives had many unattractive features. The weapon was available for the aircraft, but an air-to-ground radar-bombing facility would take years from development to operational readiness. Also an all-weather fighter-bomber would grow in size, cost, and vulnerability until it virtually duplicated a light bomber that was already in the inventory. The feasibility of providing fixes to the fighter-bomber by means of a ground-controlled electronic environment was investigated. This too has obvious disadvantages: range, line-of-sight limitations, inaccuracies, and, most important, vulnerability to countermeasures.

To accomplish the second alternative, i.e., release the weapon below the overcast, there were as many proposed solutions to increasing the escape range as there were different agencies working on the problem. Basically most of these proposed solutions had one thing in common—altering the trajectory of the bomb by significantly increasing or decreasing its velocity after release. There were forward-fired rockets, rearward-fired rockets, "chutes" of all descriptions, autogyros, maneuvering wings and fins, aerial tows, balloons, etc. Most of these solutions had another feature in common, a loss of priceless time. Production weapons were rolling into stockpile. Fighter-bombers modified to carry these weapons were operational at overseas bases. The solution had to be one that solved the time problem—"get there the firstest with the mostest"—as well as the technical problem.

Many of these proposals were technically feasible and had desirable tactical characteristics. Some required a new weapon or major modifications to the stockpile weapon while others required extensive changes or additions in aircraft equipment. None of these could get there the firstest.

The LABS by its very simplicity was its own best salesman, both technically and operationally. The LABS could employ the stockpile weapon. With the easy field installation of the relatively few pounds of LABS equipment the offensive potential of the currently deployed fighter-bombers was significantly increased. The original LABS proposal pointed out critical weaknesses in the deployed nuclear fighter-bomber force—the serious weather limitations and the inability to escape the increasing yield of its improved weapons. A LABS designed and built in six weeks at Wright Air Development Center accompanied the proposal and attested to its technical feasibility. Because the LABS made major use of the off-the-shelf items as basic building blocks, it solved the production-time problem as well as the technical problem.

The LABS has turned the dive-bombing technique upside down. The aircraft releases the bomb while "diving" up from the target. The bomb thus has a "time of fall" or flight many times longer than in dive bombing. This, together with the much-increased release ranges possible, gives the delivery aircraft plenty of time for escape from even the largest-yield weapons.

As illustrated in Figure 1 the pilot flies toward the target just high enough to clear the terrain and have good visibility. As it approaches the target the aircraft starts a smooth, high-"g" pull-up and after bomb release completes an Immelmann or Half Cuban Eight. The pilot controls the

maneuver. During the run-in to the target the optical gunsight is used for aiming the aircraft flight path toward the target. At the correct point, A, the LABS extinguishes the gunsight reticle. This is the signal for the pilot to pull up. Bomb release, which occurs automatically during the pull-up, is indicated to the pilot by the return of the gunsight reticle. In later-model LABS the maneuver is flown automatically by an autopilot tied into the LABS and the pilot just holds on for the ride.

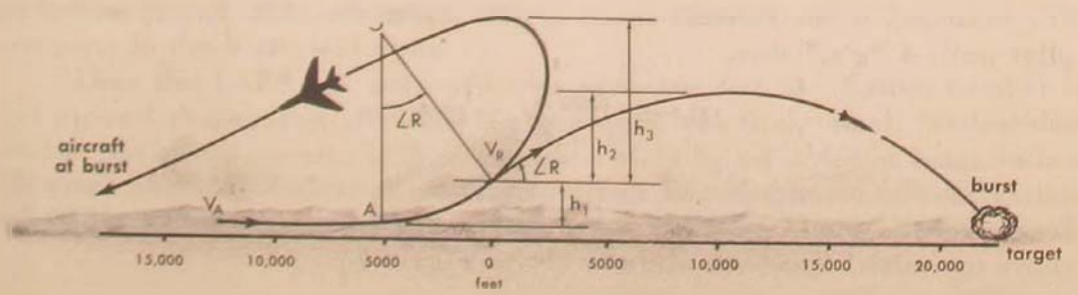
At any time prior to pull-up the pilot may select an alternate type of LABS release nicknamed "over-the-shoulder." This is illustrated in Figure 2. In this mode of operation the pull-up may start just as the aircraft passes over the target or even past the target and the resulting trajectory carries the bomb back to the target. The escape maneuver after release may be the same as in Figure 1 or may be to continue the loop. This type of LABS would possibly be used under conditions of limited visibility where it may be desirable to fly closer to the target for positive identification. Two features of the "over-the-shoulder" are disadvantages compared to the "conventional" LABS release. The aircraft is exposed to much more of the target defenses, and its escape distance from the nuclear weapons effects is not as large.

There is a wide variation of release angles and the resulting trajectories. Each has its own advantages and disadvantages. Angles can be much more shallow than shown in Figure 1; they can be 90 degrees straight up; or they can be past 90 degrees where the bomb is tossed back to the target as in Figure 2.

The maneuver is not nearly so difficult as it may appear. When flown manually by the pilot it is done entirely on instruments, holding the wings "level" and steadily maintaining a desired "g" force by coordinating a gyro-controlled reference and an accelerometer aligned with the vertical axis of the aircraft. Because it is standard procedure to fly the maneuver on instruments without reference outside the cockpit, the pilot would even prefer having a low overcast. It not only provides increased safety from the target defenses but also curtains off the brilliance and thermal radiation of the bomb explosion.

Since its first introduction by the Air Force, the LABS has grown rapidly in popularity until it is now a standard item of equipment in all USAF and Navy fighter-bombers. Fighter pilots took to it as the sport of kings. During the last three annual USAF world-wide fighter gunnery meets, the LABS has

Figure 1. The fighter-bomber approaches from the left at velocity V_A. Pull-up is initiated at A. Release of the bomb occurs automatically. Release angle and velocity are designated R and V_R respectively. The altitudes above initial approach altitude are designated h_1, release; h_2, summit of bomb trajectory; and h_3, top of aircraft maneuver. An air burst is shown above the target.



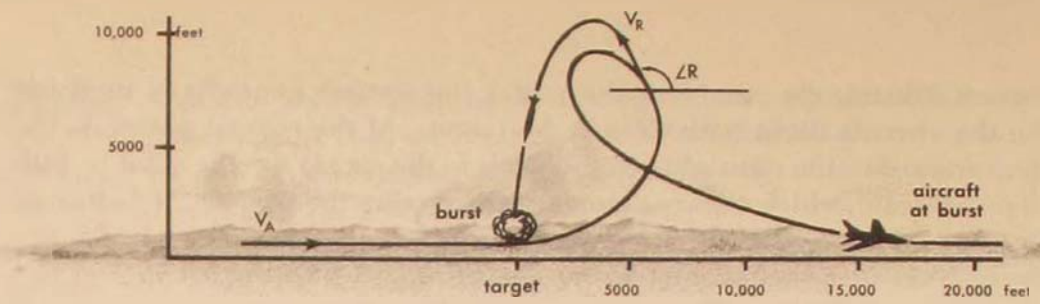


Figure 2. "Over-the-shoulder" LABS, approximately to scale.

been a major attraction. Accuracies each year have improved so much that the scores of previous champions would be low on the totem pole in successive meets. Winning teams from each of the major commands compete in the annual fighter World Series, and competition is keen. The list of commands represented is indicative of the widespread use of LABS: SAC, TAC, FEAF, USAFE, ATC.

The LABS went further than satisfying the requirement to bomb just below an overcast. It gave the fighter the capability of coming in at treetop level. Since radar is essentially limited to line of sight because of the wave length it uses, its effectiveness for warning and for control of defense weapons against a treetop level LABS attack is severely restricted.

The story of the development of this bombing system is one to which the USAF's Air Research and Development Command can point with pride. Started early in 1952, the first LABS was built at Wright Air Force Base by the middle of February. Presentations and demonstrations of a "pinball" type machine to Hq USAF, the Navy, and the AEC brought encouragement and the needed official blessing to continue.

Although the LABS could employ the stockpile bomb, the development proposal suggested an internal change in the bomb that would further increase the LABS flexibility. This was wholeheartedly supported by the AEC and soon resulted in an increased capability in the stockpile weapon. Flight testing began at Albuquerque, New Mexico, in May 1952, and by the following spring the LABS was operational in the U.S. and in Europe and the Far East.

Without going into the detailed mathematics, a few simplified assumptions and basic equations will illustrate some of the interesting characteristics of the LABS profile. Let us assume (1) a "clean" bomb with negligible aerodynamic drag, (2) the thrust of the aircraft equals its drag throughout the maneuver, and (3) the radius of the pull-up maneuver to release point is constant.

The initial pull-up radius is

$$OA = \frac{V_A^{\,2}\ \text{ft/sec}}{(\text{number of "g's" less one "g" for gravity})\ 32.2\ \text{ft/sec}^2}.$$

For example, if the aircraft speed is 520 knots, i.e., 880 ft/sec, and if the pilot pulls 4 "g's," then

$$OA = \frac{(880)^2}{(4-1)32.2} = 8000 \text{ feet}.$$

With the assumption of constant radius, the release altitude for a 40-degree release would be $OA(1 - \cos \angle R) = 8000\ (1 - \cos 40^\circ) = 1870$ feet above the initial approach altitude (h_1 in Figure 1).

The release speed is

$$V_R = \sqrt{V_A^2 - 2gh_1} = \sqrt{880^2 - 64.4(1870)} = 809 \text{ ft/sec.}$$

The top of the bomb trajectory is

$$h_2 = \frac{(V_R \sin \angle R)^2}{2g} = \frac{(809 \sin 40°)}{64.4} = 4190 \text{ feet above the release altitude.}$$

The "time-of-fall" from release to the top of the trajectory is

$$t_1 = \sqrt{\frac{2h_2}{32.2}} = \sqrt{\frac{2(4190)}{32.2}} = 16.1 \text{ sec.}$$

The "time-of-fall" from the top of the trajectory down to a burst height of the same altitude as the approach altitude is

$$t_2 = \sqrt{\frac{2(h_1 + h_2)}{g}} = \sqrt{\frac{2(1870 + 4190)}{32.2}} = 19.4 \text{ sec.}$$

and the total time of flight of the bomb is

$$t_{1+2} = t_1 + t_2 = 16.1 + 19.4 = 35.5 \text{ sec.}$$

The ground range of the bomb from release to burst is

$$(V_R \cos \angle R)t_{1+2} = (809 \cos 40°)35.5 = 22{,}000 \text{ feet.}$$

The flight path of the aircraft is somewhat more complicated to calculate, but some simplifications will illustrate the magnitude of some interesting values. Assume that the maneuver is flown so that the speed of roll-out at the top of the Immelmann is half the initial approach speed and that as before the thrust of the aircraft always equals its drag, then

$$h_3 = \frac{V_A^2 - \left(\frac{V_A}{2}\right)^2}{2g} = 9000 \text{ feet above approach altitude.}$$

In this example the aircraft would be at the top of the Immelmann about the same time that the bomb reaches its summit and during the remaining 19 or so seconds to burst would be accelerating outbound from the target, placing the aircraft some 35 to 40 thousand feet from the burst.

The radiation effects of the bomb are essentially instantaneous. The shock wave soon slows down to sonic speeds and so is of little concern to the aircraft accelerating on its homeward journey. With escape distances of this order it can be seen that the fighter-bomber in a LABS maneuver is as far from its burst as a high-altitude bomber would be from its burst. This, combined with the favorable "tail-to-the-burst" attitude and the more rugged structure of the fighter-bomber, gives it the capability of safely delivering weapons in the high-yield class.

Thus the LABS not only provides a means for the fighter-bomber to get around the weather difficulty in delivering relatively small tactical-sized yields, but offers a means of increasing the yield by an order of magnitude—all this combined with a low-level attack capability that has substantially increased the headaches of the defense force.

Headquarters United States Air Force

...Air Force Review

F-100 CONVERSION IN THE FAR EAST AIR FORCES

COLONEL WILLIAM F. BARNS

EARLY in 1956 the Fifth Air Force began preplanning and programing to ensure the successful conversion of its tactical organizations from the combat-proven F-84G and F-86F aircraft to the new F-100D supersonic fighter-bomber. Of all the contributing factors to a successful conversion program, the most important was predicted to be an informed, enthusiastic, and aggressive attitude on the part of all levels of command.

To ensure this first prerequisite, all information received on the F-100 weapon system was disseminated from Fifth Air Force to those concerned with the program by means of the Fifth Air Force F-100 News Letter. This valuable source of information continued from initiation of the project until the conversion of the first tactical organization, the 8th Fighter-Bomber Wing.

One of the first steps taken in the conversion program was the assignment of an F-100 conversion project officer to coordinate the efforts of the staff sections of Fifth Air Force and to make sure that everything necessary to the conversion program was either successfully completed or in process and to map out a properly time-phased program. A detailed check list of foreseeable actions was made and used at Fifth Air Force, with deadlines for each project. The appropriate staff sections initiated actions and kept the project officer advised by means of information copies. In this way any staff agency in the command could go to one office and get the complete story on any particular phase of the conversion.

The prerequisites for a successful conversion program fall generally into the following categories:

- facilities
- training
- logistic support action
- phasing out of old aircraft
- delivery of new aircraft

facilities

Facilities, of necessity, are related to the weapon system itself. One of the first requirements is a runway of adequate dimensions and surfacing. If prior programing action had been taken for runways of greater length than needed, so much the better. The heavy footprint pressure of the aircraft under full load made concrete taxiways and parking ramps desirable, particularly in areas of high summer temperatures. All Air Force levels worked to bring about these changes, and they were completed by the time the first F-100 arrived at Itazuke Air Base. They were still being worked on at other conversion bases.

Another necessity is a maintenance runup area with adequate mooring for running the engine at military and afterburner power. This runup area must be carefully located to make it as available as possible to all organizations and, at the same time, keep down the noise level in adjacent areas, including surrounding civilian communities. This latter is a difficult problem at some Far East bases because of the extremely limited confines of the airfields; a compromise location is necessary in some cases.

Other important facilities include adequate paradrag drying towers and repack areas, jet-engine field maintenance area, repair facilities structurally capable of accommodating the heavy J-57 engine, an adequate harmonization range for the 20-millimeter guns, and adequate storage space for aircraft external stores, tools, and test equipment.

The F-100 is a complex and expensive aircraft, and you don't operate a Cadillac out of a barn. The squadron operations section should be adequate for operations, intelligence, and personal equipment activities. If the basic buildings and foundations are available, a great deal can be improvised by willing squadron personnel, with some assistance from Air Installations, in ensuring that the facilities are compatible with the weapon system and the mission.

The first major problem worked on in the Fifth Air Force F-100 conversion program was the status of pilot personnel equipment in the Far East theater. Letters were written from the Commander, Fifth Air Force, to the Commanders, Far East Air Forces and Air Materiel Command, requesting support in obtaining new pilot personnel equipment. As a result of this and of assistance from Air Materiel Air Forces Pacific, all pilots have been or will be equipped with the necessary items of flying clothing prior to climbing into an F-100 for their first flight in the Far East Theater.

training

The next problem of a conversion program is the proper training of aircrew and materiel personnel for proper knowledge of the weapon system and its operation, support, and maintenance. A personnel replacement program was begun by writing to Headquarters USAF, requesting that fighter pilots rotated to the Far East have F-100 experience or be sent through stateside training programs before shipment. This program is working very effectively, and the personnel processing centers in the theater make sure that such personnel are properly identified and routed to F-100 units.

A limited quota was obtained for the F-100 Pilot Transition Course at Nellis Air Force Base, Nevada, and squadron supervisory personnel were selected to attend. Key factors in this selection were retainability upon return from training, position in the squadron, and over-all Air Force experience. These personnel and the pilots who had come from stateside F-100 organizations raised the over-all experience level of Fifth Air Force organizations to well above that of the previous year.

maintenance training

One of the major contributing factors to the successful conversion of the 8th Fighter-Bomber Wing was the training received by key maintenance supervisory personnel in North American Aviation's Field Service School in Los Angeles. Personnel selection was based on retainability, skill level, and enthusiasm for the program. Those chosen were rotated in four groups of 12 airmen and one officer to North American approximately five months prior to receipt of their organization aircraft. The benefits of this program cannot be overestimated. FEAF maintenance people could work on the same aircraft during production that they would later receive in their own squadron.

This factory training has been largely responsible for the successful maintenance program at Itazuke. The training of supervisors is directly reflected in the aircraft utilization achieved since delivery of the first aircraft. Although it has exceeded the number of programed hours by a comfortable margin, the maintenance capability of the organization has not been strained.

The timely delivery of the F-100D-6 Mobile Training Detachment (MTD) was another training help. Because of close coordination between FEAF and the Air Training Command this unit arrived at Itazuke well ahead of the first aircraft. The

using people had already learned about the facilities and power requirements for the MTD, so when the unit was unloaded from the transport aircraft it was installed and in operation within a very short period of time. There is tremendous value in the MTD operating, cut-away training devices, since trainees can see clearly how an entire system actually operates.

logistic support

The importance of adequate logistic support to the complex weapon system of today cannot be overstressed. Under the current Air Force weapon system concept the responsibility for each weapon system, after its delivery to tactical organizations, rests with the prime Air Materiel Area. In the case of the F-100 aircraft, the Sacramento Air Materiel Area, McClellan Air Force Base, California, (SMAMA) has developed a support system that works exceedingly well for an organization such as the 8th Fighter-Bomber Wing, nearly 6000 miles away from its primary source of supply. SMAMA assured that the Air Force Supply Directives (AFSD) for the supply support were issued to the appropriate ZI depots and that the equipment was assembled on the west coast in time to reach the using base prior to receipt of the aircraft. Thus over two thirds of the required items were at Itazuke Air Base before the first F-100D landed.

As always, there were problems with tools and test equipment. By close cooperation through the logistic support channels these problems are being resolved, and the transition program has not been detrimentally affected. The basis of some problems centers on the provisioning team, composed of representatives of all interested commands. Provisioning action is only as good as the consumption data available; therefore it is important that this consumption data be accumulated and made available to provisioning personnel when their all-important conference takes place.

A great portion of the items of supply and equipment listed for the Far East theater in the Air Force Supply Directives was delivered by airlift. The heavier equipment transported by surface vessel was closely monitored by SMAMA, the Northern Air Materiel Area Pacific, and base supply personnel to ensure expeditious off-loading and movement by rail to the using base. A system reporting on delivered equipment was set up to permit daily follow-up on those critical items not yet available for maintenance of the aircraft.

The new Air Force logistics support concept of establishing a low stock level at the overseas base with daily re-requisitioning is reflected in the high in-commission rate maintained by the 8th Fighter-Bomber Wing during its conversion period. The AOCP* and ANFE** rates have been continually reduced. Pipeline time for delivery of AOCP parts not available in the theater has been reduced by 50 per cent measured from the time that the item is requisitioned until its delivery to the squadron.

The primary weapon system is always the center of interest and receives the greatest emphasis. For this very reason the related support equipment must be carefully programed. For example, quantities of the proper quality liquid oxygen are required by the F-100. If local commercial sources are not available, the liquid oxygen generators must be provided and trained personnel and spare parts made available to assure their continued operation.

At base level, as at Fifth Air Force, it was essential that project officers be assigned to initiate and follow up all actions. One of the most important of these project officers at base level is the F-100 weapon system supply officer. To ensure that the system of support will work, one man and his assistants must have at their finger tips all of the information on current logistic support actions. This man becomes the key to the life line of the tactical organizations, and it is his daily contacts with the logistic support agencies that keep the parts flowing. He must be relieved of all responsibilities except those for the F-100 weapon system. He may be a lieutenant or a colonel, but his assignment to these responsibilities and no others is necessary in any base conversion program.

The base stock level and parts utilization must be monitored and changes to stock levels requisitioned according to consumption. This gives the depots the consumption data necessary for reprovisioning of spare parts, tools, and test equipment to support the F-100 system world-wide. En route kits used in deployments of the aircraft for operational readiness and mobility training have to be provided. All this requires a close working relationship between the squadron maintenance and supply personnel and the F-100 weapon system supply officer. The mechanization of the base supply account and the installation of the now available transceiver equipment, which submits or confirms requisitions instantaneously over thousands of miles, forms an essential link in this supply system. The desired objective, seven days from sub-

*Aircraft out of commission awaiting parts.
**Aircraft not fully equipped.

mission of requisition to delivery of the part to the tactical squadrons, on items that must travel from the ZI to the Far East theater, is almost a reality.

After the base stock level is developed to the point where all items required are available in the quantities necessary, the pipeline time from the States loses its importance to the tactical organization; but it is still necessary to ensure adequate base stockage. At Itazuke the average time for delivery of a part from the time of requisition by the squadron to delivery to the widely dispersed squadrons on the base is 38 minutes. This can be improved when radio-equipped vehicles for ordering necessary parts are available to the flight line. All these steps, tied together, become a flexible, responsive, logistic-support system that can keep the weapon flying.

phasing out old aircraft

An extremely important part of the Fifth Air Force F-100 conversion program was the system for phasing out the old aircraft. When the expected arrival time of the new F-100's was known, a gradual phasing out of the unit's old aircraft was accomplished by their transfer to other organizations low on inventory or to IRAN* facilities. This permitted an orderly decrease in the squadron aircraft and support equipment at a time when training of personnel in the MTD and in the United States was of prime importance. It also prevented the double workload of maintaining the old aircraft (and pulling transfer inspections) while making acceptance inspections on the new aircraft. One word of caution is necessary here. Do not phase out the old aircraft so rapidly as to let the pilots fall behind on their annual flying requirements, or pre-F-100 check-out requirement, which, in the case of Fifth Air Force, is 10 hours within the last 30 days.

delivery of new aircraft

Naturally one of the most important parts of the conversion program was the procedure used in the delivery of new aircraft. In the case of the Far East Air Forces a well-established method of delivering fighter aircraft in excellent condition had been developed over the years by Sacramento Air Materiel Area.

The Fifth Air Force subscribes fully to the concept that tactical air forces should have world-wide mobility. But at the

*Inspection-and-repair-as-necessary.

time of this conversion program, the in-flight refueling capabilities of the F-100 had not been adequately proved. Therefore the delivery of the aircraft was accomplished by surface transport. They arrived ahead of schedule with absolutely no losses of aircraft, equipment, or personnel. As Fifth Air Force tactical organizations progress in the conversion program and the external wing-tank capability of the F-100 is exploited, long-range flights and in-flight refueling will become routine. Thus, at the proper time, the mobility concept is being achieved.

After correction of flight-test discrepancies the aircraft were delivered by 8th Fighter-Bomber Wing pilots. Upon arrival an acceptance inspection was pulled to ensure the quality of the aircraft after several hours of operation. The results of these agreements and procedures were most gratifying because the quality of the aircraft received from the deprocessing facilities was excellent. The steps taken were completely justified.

At Itazuke Air Base the pretraining of maintenance personnel, as outlined previously, really began to pay off. Maintenance procedures set up as a result of the stateside training, MTD training, and careful study of tech orders had the aircraft exceeding by a comfortable margin the programed flying hours—without stretching logistic support and maintenance capability beyond the breaking point.

Contractual augmentation was arranged by Fifth Air Force early in the preplanning for the conversion. As a result North American technical representatives for the base and tactical squadrons were on hand to assist on specific problems. In addition three on-the-spot maintenance teams arrived slightly ahead of or concurrently with the aircraft to assist squadron maintenance personnel. These teams were programed to remain with the squadrons for the first six months after transition, with one team remaining indefinitely to support the field maintenance squadron and tactical squadrons as required. Technical representatives from the other contractors supplying aircraft equipment or supporting equipment, such as the MA-2 starting unit, were also available to prevent equipment breakdowns.

Approximately three months after arrival of the first aircraft the F-100D pilot indoctrination team, made up of both Air Force and contractor personnel, arrived to discuss aerodynamics, performance, maintenance, armament, supply, and aircraft configuration.

The operations aspects of a conversion program require a great amount of preparation. Fifth Air Force operations per-

sonnel drew policy guidance in the form of mission directives for the transition and operational-readiness phases of flight training. Detailed planning was left to the discretion of the tactical organizations; only the objectives were prescribed by the higher headquarters. This point is important. The Air Force's development of leadership at lower echelons of command that is capable of progressing to higher responsibilities needs every encouragement. If the method of carrying through each objective is spelled out by higher headquarters, the subordinate commander need exert no initiative in developing techniques on his own. He becomes bound by detailed regulations. If, on the other hand, the objectives are clearly outlined and the responsibility and authority for achieving them are assigned to the appropriate level of command, the initiative and aggressiveness of the American airmen will be exercised to the clear advantage of the Air Force—and the desired goal will be achieved.

Headquarters 8th Fighter-Bomber Wing

WEAPON SYSTEMS AND THE WEAPON SYSTEM CONCEPT

Lt. Colonel J. W. Colopy

THREADED throughout the many current studies by military and civilian scientists and engineers on research and development appear two relatively simple terms: "weapon system" and "weapon system concept." Even to many professional people in the military and scientific fields, the terms are mystifying. They signify a new and radical approach in fulfilling the Air Force mission of maintaining a superior striking arm.

Actually neither a weapon system nor the weapon system concept is much of a departure from the old accepted military axiom that a weapon is an instrument of combat for offense or defense. What is new about the weapon system concept is our definition of what constitutes a weapon and the manner in which it is conceived, researched, developed, and produced.

Any of King Arthur's knights put his suit of armor to use as defensive armament, his sword and spear as offensive armament, his mount as his power plant and airframe combined, the crane to put him on his horse as his ground support equipment, and his armorer as his maintenance crew. All these equipments and accouterments constituted what, in those days, could have been called a complete instrument of combat. Certainly to have had the knight trained as a swordsman, then to have denied him his weapon in combat, would have rendered him militarily ineffective. Similiarly, as runs the oft-repeated tale, the loss of a bolt through the ineffectiveness of the maintenance crew could cause the loss of a battle. With weapons all parts are required to make an effective whole. The whole can then be called a weapon system.

All too often in the past Air Force attention focused on the air vehicle or airframe-engine combination and performance without adequately considering the complementary parts that would enable the airframe-engine combination to perform its required mission. True, the complementary parts were not forgotten. But they were frequently forced into secondary positions with the same end result—operational limitations. Military men came to recognize the urgent need for adequate consideration of all the parts of an Air Force combat vehicle just as the knight considered his. The all-encompassing term *weapon system* was adopted to ensure the inclusion of all complementary parts of each air vehicle, the air vehicle itself being only one segment.

What, then, is the modern-day definition of a weapon system? In official wordage, a weapon system is:

> a composite of equipment, skills, and techniques that form an instrument of combat which usually, but not necessarily, has an air vehicle as its major operational element. The complete weapon system includes all related equipment, materials, services, and personnel required solely for the operation of the air vehicle, or other major element of the system, so that the instrument of combat becomes a self-sufficient unit of striking power in its intended operational environment.

The definition includes the air vehicle with its airframe, power plant, and fire control; bombing; navigation; flight control; electrical, ground, and training equipments; and personnel training programs. Although this definition of a weapon system appears to be simple, it does incorporate some complex features that will be covered later in some detail.

At this point it is logical for the professional military man to ask: If the term weapon system has existed for some time, why has its importance been stressed so much of late? The answer, entirely in keeping with military aviation and scientific progress, is that for many years the Air Force used aircraft that were relatively simple in design and somewhat similar in construction. Moreover the airframe-engine parts of those early weapon systems and many of the other parts could be used more or less on an interchangeable basis.

For a comparison between the "old and the new," let us backtrack to the days of the Kitty Hawk. The Wright brothers' 4-cylinder reciprocating engine developed 12 horsepower and weighed about 13 pounds for each

horsepower produced. With two wooden propellers the plane was able to sustain a speed of about 25 miles per hour. What has happened since? Today we have the B-52, which features eight J-57 turbine engines. Each engine develops 30,000 horsepower, a total of more than 240,000 horsepower. When we consider that the 10 turbines that drive the large generator at Bonneville Dam develop about 600,000 horsepower, we can readily grasp the significance of the progress in plane propulsion. Even in relatively recent years aviation progress has increased a thousandfold the complexity of aircraft research, testing, development, and production.

For another comparison the Boeing B-17, the Flying Fortress of World War II fame, carried 1600 pounds of electronic gear, the B-29 more than 2100 pounds, the B-47 Stratojet 5400 pounds. The B-17 required 100 electronic tubes, the B-29 more than 500, the B-47 some 1125.

A final comparison between the old and the new underscores the complexity of modern-day aircraft. World War I planes often were compared to orange crates held together with canvas and baling wire. Even more facetious was the oft-made remark that changes in specifications only required more and varied lengths of canvas and baling wire. The B-47, our first-line medium bomber, already has undergone more than 3000 modifications during its six-year life as a major weapon in our armament inventory.

Growth of the Idea

Prior to World War II, primary pressures in aeronautical systems centered on the basic vehicle. Consequently we entered that conflict with basic vehicles fairly abreast of the state of the art but possessing a kill potential limited to a machine gun designed in 1903. Even in so recent a time the military tenet that we were "fighting today's war with yesterday's weapons" held true.

But in the crucible of battle military men soon recognized the need for a change in concept of the weapon systems. The potentialities of such a concept added further pressure for a complete re-evaluation in this area of military art and science. Techniques of operational analysis, developed and demonstrated in combat, convinced military men that a weapon system must be considered in the light of its whole rather than its parts.

Perhaps the first indication of formal recognition of the need for a total weapon occurred with the establishment of a weapon system evaluation group during World War II. But even after the weapon system terminology gained prominence in military, industrial, and scientific circles, fascination with the airplane per se diverted attention from the subsystems. Development had continued with the idea that "when we get it, we'll wrap aluminum around it and stick an engine in it." Here was oversimplification in its broadest term. The shortcomings of such a philosophy were brought to light when the development of the subsystem could not be completed without knowing the characteristics of the airframe. As a result the complete system program slipped badly.

Meanwhile airborne vehicles, their specialized airborne and ground maintenance equipment, and trained ground crews to maintain them were becoming increasingly complex. The problem became uncomfortably evident when the B-36 became operational. After all the planning it was found that the tugs then in service could not tow these monsters; nor had provisions been made for a new vehicle. Fire-control problems plagued engineers. Lack of trained ground crews limited operations. While some of these problems could be attributed to a shortage of military manpower and funds, one single fact stood out sharply against the horizon of military necessity: greater emphasis should be placed on all the parts of the whole that made up what was called a weapon system.

The concern that arose during World War II over the development of new weapon systems extended to the organizational structure that had been charged with this function. About the time the term *weapon system* was gaining wide recognition General Hoyt S. Vandenberg, then USAF Chief of Staff, became concerned about the lack of emphasis being placed on research and development in the Air Force. Research and development then was the responsibility of the Engineering Division, Air Materiel Command (AMC). Because of its vast and intricate logistics activities, AMC was not able to give research and development efforts the prominence and priorities they warranted. This situation, recognized by both military and civilian authorities, resulted in the appointment of a special committee to investigate and recommend changes in the Air Force structure in order to place more emphasis on research and development. The committee was headed by Dr. Louis Ridenour, then Dean of the Graduate College of the University of Illinois.

In September 1949 the committee produced and published the Ridenour Report. Briefly the report stated that the priority placed on research and development effort was too low, that effective use was not being made of the scientific and technical resources of the nation toward solving Air Force problems, and that organization, personnel, policies, and budgetary practices were inadequate for prosecution of Air Force research and development responsibilities. As a result of the Ridenour committee report, research and development was given prominence. It was separated from the Engineering Division of AMC and established as a major command, the Air Research and Development Command (ARDC). On 23 January 1950 all Air Force research and development activities were consolidated and brought under the jurisdiction of ARDC.

Before ARDC was organized, weapon systems were developed through the experimental stage by the AMC Engineering Division. Following completion of testing, the design was turned over to the Procurement Division for inventory production. This transfer of responsibility caused much delay, especially in the sizable time loss between experimental and production models. At the time that ARDC was formed, the multiengined B-52 had progressed to late development stages. Since the globe-girdling bomber was being considered for production, officials sought to close the time gap between

the experimental and production models. Logically this could best be accomplished by physically merging the Engineering and the Procurement divisions.

With the formation of ARDC this command took over the Air Force engineering responsibilities from AMC, but AMC retained logistic responsibilities for procurement, production, maintenance, and supply. Officials considered it essential that joint operation be continued for the B-52. Later, similar arrangements were made for all subsequent aircraft. This decision was necessary to tie together the functional responsibilities of the two commands and to plan and time-phase activities in the development and logistic support of the weapon system.

Now what about the other factors that make up the weapon system: the training programs, the maintenance programs, support personnel? When brought together, all these lead to a concept envisaging the proper relation of several significant factors:

- the need for properly relating the functional activities of the various Air Force organizations participating in these weapon systems programs
- the need for identifying and scheduling all the parts of the weapon systems so that all are properly related to one another in point of time
- the need for a contractor to ensure the proper technical integration of the numerous complex parts into a satisfactory weapon for combat.

The Case for Management

Stated another way, the weapon system concept is based on the recognition of the complexity of modern Air Force instruments of combat. It becomes a management concept that provides for plans, schedules, and controls of a weapon system from its design through its life as an operational entity.

With the restricted inventory available to the Air Force, any weapon that is in the active inventory but is not operational reduces our total military capability. To be operational, all the elements of that weapon must be available, compatible, supportable, and capable of being used efficiently by our personnel. The complexity of modern air weapons requires the astute management of time, effort, and resources, in conjunction with industry. If such management is exercised, a complete weapon enters the active inventory, not so early that it needs more time to become truly operational or so late that we fall behind our potential enemy.

Such a management concept is now employed by ARDC and AMC working as a team. The team activity is performed by a weapon system project office (WSPO), staffed jointly by ARDC and AMC people. Executive responsibility rests with ARDC until the weapon system reaches the production stage.

Weapon system project offices are charged with the responsibility of exercising management control of weapon systems programs to ensure proper phasing of actions in the development, procurement, production, maintenance, and supply of the weapon systems. They provide a focal point for pulling together the various Air Force weapon development activities, and

they serve as a central point of contact for industry on all aspects of the individual weapon systems programs.

Lest there be misinterpretation of WSPO authority, it should be stated that the offices do not have command direction or control over any other commands with functional responsibilities that are a part of the weapon system: i.e., Headquarters USAF, Air Training Command, Air Proving Ground Command, Military Air Transport Service, et al. WSPOs function as coordinators, from which position they resort to the normal chain of command when incompatibilities that cannot be resolved by coordination become evident in the over-all weapon system program. Since a WSPO is made up jointly by ARDC and AMC, different means must be employed to coordinate the activities of the other agencies involved. To do this, the WSPO is authorized to organize and supervise whatever specialist groups are deemed necessary. In addition WSPOs organize weapon system phasing groups staffed with members from the using commands.

Present WSPOs are composed of from two to 20 representatives of ARDC and a like number from AMC, the actual number depending on the magnitude of the program. ARDC members are headed by a chief project officer and an assistant. They resolve management problems in such technical areas as aerodynamics, electronics, propulsion, ground support equipment, navigation, flight testing, and training. For the most part their activities are directed toward determining the course of action that will be of most benefit to the Air Force. Their decisions are arrived at only after fully considering the technical recommendations of the specialists from the ARDC centers and from the contractors involved in the weapon systems programs.

Air Materiel Command members are also headed by a project officer and assistant. The AMC representatives concern themselves with contracts and activities connected with the provisioning for government-furnished aeronautical equipment, production engineering, procurement of training equipment, and general weapon systems support.

With what amounts to a two-headed office, it is necessary that one project officer be accepted as the team captain. In addition Headquarters United States Air Force needed to have one command providing information on any single weapon system program. The need for centralization helped establish the philosophy of executive responsibility. The ARDC member is designated the executive agent for each weapon system program and acts as team captain for the program until the weapon system reaches the production stage.

No change to the functional responsibilities results from this philosophy; rather the recommendations and decisions on the over-all program are made by the executive agent. To allow for differences of opinion, a provision was made for the other command to appeal to Headquarters USAF any decisions considered contrary to the assigned functional responsibility. To date no such appeal has been necessary. The various steps in each program develop smoothly until finally at some point after the decision is made to produce the weapon system for the inventory, the responsibility is transferred to AMC.

The Development Cycle

How, then, does a weapon system evolve under the weapon system concept and in the weapon system project office environment? Space limitations preclude covering each step in full detail. But generally speaking the development cycle runs the following course.

Headquarters USAF determines the need and formulates the over-all plan for any major weapon system. Specifically the need is determined by the Air Staff, especially a group of officers and civilians within the Directorate of Development Planning of the Air Staff. These Air Staff planners are up to date with advances in world weaponry and use the latest scientific methods available. Upon their collective shoulders rests a great responsibility. During their analyses members of the group contemplate many critical factors, including our military strategy and tactics; war plans; the military, technical, and scientific capabilities of other world powers; and the state of our science and technology. Both the present and future potentials of all these categories are thoroughly dissected and evaluated. In some instances the potential is projected far into the future.

Working jointly with ARDC, the Directorate of Development Planning in the Pentagon prepares a development planning objective (DPO) after carefully considering all approaches to the problem. The DPO describes the desired capabilities of the air weapons required to support strategic, tactical, defense, and logistic missions of the Air Force. Projected ahead from five to 15 years, the DPO probes the technical feasibility of possible weapons, at the same time considering the enemy's probable capabilities. Lastly it establishes a deadline when all objectives must be met.

After Air Staff approval ARDC uses the development and planning objective to set up development programs for long-lead items for weapon systems. When necessary ARDC realigns the programs to keep them consistent with the development planning objectives.

With the DPOs approved, a more specific plan for a complete, combat-ready system for the future is needed. At this point a general operational requirement (GOR) is published by Headquarters USAF, describing the operational need for a weapon to fulfill a specific mission. While the GOR specifies the operational need for the weapon, it does not spell out the technical approach for its development. Upon receipt of a GOR by Headquarters ARDC, action is started to obtain from industry one or more general design studies of a weapon system that will fulfill the requirement. General design studies explore possible technical and scientific approaches to the problem. After reviewing all design studies, ARDC prepares a development plan that identifies the capability of the proposed weapon system, specifies the time to obtain the capability, and estimates its costs. The Air Staff reviews the development plan. When approved, it is returned to ARDC for execution. And at this time the WSPO is established.

Eligible contractors for development are selected jointly by ARDC–AMC. Selection is made by a source selection board, chaired by the ARDC Director of Weapon Systems Management. The board exists to eliminate, as

much as possible, the time-consuming period of design study and contributes to shortening the development cycle. Using information held by AMC on contractors' facilities and capabilities, the board is able to reduce the large number of potential contractors to those few capable of performing the required work. Then, with brief management reports furnished by the contractors covering technical approach, facilities, manpower, and workload, the board further reduces the number of contractors to the minimum consistent with the risk involved—the urgency of the program and the advances it requires in the art of weapon system development.

On high-risk programs perhaps three or more contractors are selected to start the program; on low-risk programs perhaps one contractor would be considered adequate. On programs involving more than one contractor, the board continues to function, evaluating their progress so that their number can be reduced to one as soon as practicable. Both the final selection of development contractors and the decision upon the scope of the development contract are subject to variations in procedure. Headquarters USAF, ARDC, and AMC participate in the final selection. The joint proposals of ARDC and AMC, supported by the findings of the source selection board, are submitted to Headquarters USAF. After the Air Force deputy chiefs of staff, and in some cases higher authorities (Chief of Staff, Secretariat), review and approve the recommended contractor, a project priority is assigned and an authorization is issued to ARDC to proceed with the project.

Following the contractor selection, the weapon system project office assumes the entire workload of managing the program. Immediately work statements and contracts are issued. Continuous contact is maintained with the technical personnel of ARDC centers and the contractors—not only the weapon system contractor but also the subsystem and equipment manufacturers who provide parts of the system directly to the weapon system contractor and through direct government procurement. These activities generate development-engineering inspections and involve interested representatives from commands and organizations outside ARDC. The AMC members of WSPO are now concerned in production-engineering problems, Government-furnished equipment scheduling, and training-equipment procurement. As the design becomes firm, a mockup inspection is held; and after the detailed engineering and fabrication period, a contract technical compliance inspection is conducted, normally prior to the first flight of the air vehicle.

Following this, the test phase of the air vehicle and, insofar as possible, the ground equipment to support it is begun:

Phase I: Air worthiness and equipment functioning tests—to determine functional adequacy and to ensure that engineering specifications have been met.

Phase II: Contractor compliance tests—to determine compliance with performance and handling specifications exhibited in the contract.

Phase III: Design refinement tests—to evaluate new design changes prior to incorporation in the production item.

Phase IV: Performance and stability tests—to obtain and compile data for the handbook and other publications on equipment committed to production.

Phase V: All-weather tests—to determine the capabilities and limitations under actual or simulated climatic conditions. This includes ground and flight tests under adverse weather conditions and provides adverse weather data for the handbook.

Phase VI: Functional development tests—to determine the functional compatibility, durability, and acceptability of maintenance qualities, the rate of parts consumption of the equipment, and the adequacy of initial personnel skills and training requirements.

Phase VII: The employment and suitability test is conducted by Air Proving Ground Command (APGC).

Phase VIII: Unit operational employment testing is conducted at an operational base with personnel and equipment authorizations for a unit or squadron. This testing is performed under actual field operating conditions with typical personnel and maintenance facilities.

During the testing period production is continued at a slow rate. The changes and modified requirements determined by testing and the improvements in installations are a major portion of WSPOs' continuing work. Coordination with other agencies never lets up, especially in maintenance, supply, operations, and training. Normally the weapon system project office is disbanded as production nears completion, and the executive responsibility is transferred within Air Materiel Command to a Lead Air Materiel Area. ARDC engineering-support activities are continued on items affecting safety of flight.

The Big Difference

Air Research and Development Command functions as a unique management tool to achieve and maintain qualitative superiority for the Air Force over any potential enemy. To ensure this, ARDC draws upon the total technological potential of the nation. The command maintains close working liaison with scientists, with industry, with educational organizations, and with Government agencies so as to gain the best results with a minimum of research and to keep within the limits of the development dollars available. Today some 80 per cent of the Air Force's research and development effort is being contracted among nearly 200 universities, colleges, and other nonprofit institutions, and 1500 industrial concerns. Close cooperation with these research and development agencies is especially important because the Air Force, being the youngest of the three services, operates no arsenals, gun factories, shipyards, and other facilities already in being and maintained by the Army and Navy.

While ARDC and its centers provide the direction and management of the various programs, most of the actual research and development is carried out by the contractors. But ARDC keeps its responsibility for the entire spectrum of weapon systems development, from basic research design to the testing of hardware.

Research and Testing

ARDC's Office of Scientific Research contracts with scientific institutions and universities for basic research projects that may or may not yield immediate military benefits but always add to our scientific knowledge. This applies to ARDC's European office in Brussels, Belgium, which awards contracts for basic research to selected individuals and institutions in West Europe and thus taps a huge reservoir of scientific talent and know-how.

In the testing of hardware ARDC provides its contractors with test facilities that are far beyond the economic capabilities of non-government organizations. At Patrick Air Force Base, Florida, for example, ARDC's Missile Test Center operates a completely instrumented test range stretching over 1000 miles—and, ultimately, 5000 miles—down the Atlantic Ocean to Ascension Island. The range also serves as a testing ground for the Army's missiles. At the Arnold Engineering Development Center in Tullahoma, Tennessee, huge wind tunnels permit testing of full-size jet and rocket engines at simulated altitudes up to 80,000 feet. At the Air Force Flight Test Center, in California's Mojave Desert, a vast dry lake provides miles of the hard landing surface needed for testing tomorrow's airplanes.

Especially noteworthy is the Ballistic Missile Division located in Inglewood, California. BMD manages the Air Force's top priority program—development of ballistic missiles. Assisted by highly qualified experts of the Ramo-Wooldridge Corporation, Ballistic Missile Division coordinates the efforts of some 70,000 personnel employed by hundreds of prime- and subcontractors for the development of the Atlas and Titan intercontinental ballistic missiles and the Thor intermediate range ballistic missile.

ARDC's weapon system concept has proved practical in funneling superior air weapons into the Air Force operational inventory in a minimum of time. In monitoring industry's effort the command has provided the largest return from America's inventory of talent, skills, and facilities. ARDC's new management principles, techniques, and methods are getting results. The progress made in air research and development during the past year gives us every reason to look forward into the future with confidence.

Headquarters Air Research and Development Command

Books and Ideas...

Thoughts on British Contributions to Air Power

DR. EUGENE M. EMME

All that is necessary for the triumph of evil is that good men do nothing.—EDMUND BURKE

WITHIN the not-yet-ivyed halls of Air University the ever-growing threat of Soviet atomic air power has animated serious thought and influenced the formulation of school curricula. In its officer education and doctrinal research programs Air University as a whole has not labored under the binding effects of stilted historical tradition or with a slavish worship of past experience. World War II was a TNT war. Today's air vehicles, some pilotless and others soon ballistic, make the B-29 Superfortress as obsolete as the Wright brothers' biplane would have been in the Battle of Britain.

Swift technical advances in the science of war since Hiroshima and Nagasaki have, in fact, enforced an intellectual behavior among thinking airmen and shattered the conceptual idols of time-tested doctrines, following much the same pattern as that established by Billy Mitchell and confirmed at Pearl Harbor regarding battleships. Unprecedented strategic circumstances thrust upon the United States by the evolution of global air vehicles, nuclear weapons, and the challenge of militant Communism have helped to make this behavior pattern almost inescapable.

To a large extent, one-time air theories have become living military realities. Some American air professionals often appear unfamiliar with the precepts of Douhet, Trenchard, and Mitchell as well as the classical doctrines of Clausewitz, Mahan, and Mackinder. But it is likewise true that American airmen have not been found wanting in the exercise of their responsibilities for national security since the Air Force achieved its independence in 1947. *Proficimus More Irretenti*—"We proceed unhampered by tradition"—remains the worthy motto of the U.S. Air Force educational and doctrinal center. No quarrel can be made here. But is something missing? Is a tradition of being untraditional, or of seeking escape from the facts of historical experience, beginning to fetter the minds of some airmen?

In attacking the unconventional problems posed by atomic air power, have American airmen in their intellectual moments maintained warped assumptions underwriting their doctrines and concepts? Can the preconception of discounting history, even the history of air forces, be misleading if not dangerous in the study of military affairs? Is it as misleading as fallaciously attempting to solve today's problems with yesterday's solution? Are all crucial military problems today actually new in their basic features?

What about the role of air forces in "limited wars"? What about the role of military power today as a "deterrent" to enemy initiative in both limited and general wars tomorrow? What about tactical air forces? What about leadership and the exercise of command, sometimes called "management"?

Why is it that a coherent philosophy of air power has not yet been formulated? Were there no mistakes in the past with regard to the creation, employment, and command of air forces that should be avoided in the context of today's vehicles and firepower? Has the new weaponry of warfare changed human nature or the basic behavior patterns of military institutions in any significant manner? And, if history does not teach something, why do general officers with several decades of experience command air forces today? Keeping the dust of the phalanx out of our eyes, can all the answers to strategic military problems be found above 50,000 feet?

American students of military affairs can learn much from a detailed study of the evolution, the failures, and the accomplishments of air forces in war and peace. An appreciation of the inevitability of change is one of the intellectual touchstones serving future realities thereby obtained. And it is not always most illustrative to study merely the fortunes of the U.S. air services during the past decades.* One of the major chapters in the book of history dealing with the role of air power in national security in yesteryear is the rise and prominence of the Royal Air Force in British strategy. American readers now have available perhaps the best memoir by any airman, one that spans with great detail the almost half-century of the existence of the air weapon system.[1]

To trace British pioneering in air power cannot be done in any substance here. But England was no longer an island because of the airplane—this as early as 1909. The actual bombing of London by German Zeppelins and Gothas in World War I merely prefaced the role of air power in British survival and prosperity. In 1917 Field Marshal Smuts wrote the Magna Charta of the Royal Air Force. Sir Hugh M. Trenchard fathered an embryonic strategic bombing force and sparked the original thoughts of Billy Mitchell, as Mitchell himself admitted. The sovereign Royal Air Force came into being and was adapted to policing underdeveloped areas of the Empire and mandates of the League of Nations. After the aerial blackmail enforced by Hitler's Luftwaffe at Munich in 1938, the outbreak of World War II was merely delayed. Came the Battle of Britain in 1940. The survival of England itself rested upon the outcome of the contest for daylight aerial superiority.

Lord Tedder, General Eisenhower's professor of air power in North Africa and Normandy, stated after the war: "I am utterly convinced that the outstanding and vital lesson of the last war is that air power is the dominant

*[Dr. Emme has examined this thesis before, Cf. "Lessons from the Luftwaffe," *Air University Quarterly Review*, VII, 3 (Winter 1954-55), 89-95.—*Ed.*]

[1]**The Central Blue: The Autobiography of Sir John Slessor, Marshal of the Royal Air Force, (New York: Frederick A. Praeger, 1957, $7.50), 709 pp. An exact reproduction of the English edition, the American printing contains a short American preface by the author and a foreword by General Carl A. Spaatz.**

factor in this modern world and that, though the methods of exercising it will change, it will remain the dominant factor as long as power determines the fate of nations."[2] And now Sir John Slessor's autobiography has appeared. *The Central Blue* well records one man's view of the dramatic ascendancy of the Royal Air Force in British strategy and documents the basic assumptions of a gifted British strategist's view of contemporary affairs.

To treat in any detail the distinguished career of Sir John Slessor cannot discount the enormous contributions of his predecessors, contemporaries, and successors such as Trenchard, Portal, Dowding, Leigh-Mallory, Coningham, Tedder, Harris, and Saundby. These and others have their important place in the book of history as air strategists, tacticians, planners, and teachers. Slessor, as his lengthy autobiography reveals, was not typical—for no British airman can be said to be a classic type. If Slessor has a particular claim to special fame it is because he not only held positions of high responsibility at crucial moments but that he also has demonstrated greatest willingness and skill in committing his views, historical and otherwise, to print.[3] His stimulating influence on ideas and concepts will thus long endure.

With polio-weakened legs and a driving energy Slessor in 1915 joined the Royal Flying Corps at the age of 17. Thirty-five years later he became Chief of Air Staff, serving through the difficult days of the Korean War and the authoring of the "New Look." His early career, treated in interesting detail, records his youthful impressions during the birthpangs of the Royal Air Force. Anecdotes about "Boom" Trenchard and junior officership in the first autonomous Air Force are most colorfully told. His experiences with the employment of "Air Control" in the Middle East and Southern Asia are recounted in an analytical manner. But it is Slessor's pre-World War II service as director of plans for the Air Ministry during the Nazi-inspired "cold war" of the late 1930's that makes highly instructive reading today.

As chief RAF planner, Sir John has much to say about the trials and tribulations of a military planner in a democratic nation seeking to avoid at almost any cost a war involving air power. Disarmament versus rearmament, varying rates of force expansion to meet the devastating threat of the Luftwaffe in the coming war—indeed, all of the on-again/off-again force levels, budget debates, and even target selection planning—are discussed in hitherto unavailable detail. Here Slessor provides invaluable documentation to the dismal story recounted about *The Gathering Storm* by Sir Winston Churchill. Particularly his reconstruction of the psychological climate of Munich-time and of the "evil dream-world" that carried on through the "Phoney-War" period reveals the frustration of air planners bound by innumerable political and strategic restraints. These were the novel and unprecedented days of deterrence and the probability of limited and general wars in the age of short-range aircraft and TNT firepower.

[2] *Air Power in War* (London: 1948). Tedder's published lectures remain one of the best summaries of the air lessons of World War II.

[3] Besides innumerable articles and lectures prepared since retirement, Slessor has written two other books: *Air Power and Armies* (1936), based upon Staff College lectures, and *Strategy for the West* (1954). This latter volume contains his views on the "New Look," "future Koreas," and deterrence. *The Central Blue* ends with peace in 1945 and is really a basic philosophy underwriting his thoughts on more recent events.

Out of the surrender to the Luftwaffe at Munich came the desperate Anglo-French combined planning for the eventuality of total war. During the "foul year" of 1939 Slessor recalls one Sunday afternoon in June when a small group of government leaders were "discussing what to do about a secret report just received, to the effect that the Germans were going to bomb London without warning that next Tuesday—or was it Thursday?" When the London air-raid sirens sounded for the first time in September, Slessor recalls: "It was an odd sensation, standing there wondering whether this was in fact the 'knock-out blow' to which we had given so much thought." It was a false alarm. With the quick collapse of Poland in the blitzkrieg form of "limited war," the "Phoney War" really began. Bomber Command dropped pamphlets, not bombs, on Germany. Detailed planning for supporting Finland against Russia and the interdiction of Swedish iron ore was undertaken.

Then the war finally began. It began for the RAF in France and the Lowlands in May 1940. The course of unhappy events went all too fast. The salvage at Dunkirk and then the Battle of Britain began the test of Fighter Command. With the bombing of Rotterdam by the Luftwaffe, Bomber Command, such as it was, could at last be unleashed on German inland targets. Now the employment of forces and battle attrition, not political restraints, governed the course of military events. At long last the basic assumption of prewar RAF planning—the eventuality of total war—had come to life. Although it was almost too late, German ineptness and the limited range and penetrating capability of the Luftwaffe helped to bring British airmen "their finest hour."

Not the least useful of Slessor's memoirs is his account of the desperate battle against the German U-boat in the Atlantic and the relative effectiveness of air forces and naval forces. As Commander of Coastal Command and of the RAF in the Mediterranean, Slessor demolishes the war-drawn doctrines of U.S. Navy historians about U-boat kills by land-based aircraft in European waters. The Germans were not Japanese. Even Sir Winston Churchill is a target for the observation that he suffered "from his occasional genius for self-deception and his Olympian detachment from the detailed workings of the machine for the higher direction of war."

Throughout *The Central Blue,* Sir John neither hesitates to disagree with the merit of command decisions nor to draw clearly a lesson for understanding of the elements of air strategy today. He often admits he was wrong—a rare autobiographical trait. American readers will particularly enjoy Slessor's treatment of his visit to Washington in the fall of 1940, when he sought to acquire for the Royal Air Force a goodly portion of President Roosevelt's 50,000-airplane program. This proposal could have greatly hampered the rapid expansion of the Army Air Force. Slessor was not entirely successful. The Combined Bomber Offensive after Casablanca, the bombing of Cassino, and the conclusion of hostilities in the Mediterranean (i.e., in Greece and Yugoslavia) are also of special interest. Innumerable anecdotes, critical analyses of mistakes and successes, and a British outlook on the entire air war make for animated language on every page.

British airmen are avid believers in the virtues of reflection on historical experience. This provides coherence for and realism to their thoughts on future strategy and military leadership. The recent British White Paper, entitled *Defence: Outline of Future Policy* (Cmd. 124, April 4, 1957), clearly reflects an appraisal of Britain's security problem based on historical perspective.[4] It is not difficult for Englishmen to visualize nuclear warheads in V-2 type missiles. Unlike the moment of Munich, British policy today is dedicated to collective security, the strategic virtues of the Strategic Air Command, and a realistic willingness to provide forces within England's power to create, maintain, and pay. No fallacies are apparent with regard to deterrence of all-out war and the limitations of air defense and sea control in an air-atomic conflict. On the nature of war, after his autobiography was written, Sir John commented:

> However mechanized all instruments of war may become, the ultimate decisive factor will still be the man who uses them. Remember, a characteristic of all war is muddle and uncertainty, the influence of the unexpected, chaos in greater or lesser degree—in another world war probably to the ultimate degree. And the side which in these conditions maintains its cohesion and direction (or, at best, loses it least)—the man who retains his balanced judgment in the face of fear and perhaps of almost unbelievable calamity, comes out on top.[5]

Though *The Central Blue* provides few clear-cut answers to specific problems of today, the perspective provided by reliving British experiences with Sir John Slessor appears highly recommended for serious-minded American students of military affairs. Sir John stated in his introduction of *The Central Blue* that his "first object in writing this book is to tell something of what the Air Force has meant to Great Britain, which may lead to better understanding of what it will mean in the future." This objective he clearly obtains. Can forethought about the future be gainfully served by a thoughtful study of the history of air power? If a future commander or high staff officer attempts a negative response to this question, he had best read *The Central Blue* first.

Air War College

[4]Cf. "On the Nature of War," The *Times* (London), 5 April 1957, p. 5.
[5]Sir John Slessor, "Half a Century of Air Power," *The Air Power Historian*, January 1957, pp. 15–24.

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ATTENTION

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