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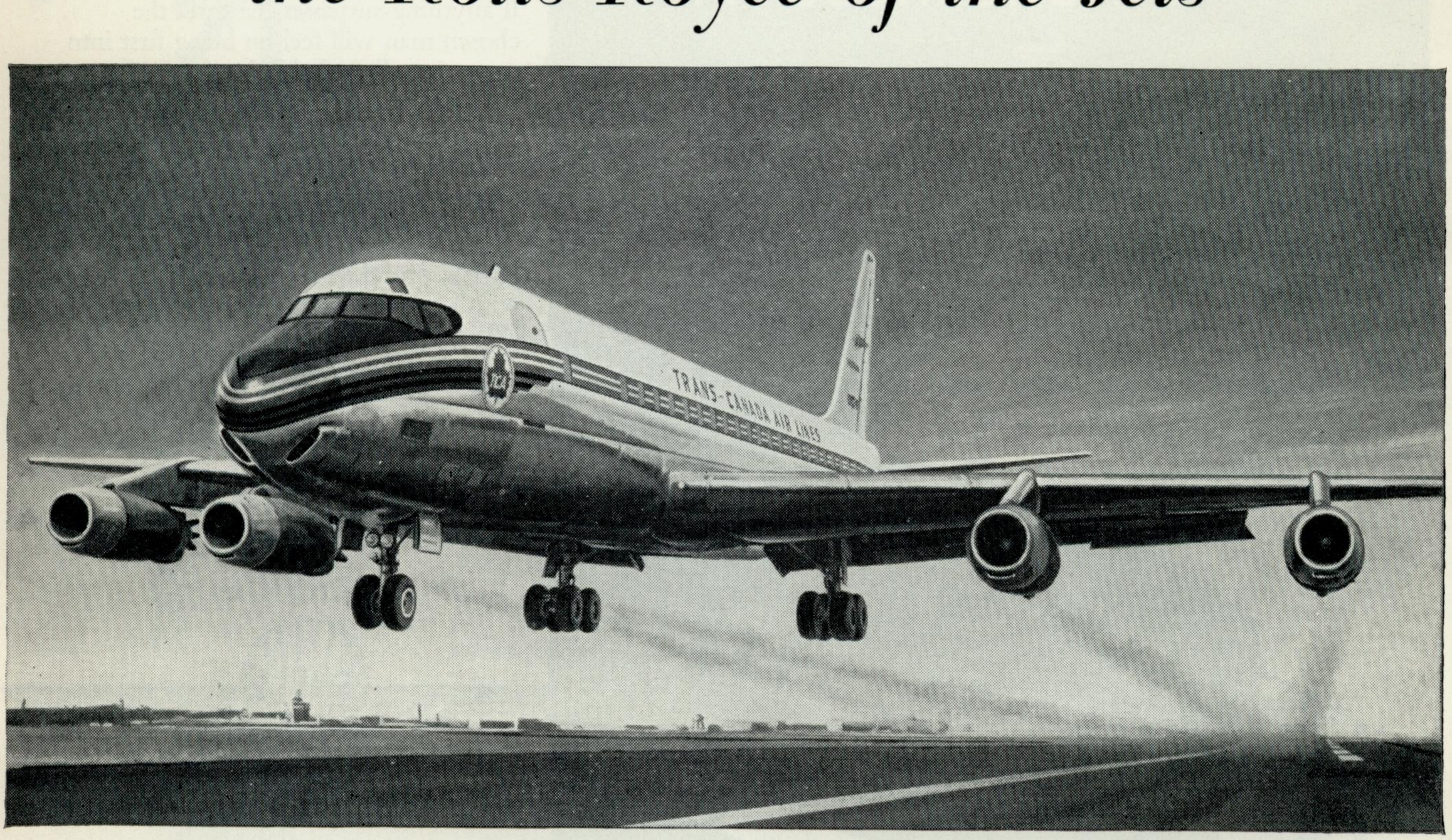

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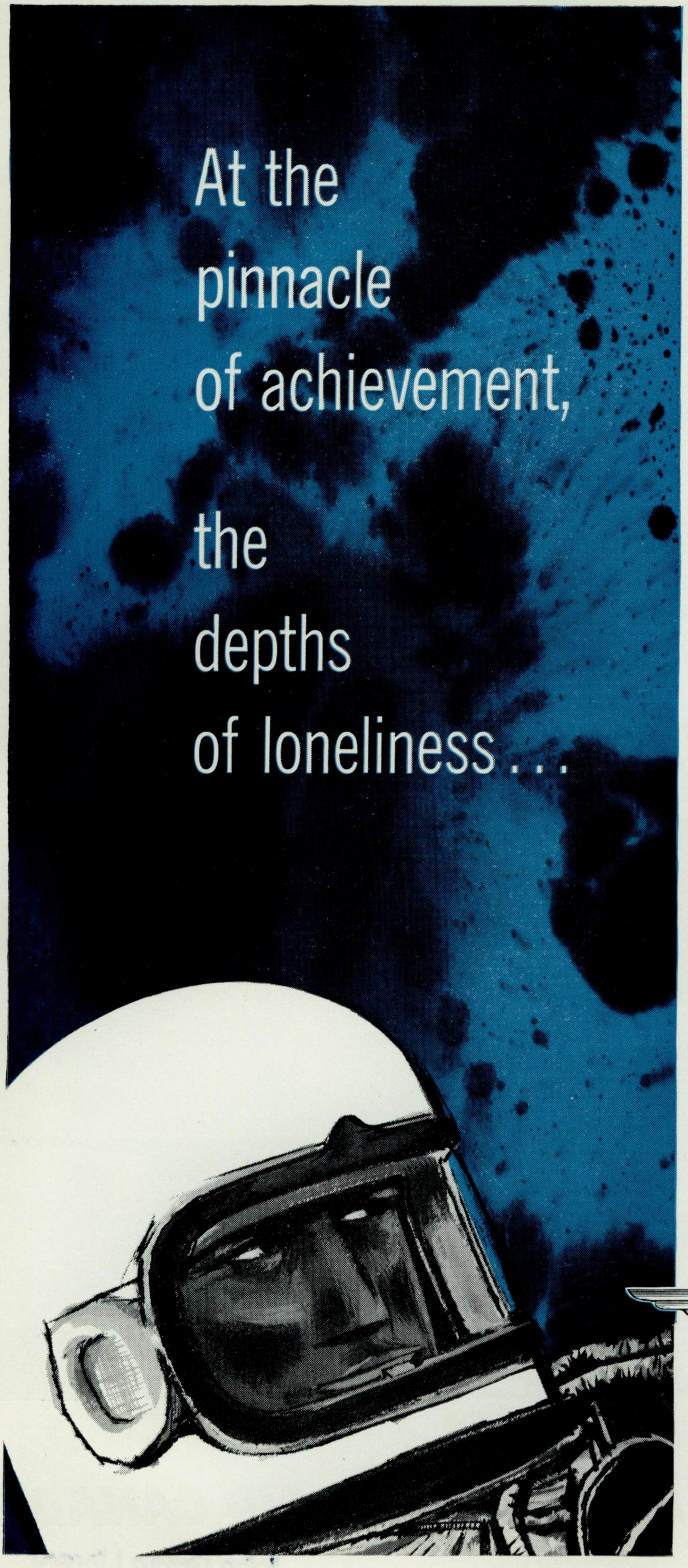

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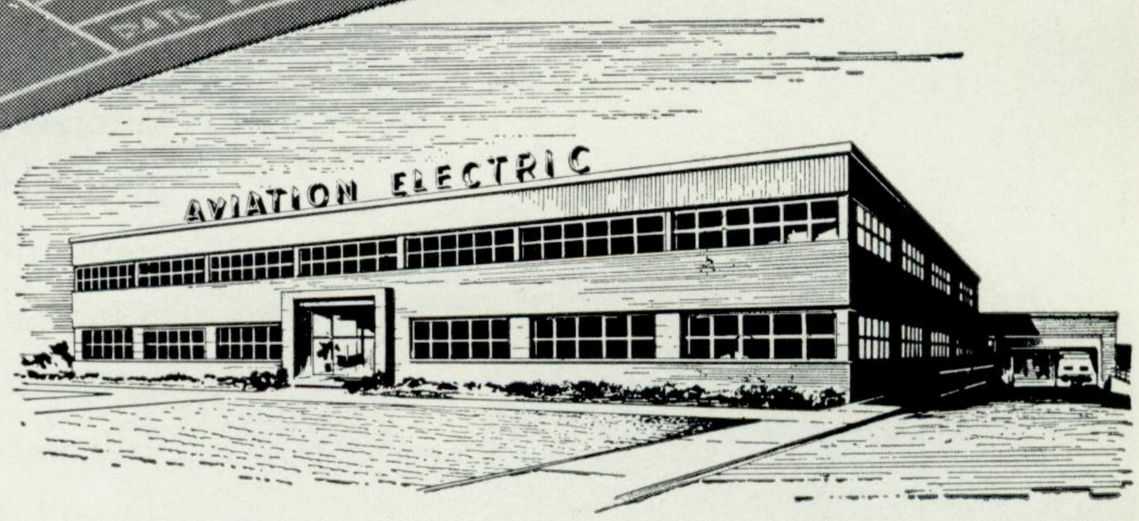

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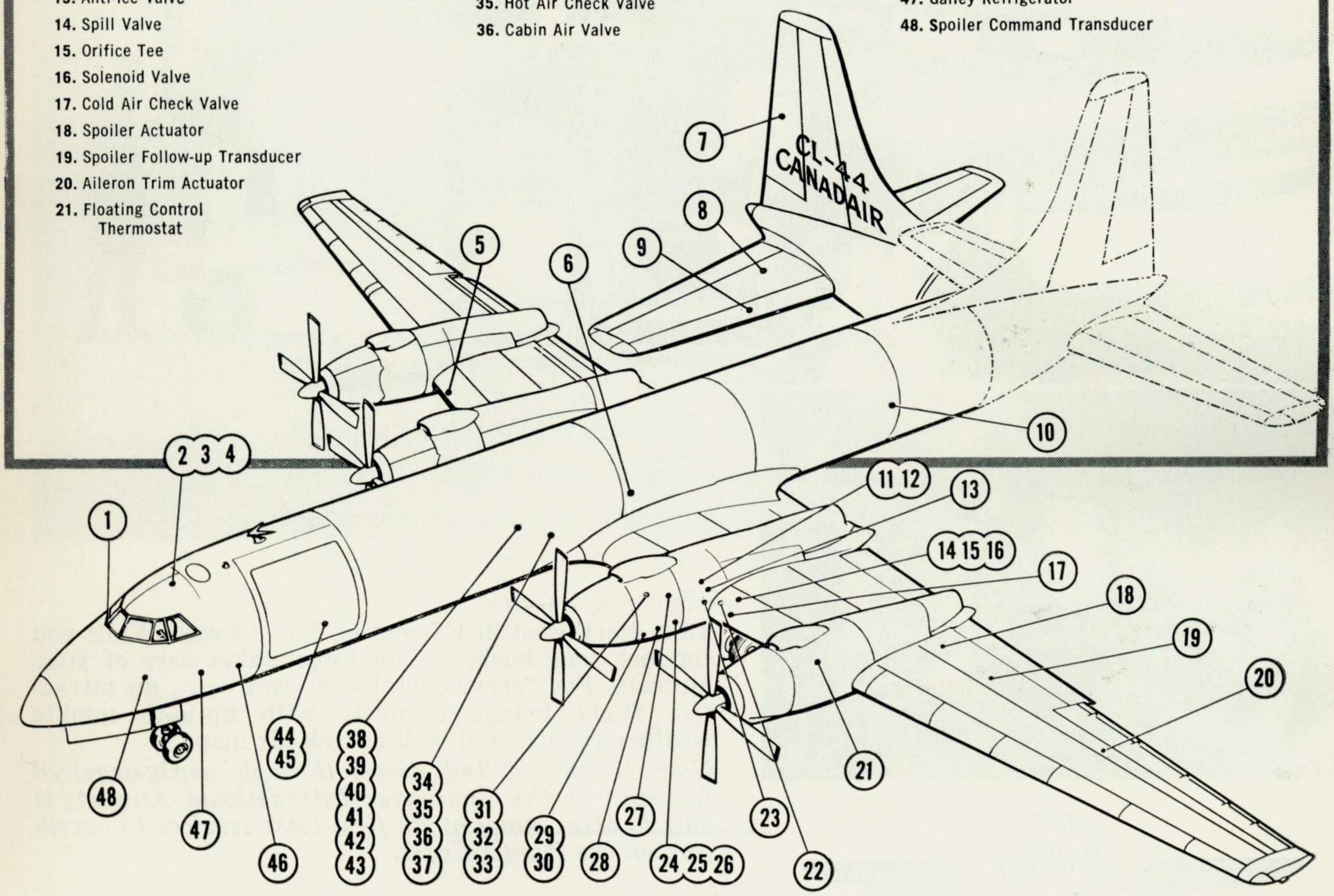

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Foreword

ON the eve of its Fifth Anniversary the R.C.A.F. Staff College Journal, and the R.C.A.F., suffered a major loss in the untimely death of Air Vice-Marshal Keith L. B. Hodson, O.B.E., D.F.C., C.D., the founder of the Staff College Journal.

The production of the first Journal was a bold venture. It was the expression of a desire to produce something more than the usual College year book or a collection of historical essays. The aim of the Journal was "to encourage professional writing on military matters, particularly those of an air nature, and in so doing to generate ideas and allow those ideas to be assessed through the medium of objective discussion". True, this would involve an examination of significant events in military history, but what was more important, it would mean the publication of original ideas on contemporary and future military affairs which might not necessarily be in concert with national defence policy.

To explain the original purpose of this venture, the late Air Vice-Marshal Hodson introduced the first edition with an editorial designed to justify the need for a Canadian journal of this kind. It seems to us that much of what its founder had to say on this subject then—five years ago—still makes sense today. With this thought in mind it seems fitting to reprint in full the text of the first editorial as a tribute to the one whose inspiration, far-sightedness and perseverence were largely responsible for the Staff College Journal.

"A well-recognized phenomenon of this post-war decade has been the continuation of the high rate of development of armaments usually found only during a period of actual war. Spectacular advances in nuclear weapons, man's conquest of the air, and rapid progress in electronics—have combined to make possible weapon systems which are capable for the first time of literally destroying civilization. One consequence has been the upsetting of hitherto accepted conceptions of the place of war in international relations. As a result, any logical development of defence measures, today, must be preceded by a definition of the role of the military Services. In the light of the new forces at play, this role is not easily apparent, nor necessarily constant.

Nor has the task of those responsible for defence measures been made easier by the astronomical cost of modern weapons; by the insatiable demands of research and development with the accompanying penalties that may follow any serious misdirection of effort; by the conflicting requirements of nuclear and conventional forces, and by the need to husband resources for the economic conflict which is now getting underway. That the price of failure to take appropriate measures could mean removal from the face of the earth only increases the strain under which these problems must be considered.

If the sophistication of current weapon systems relies more on the electrical impulse than on human endeavour, it also emphasizes the need for human thought. For the more complicated and expensive become the weapons of war, the more important it is that we choose the right ones. But we can only develop the right ones if we know what we are trying to do. Therein, of course, lies the difficulty since the magnitude of the forces involved, the importance of the stakes and the sensitiveness of the time factor have given rise to a situation that is novel in both its urgency and its complexity. Only a clear understanding of this situation will provide the direction needed to resolve our problems. Such an understanding, on a continuing basis, will only come from the concerted and constant study of the statesman, the scientist, the business man, the military man and the philosopher. The more ideas that can be brought to bear, the more likely is such an understanding to be generated.

Military history is full of ideas which were sponsored, adopted or rejected with varying consequences. The development of the employment of air forces is a timely example of an idea that prospered. We have reason to be grateful for those clear-thinking officers of the Royal Air Force who in the 1930's conceived that, for that period, an air force to be effectively employed must be a cohesive, independent force capable of fighting and winning the battle in the air. The subsequent organization, equipment and training of the R.A.F. based on this novel and hotly-contested idea led in 1940 to Germany's first setback with the results that we now know.

The role of the specialist, since he is very often the idea man, is an interesting aspect of this dis-

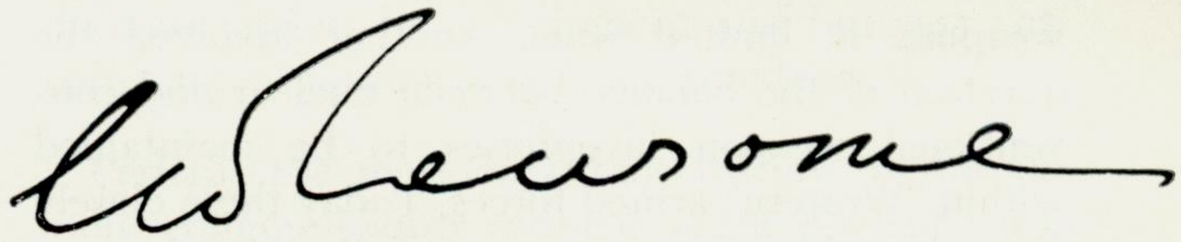
cussion of the importance of ideas. If the specialist has ability, he very soon decides that either his specialty has no future—and he changes his job—or that his specialty has real merit, in which case by reason of enthusiasm, of a desire to do a good job and to bring credit to his branch, he pushes his product for all he is worth. He is encouraged by the number of times in the past that success in war has been attributable to the faith of an individual in a new idea and to determination exhibited in translating the idea into a surprise weapon or an unexpected plan of action. Present spectacular technical advances give the specialist lots of scope for his talents.

On the other hand, there are many instances of much-needed industrial capacity being wasted because a specialist won support for a weapon or for a line of action which later failed to live up to expectations. This is understandable since it is unusual for the specialist to have a broad understanding of the problem as a whole; to keep a well-developed sense of proportion; to be concerned with the repercussions on other systems of an increased emphasis on his own. Indeed, too much concern for the broader picture would dull the point of his own attack. This is not to say that the specialist is suspect. On the contrary, he is a key man who must be encouraged not only for his technical knowledge but for the stimulation he provides. It is to say, however, that the specialist is seldom capable of assessing his own contribution in terms of the problem as a whole.

What is needed, then, is a forum, or many forums, where competing specialist claims can be resolved; where new ideas can receive attention so as not to be lost from view, and where all ideas can be measured against the yardstick of what we are trying to do.

In a limited sense, the R.C.A.F. Staff College provides one such forum. Here, staff officers are constantly being reminded that good staff work consists of drawing rational conclusions from an objective study of the facts. The facts are presented by lecturers representing all branches of the Services and appropriate governmental and scientific departments. The student body, itself, constitutes a cross-section of the Service so that syndicate studies produce a many-sided, and hence reasonably objective approach to problems. The forum is limited, of course, because participation is predominantly Service in character and the student body is of but medium-senior rank. Nevertheless, considerable value is derived.

It is hoped that this Journal will provide another and a broader forum, since participation is less restricted. The aim is to encourage professional writing on military matters, particularly those of an air nature, and in so doing to generate ideas and to allow these ideas to be assessed through the medium of objective discussion. In this manner a useful contribution can be made towards an understanding of the complex and dangerous forces which threaten national security and of the defence measures best calculated to support the attainment of an honourable, prosperous and secure existence."



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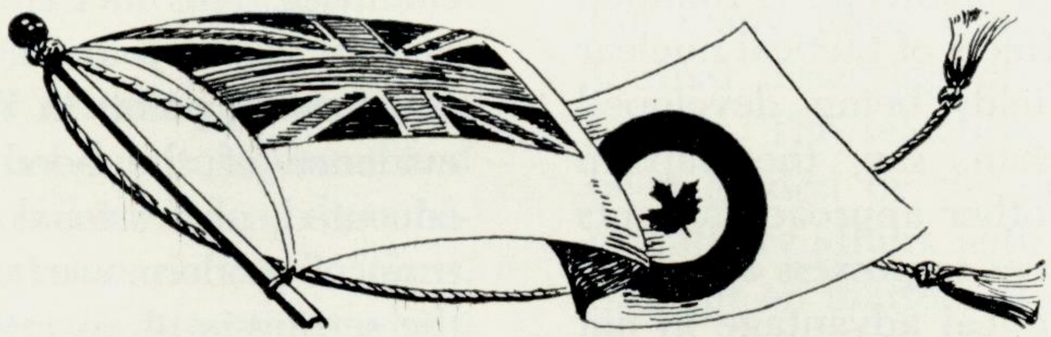

Editorial

THERE is one obvious feature of this Fifth Anniversary edition of the R.C.A.F. Staff College Journal. Its pages reveal quite clearly that many of the problems discussed in the late Air Vice-Marshal Hodson's original editorial demonstrating the need for this intellectual forum, are seemingly no closer to resolution than they were five years ago. There is, of course, the possibility that the efficacy of any solution is indeterminable in time of peace or cold war, or is implicit in the successful deterrence of total and major limited war to this date. Thus, it may be unwise to expect absolute resolution of such problems. What is clearly evident, therefore, is the continuing need for unhurried, intelligent examination of the changing facets within each problem area and their influence on current military doctrine.

One such problem concerned the controversy about the employment of conventional and nuclear weapons in limited wars. Another involved the question of the balance between nuclear and conventional weapon inventories to be maintained within "Western" armed forces. Today these closely related problems remain two of the West's most challenging to resolve.

The nature of the current conflict in conceptual thinking is illustrated by the variation in approach evident in several of this year's articles. One concept of particular interest challenges the moral considerations which some people believe will preclude the employment of nuclear weapons, particularly in limited war. This challenge is founded on the contention that the effects of tactical nuclear weapons of the limited yields being developed today are less inhuman than, say, the napalm bomb or flame thrower. Another approach accepts the need for limited war forces to possess a nuclear capability but foresees a tactical advantage in not employing nuclear weapons at the outset of any limited action. This acknowledges the traditional situation for United States, United Kingdom, and Commonwealth forces, wherein military operations are inevitably dependent upon long lines of communication and confined beach-heads; it recognizes the desirability of not forcing a nuclear counter-strike during the vital and very vulnerable phase of establishing a secure base ashore. And then there is the "proportional deterrent" concept justifying for the French their development of a nuclear retaliatory capability.

Another approach criticizes a blind faith in the absoluteness of the nuclear weapon and sees the continuation of such reliance, in the face of positive evidence of Soviet nuclear deterrent capability, as a "military absurdity". Concern is expressed over an alleged mental inflexibility which bodes ill for the Western community and the author turns to history to validate his opinion. The circumstances which led to the Fall of France in 1940 are cited as pertinent to his argument, and he emphasizes in particular the superiority of Allied strength and equipment and the contrasting marked inferiority of employment techniques. The latter is credited in the main to a remarkable inflexibility of mind and adherence to out-dated doctrine. This was despite the pre-war teachings of significant military thinkers like Captain B. H. Liddell Hart, who, among other things, was ultimately to be acclaimed as the father of tank warfare in the eyes of such renowned "Blitzkrieg" commanders as Guderian and Rommel. Perhaps the most pregnant point is the reminder that for more than fifteen years prior to the outbreak of World War II, Liddell Hart's theories on mechanized warfare went relatively unheeded within his own and Allied countries. This fact is borne out by his own article in this year's Journal, which reviews key factors and turning points in World War II. Here is ample evidence of the need for continued enquiry by educated, professional minds, into the entire spectrum of modern warfare, as a safety valve against the setting-in of an intellectual inertia of the order experienced before World War II. A case in point may well be the reluctance of some of the significant Western military powers to devote more substantial resources toward the development of new non-nuclear weapon systems.

It is interesting to note that the consensus of contributors' opinion concerning the balance of nuclear and conventional forces supports the school of thought which cautions against premature nuclear disarmament agreements when significant Western forces are so predominantly nuclear armed. This concern is based on the grounds that agreements reached under such circumstances could throw the balance of military power perilously in favour of the opponents of Western philosophy.

The possibility of some form of nuclear disarmament, no matter how unwise or remote it may appear, is with us now and for some time to come. To what extent this will directly affect military operational capabilities is certainly not clear. But there is little doubt that it must be already perplexing those responsible for such programmes as the development of the IRBM-equipped nuclear submarine. The operational effectiveness of such a weapon system, if restricted to non-nuclear warheads, is certainly open to question. This comes at a time when its potential as an invulnerable element of strategic deterrence is gaining for it considerable favour amongst military strategists; this is the theme of another of our contributors. The development of this theme has apparently been greatly influenced by the lack of a significant breakthrough in the anti-submarine detection problem which has now been compounded by a need to determine, not only the location of a high speed, underseas craft, but also its intention to launch a missile underwater. Also having an obvious effect is the recently established technical feasibility of space satellites as primary instruments for obtaining early warning and strategic intelligence throughout the world.

But another contributor reminds us of the large fleets of "conventional" submarines in existence and the threat they represent to vital sea communications throughout the world; and he implies that their use in limited war is not improbable. He proposes the development of the hydrofoil craft for anti-submarine operations as a major step towards negating the still very restricted underwater detection capability of present-day equipment and techniques. In the face of possible nuclear disarmament and its military and economic implications, the hydrofoil proposal has certain attractions which could lead to some interesting speculation about future equipment requirements for anti-submarine operations. However, not even the hydrofoil seems to hold a potential for countering the underwater launched missile. Possibly of more immediate significance, therefore, is the suggestion that the emergence of the submarine as a relatively invulnerable element of strategic deterrence may not have to complicate further the already complex anti-submarine task. For this development, surely, gives rise to the question "is defence against the nuclear powered, IRBM equipped submarine, possessing an underwater launch capability, properly within the province of the maritime commander, or is it now the problem of the nuclear deterrent force commander?"

The military, political, and economic implications of such modern weapons systems are unprecedented in history as emphasized by another of this year's contributors. Similarly unprecedented is the rate of significant scientific and technological advances of the post World War II period. One result of these developments has been the expanding demand for specialized technical and scientific knowledge of these complex systems together with a complementary understanding of the broad facets of military strategy and operations. This is complicating the decision-making process. An interesting aspect of the latter is the growing evidence that scientific and technical specialists are experiencing progressively greater difficulty in exchanging ideas and opinions among themselves and with "the well-rounded military professional". Significantly, this development is not peculiar to just defence circles, for government and business concerns are experiencing similar problems.

Perhaps the most important feature of this obvious communication problem is the evident variation in professional opinion about the precise nature of the problem, and its solution. One such opinion has been included this year, not because it is a favoured point of view, but because it is a learned vehicle with which to focus attention on this vital problem. The approach is both educational and challenging.

This editorial has drawn attention to a few of the many ideas contained in this edition of the Journal deserving of intelligent enquiry and discussion. The selection of material has, once again, been guided by the desire to provide the student of military affairs with a wide range of professional thought on matters of contemporary military significance. It is to be hoped, however, that these efforts will also contribute to the development of a more adequate national understanding of the military problem and its impact on national affairs.

V.C.H.S.

"Deterrence" and Surprise Attack in Soviet Strategic Thought

A. L. HORELICK

A specialist on Soviet political and military affairs, Arnold L. Horelick was educated at Rutgers and Harvard Universities. He worked for several years as an analyst of Soviet affairs for the U.S. Government before joining the Social Science Division of the RAND Corporation in September 1958.

THE ADVENT of modern strategic weapons systems, with their highly concentrated destructive power and drastically compressed delivery time, has made the stability of deterrence, as between the two superpowers, critically dependent upon the maintenance of a mutually shared conviction that surprise attack is an infeasible or prohibitively risky strategy for either one to employ against the other. Despite serious differences of opinion on the difficulties involved in maintaining an assurred second-strike capability, the specific measures required, and the costs associated with them, responsible Western political and military leaders seem now to have reached broad agreement on the proposition that ensuring the survival of nuclear retaliatory forces against surprise attack is the central problem of deterrence in the nuclear-missile age. Imperfectly as the implications of this proposition may yet be understood, the measure of agreement already reached constitutes an intellectual leap forward from the not too distant days when deterrent power was comfortably measured according to the formula: one bomb in the pre-war stockpile equals one retaliatory bomb launched and delivered on target.

As our concept of deterrence becomes more sophisticated and the problems associated with it more complex, we are led to ponder how our opponents may view the questions which agitate us and how closely their beliefs may correspond to the assumptions that are made about them in the framing of Western deterrence strategy. The assumptions we make about the beliefs of the Soviet leaders are, by their very nature, not susceptible to conclusive proof, but they should be based on something more substantial than the mere projection of our own convictions. If they are to be reasonable assumptions, they must take into account whatever relevant *evidence* we can bring to bear.

This paper seeks to contribute to this task by illuminating some aspects of the Soviet leaders' beliefs about deterrence and the related question of strategic surprise insofar as these beliefs are revealed in their public statements. These source materials have obvious limitations, but they can yield important insights, provided that due care is shown in their interpretation. In examining the statements of Soviet leaders, it is necessary to analyze their rhetorical objectives, to keep in mind that their statements are designed as much to influence their external opponents and to disarm the criticisms of their internal rivals, as to disclose their beliefs. If we can ascertain these objectives, we can relate them to the underlying beliefs and values which they are calculated to serve.

I

It has become fashionable in recent years not only to attribute to the Russians theories of deterrence that are distinctively Western in origin, but even to impute to them the Western jargon of deterrence. Thus, for example, one American authority on Soviet military affairs writes of ICBM's as compromising part of the "Soviet strategic deterrence forces".[1] However, the jargon and the theories are ours, not theirs. There is no Soviet counterpart to the highly articulated, self-conscious Western doctrines of deterrence.

More than six years ago, a Soviet leader set forth what might have become the foundation for a Soviet theory of deterrence. On March 12, 1954, several months after President Eisenhower, in his "Atoms for Peace" speech before the U.N., foresaw the "probability of civilization destroyed" as the consequence of nuclear war, Soviet Premier Georgii Malenkov told the Soviet people that a new world war fought with present means of warfare "means the destruction of world civilization."[2] Malenkov thus became the first Soviet spokesman to deviate from the Stalinist prediction that a new world war

would lead only to the collapse of capitalism. It is important to note, however, that the first Soviet enunciation of the destruction of world civilization thesis was also the *last;* its lone exponent was soon compelled to recant his heresy and was later removed as head of the Soviet Government.

Malenkov's unprecedented statement was welcomed in some Western circles as an indication that the U.S.S.R. might at last be prepared to accept the political consequences of peace enforced by mutual deterrence. In the West, belief in mutual deterrence, or what has been called the balance of terror, is widely based on the expectation that thermonuclear war must result in mutual destruction on a mutually unacceptable scale. Expressions like "mutual annihilation" or " destruction of world civilization" are commonly employed to convey the expected outcome of such a war. These expressions are not necessarily meant to be taken literally, but they are understood to signify that distinctions between possible outcomes are meaningless, since no outcome could conceivably be bearable or acceptable to either side, under any circumstances. It therefore appeared as if Malenkov were ruling out a military resolution of the East-West conflict as no longer feasible for either side.

In the Soviet Union, the implications of Malenkov's statement became the subjects of a stormy intra-Party dispute. Malenkov had apparently come to the conclusion that the USSR's acquisition of nuclear weapons, and particularly its successful testing of a hydrogen device in August 1953, deterred the West from employing its nuclear weapons against the USSR and therefore reduced the likelihood of a new world war. This view was supported by several other Soviet leaders, who did not, however, go so far as to predict the destruction of world civilization as the consequence of a new war. Speaking in Yerevan the day before Malenkov spoke in Moscow, Mikoyan was quite explicit in noting the deterrent effect of Soviet nuclear weapons:

> "The danger of war has receded to a large extent in connection with the fact that we now have not only the atomic but also the hydrogen bomb."[3]

It was apparently on the basis of this estimate that Malenkov proposed a levelling-off of military expenditures and a diversion of Soviet resources into stepped-up production of consumer goods. Malenkov may well have been the first Soviet advocate of "minimum deterrence". But these proposals, and the estimate on which they were based, met with stiff opposition from other members of the Party Presidium. Malenkov's opponents warned against complacency and relaxation of the military effort, and emphasized that so long as capitalism existed the possibility of an attack on the Soviet Union was ever present. They refused to believe, or at least concede, that the West would, in Bulganin's words, be satisfied merely to "frighten" the Soviet Union, and they warned that under conditions of rapidly advancing technology it would be fatal to let the Soviet military effort lag.[4]

A hapless theorist who dared suggest that it had now become possible to "paralyze" the operation of Lenin's law on the inevitability of war under imperialism was sharply reminded that laws of history can neither be destroyed nor paralyzed.[5] Emphasis on the mutually destructive consequences of nuclear war, Malenkov's opponents argued, played into the hands of the imperialists; it created the false impression that "the atomic threat is such that the instigators of war will not dare to use their own bombs, since they will not decide to commit suicide". Such a concept, they said, blunts the vigilance of the people toward those "who in the preparation of nuclear war would like to take the peoples by surprise".[6]

Malenkov's opponents may have feared that his stated belief in the capacity of nuclear war to destroy world civilization might lead the Soviet Premier to adopt a more cautious and concilliatory foreign policy in which opportunities for Soviet political gains would be severely limited. Indeed, Malenkov voiced his view on the consequences of nuclear war in expressing the determination of the Soviet Government to end the cold war. Peaceful coexistence, Malenkov argued, employing another formulation unique to him at the time, was now both "necessary and possible".[7] Presumably it was possible because Soviet acquisition of the hydrogen bomb strengthened what had previously been a weak Soviet bargaining position; and it was necessary because recourse to war could result only in mutual annihilation.

It was the implications of Malenkov's emphasis on the "necessity" of peaceful coexistence that rankled his opponents. As Voroshilov stated shortly after Malenkov was deposed: "We cannot be *intimidated by fables* that in the event of a new world war civilization will perish."[8] A journal of the CPSU Central Committee later spelled out the Party's objection to the balance of terror thesis: It attacked "revisionist" propagation of this thesis as an "effort to *intimidate the working class with atomic weapons, to compel the proletariat to give up the struggle for power and for socialism*". It

branded those within the socialist camp who predicted mutual annihilation "frightened Phillistines, fawning before their [imperialist] masters"; they were "trying to *sow terror* in the world and to push the toilers on to *the path of capitulation to imperialism*, allegedly in the interests of 'self- preservation' of socialism . . . from the atomic bomb".[9] The Communist objection to basing policy on the acceptance of a state of mutual deterrence has perhaps never been stated more clearly.

The post-Stalin revision of Soviet military doctrine, centering on the role of strategic surprise in nuclear war, reached its culminating point precisely at the time of Malenkov's defeat. There was good reason for this. For while Malenkov emphasized the deterrent effect of thermonuclear weapons, others in the Soviet Union perceived that their effect might be ambivalent. As one Soviet writer put it, nuclear weapons had the double-edged effect of sobering the capitalists and simultaneously arousing in them hopes of a new blitzkrieg.[10] In mid-1954, Soviet political and military leaders for the first time began referring publicly to the increased danger of surprise nuclear attack.[11]

The counter-argument to Malenkov's position seemed to be that the availability of nuclear weapons made surprise attack a particularly tempting strategy for the imperialists, who were predisposed to adopt such a strategy by virtue of their perfidious nature. To meet such an eventuality, it was not enough to rely on the deterrent effect of the Soviet Union's possession of nuclear weapons; the USSR had to strengthen and improve its forces to make them capable of dealing with a nuclear surprise attack. Hence, the revised doctrine discarded the old Stalinist thesis, to which the USSR had clung dogmatically since World War II, that strategic surprise was an unreliable "temporary" factor which could not, under any circumstance, play a decisive role in war. The new doctrine held that post-war advances in military technology, notably the advent of nuclear weapons and jet aviation, had greatly enhanced the role of surprise in war and rendered surprise attack "particularly dangerous".[12]

However, the extent to which surprise attack might prove decisive was established only within very broad limits. Regardless of the convictions of the Soviet leaders at the time, it was necessary to avoid creating the impression, at home or abroad, that the USSR believed a surprise attack by the West could succeed. Thus, while it was asserted that surprise attack with weapons of mass destruction could, under certain conditions, play a decisive role in determining the outcome not only of battles, but of war as a whole, these conditions were never precisely defined. Its employment against a state with low powers of resistance, arising from radical faults in its economic and social structure and from an unfavourable geographic position, could lead to the rapid collapse of that state; but surprise attack could not in itself prove conclusive against "a serious and strong opponent", provided that he was markedly superior to the attacker in basic military, political, and economic strength (i.e., in the so-called "permanently operating factors" originally defined by Stalin).

From their ominous but ambiguously phrased appraisal of the potentialities of nuclear surprise attack, Soviet military writers reached an appropriately equivocal strategic conclusion: in order not to become the victim of an enemy surprise attack the USSR must be prepared to deal "pre-emptive blows". In theory, this did represent a significant departure from the old Stalinist doctrine of "active defense", which relied on the ability of the USSR to overcome the initial advantages gained by an enemy to whom the strategic initiative was conceded and to go on to victory in a prolonged war of attrition. But pre-emption is an inherently elusive concept susceptible to a wide range of interpretations and applications. The Soviet writers went no further than to indicate that pre-emption meant something more than mere retaliation, but something less than preventive war.[13] How a "pre-emptive strategy" might be implemented, what kind of warning would be required to activate it, and what type of force structure such a strategy demanded was not discussed, but it is likely that important strategic and weapon procurement decisions were made at that time in accordance with the Soviet answers to these questions.

II

In the five years since Malenkov's defeat (February 1955), the growth of Soviet military power, particularly the USSR's acquisition of long-range missiles, and the new blackmail opportunities created thereby, have led Soviet leaders radically to revise their public estimates of the effectiveness of Soviet deterrence and the likelihood of war. In some respects the current Soviet estimates, expressed now by Khrushchev, resemble those attributed to Malenkov in 1954. There is, however, a fundamental difference: Khrushchev's confidence that the West is deterred is based not on a rough equivalence of strategic power, as Malenkov's apparently was, but on an explicit assertion of the

superiority of Soviet strategic forces. "The Soviet Union", Khrushchev has boasted, "is now the world's strongest military power."[14]

At the XXI Party Congress in January 1959, Khrushchev declared that the balance of forces has shifted so markedly in favour of the socialist camp, that the danger of capitalist restoration in the USSR is now finally excluded: in the USSR "socialism has triumphed not only fully, but irreversibly".[15] The end of "capitalist encirclement" has been officially proclaimed: "At present," Khrushchev stated in 1958, "it is not known who encircles whom, the capitalist countries the socialist states, or *vice versa.*"[16]

Accompanying these claims have been increasingly confident assertions about the deterrent effect of Soviet military strength, i.e., assertions that the shift in the balance of forces is now understood in the West. Thus, Khrushchev declared in May, 1959:

> "The imperialists know our strength. To attack us is tantamount to suicide; one would have to be insane for this. I do not believe they are as stupid as all that; they understand the consequences which the unleashing of war against the socialist countries may have for them."[17]

And a few months later, Khrushchev reiterated this statement, leaving no doubt about its authoritativeness by attributing it to the Party Central Committee and the Soviet Government:

> "Comrades, the Central Committee of our Party and the Soviet Government believe that a situation has at present been created in which the imperialists will hardly dare to launch a war against our motherland or against the countries of socialism. Our forces and those of our socialist allies are colossal and in the West, apparently, this is now understood."[18]

The possibility that a madman, like Hitler, might embark upon a suicidal adventure, has been conceded, but Khrushchev has expressed confidence that such adventures could be "cut short" or that "a straightjacket can be found for such a madman.[19] Since late 1957 the Soviet leaders have been deemphasizing the danger of a rational, premeditated attack by the West against the USSR, stressing instead "the grave danger that even a slight miscalculation by statesmen in one country or another may lead to yet another war."[20] The danger that war might result from a technical accident or from an irrational act by a subordinate officer has also been a standard Soviet line since the fall of 1957. But war, which several years ago was still deemed inevitable so long as capitalism existed, is now officially no longer "fatalistically inevitable" and may soon (1965) "be excluded from the life of society."[21]

Khrushchev has insisted that the probability of a premeditated Western attack on the USSR has been reduced "not because the imperialists have become wiser or kinder, but because they have become weaker." He has likened the aspiration of the West to destroy the socialist countries to the desire of a hungry wolf with blunt fangs to kill a powerful lion.[22]

In the past five years, too, and particularly since the 1957 Soviet ICBM test announcement, the Soviet leaders have been far less reluctant than before to focus attention on the destructiveness of nuclear war. Indeed, now that the Soviet strategic nuclear capability is well established, rather than merely emergent, the image of vastly destructive nuclear war is deliberately raised in support of Soviet diplomatic blackmail. To back up his political demands, Khrushchev has often reminded his antagonists of the USSR's capability to put countries "out of commission" or to "wipe them from the face of the earth" with nuclear-missiles. He has thereby introduced into Soviet discussions of modern war what might be termed the concept of "country-busting".

Initially, Khrushchev restricted his "country-busting" claims exclusively to the NATO allies of the United States. Although in seeking to neutralize U.S. strategic nuclear power and to destroy the confidence of America's allies in the reliability of U.S. protection, Khrushchev repeatedly emphasized that Soviet ICBM's made the U.S. vulnerable to nuclear attack, he seemed at first to distinguish between the susceptibility of the NATO allies, on one hand, and the U.S., on the other, to attack on a "country-busting" scale. In November, 1959, he collapsed this distinction. "We now have stockpiled so many rockets, so many atomic and hydrogen warheads," he said, "that, if we were attacked, we could wipe from the face of the earth *all of our probable opponents.*"[23] He repeated this claim the following month and again in January 1960.[24]

However, Khrushchev may have calculated that precisely because the IBCM had made America vulnerable, the U.S. needed to be reassured that the USSR was also aware of its own vulnerability. It was only after acquiring the ICBM that Soviet leaders began to refer explicitly to the damage the USSR might expect to suffer in a new world war. Khrushchev has spoken of the "great losses", and "great damage", "great sacrifices", and "no little destruction" that the West could inflict upon the USSR, if it attacked.[25]

But he has stopped far short of Malenkov's prediction of the outcome of a new war. Khrushchev has not said that World War III would end in mutual annihilation, the destruction of civilization, or the extinction of mankind. On the contrary, he has several times explicitly denied such an outcome; if war is unleashed, he once said, "despite great losses, mankind will not only survive, but will continue to develop."[26] The intensity of Soviet insistence on this point was illustrated on April 27, 1958, when the Soviet press excised from the published version of a speech by Voroshilov, broadcast while he delivered it the day before, a passage which stated that a new war would result "not in bloodshed, but in the simple annihilation of all life on earth."[27]

The prediction, invoked against Malenkov in 1955, that capitalism, not socialism or world civilization would perish in a new war, continues in force. In Khrushchev's words:

> ". . . We are convinced that as a result of a new war, should it be unleashed by capitalist circles, the system which creates wars, that is, the capitalist system, would perish, and the socialist system would win."[28]

Moreover, recent Soviet statements have forecast not only the collapse of the capitalist *system*, an outcome not tied to any specific level of physical destruction, but also, as stated above, the obliteration of the capitalist *countries*, which could be "wiped from the face of the earth" in a new war. Thus, Khrushchev has now invoked the threat of *maximum retaliatory damage against the West.*

Finally, Soviet acknowledgements that the West could inflict "great damage" upon the USSR are invariably coupled with assertions that the West would suffer more in a new war. In discussing expected Soviet war losses, Khrushchev has several times pointed out that the greater land mass and more widely dispersed urban population and industries of the USSR give it important advantages over Western countries, including the U.S., which enable it to limit damage to the Soviet population and economy.[29]

In his January 14, 1960 speech to the Supreme Soviet on military affairs, Khrushchev differentiated most explicitly between expected war outcomes for the USSR and the West:

> "Of course, in the event of a new world war all countries would ultimately suffer in one way or another. We, too, would endure great misfortunes; we would have many losses, but we would survive. Our territory is immense and the population is less concentrated in major industrial centres than in many other countries. The West would suffer incomparably more."[30]

It should also be noted that the Soviet losses which have been explicitly conceded refer to a war initiated by the West. We do not know how the Soviet leaders might estimate the losses which the West might be able to inflict upon the USSR after being subjected to a Soviet first-strike, for this possibility, of course, is not discussed.

But what of the danger of surprise attack? If Malenkov's estimate of the deterrent effect of Soviet nuclear weapons was deficient because it overlooked the enhanced potentialities of nuclear surprise attack, might not the significance of the new weapons which have come upon the scene since 1955, and on which Khrushchev's confidence in the current effectiveness of Soviet deterrence is based, be equally ambivalent? The revised Soviet military doctrine of 1955 emphasized the vital link between the state of military technology and the role of surprise in war. The role of surprise in war, according to *Soviet Fleet*, "changes substantially in accordance with the level of development of military technology."[31]

Soviet political and military leaders were as quick to proclaim that long-range missiles are revolutionizing modern warfare as they were previously slow to acknowledge that nuclear weapons had significant military worth. The ICBM, Major General Talensky declared in March 1958, represents "not a quantitative increase in the possibilities of strategy, but a qualitative leap which fundamentally changes the methods and forms of modern warfare."[32] Despite the traditional Soviet view that there can be no such thing as a decisive weapon in war, the ICBM was soon called precisely that, both by Khrushchev and by the aforementioned General Talensky, who is perhaps the leading Soviet military theorist.[33] At the XXI Party Congress in January, 1959, when Khrushchev announced that the USSR had begun serial production of IBCM's, Marshal Malinovsky declared that the Soviet Union considered the rocket weapon "precisely the weapon best answering the demands of contemporary warfare," and that it was capable of effectively accomplishing both strategic and tactical tasks on land, sea, and in the air.[34]

Soon after the August 1957 Soviet ICBM test, Soviet writers began to stress that acquisition of long-range missiles by the USSR had radically transformed the strategic picture: gone forever was traditional U.S. invulnerability; the importance of strategic air forces was sharply reduced; and the

military value of U.S. overseas bases was radically diminished.[35] These strategic consequences are doubtless important, but they clearly do not exhaust the subject. Remarkably, virtually nothing has been said in Soviet public media about the distinctive advantages of long-range missiles for surprise attack. Little more has been done than to add the ICBM to nuclear weapons and jet aviation in the list of weapons whose advent, according to the 1955 formula, has "significantly increased the importance of surprise attack". Only once has a Soviet writer called attention to the special advantages of the ICBM for achieving strategic surprise. This was in a book published more than a year before TASS announced that the USSR had successfully tested an ICBM; the statement was excised from the second edition of the book published in 1959.[36]

Clearly, Soviet priority in developing the ICBM has coloured everything that has been written in the USSR about the strategic implications of that weapon. In Soviet hands, the ICBM is, by definition, exclusively a retaliatory weapon. As General Talensky wrote: "In the Soviet Union no one speaks or even thinks of using our advantage for preventive war or sudden attack on anyone."[37]

However, there has been evidence that the status of the surprise factor remains an unsettled and perhaps even contentious issue in Soviet military circles. The evident constraints on public discussion of this sensitive question have beclouded the issue, but have not obscured differences among various views on surprise attack that have been advanced in theoretical articles since 1958. In 1955, Soviet writers on doctrine discarded the Stalinist thesis on the decisive importance of the "permanently operating factors", a thesis which automatically precluded surprise, a "temporary factor", from being considered decisive, and theoretical discussion was centred instead on the "basic" factors, so long distinguished by their alleged long- or short-term effects in war.

While surprise was at first so explicitly identified as one of the "basic factors" in war, this step was taken in the summer of 1958 in an Air Force newspaper article,[38] but subsequently when this article was revised for publication in a Defense Ministry textbook on military theory, surprise was withdrawn from the list of basic factors and several paragraphs were rewritten to imply that strategic surprise could not have a decisive influence on more than a phase of war.[39] Two other Soviet writers in 1958 revived the old Stalinist concept of "permanently operating" and "temporary" factors, but only to deny its former import, for they now included surprise attack among the factors that could decide the outcome of a war. One colonel argued that surprise *is* a "temporary" factor, but only in the contingent sense that wars can theoretically be fought and won without its employment; if employed successfully, however, surprise could be decisive.[40] Another colonel asserted that, as a result of advances in weapon technology, surprise is in fact now being transformed into a "permanently operating factor".[41]

III

Khrushchev first addressed himself to the surprise attack question in his January 14, 1960 speech before the Supreme Soviet. In the course of justifying his proposed one-third cut in the Soviet[42] armed forces, Khrushchev sketched the outlines of a comprehensive strategic doctrine, bringing together the ideas about modern war he has been propounding publicly since mid-1957. These ideas have now been raised to the level of military doctrine and have been endorsed by the top marshals and admirals, though perhaps grudgingly by some. Thus, Khrushchev's intervention into the military domain has reached its culmination. His emergence as chief military strategist has rapidly accelerated the slow and sometimes halting transition of Soviet doctrine from the old battlefield-oriented concept of war to a new concept oriented on the dominant role of strategic nuclear weapons.

Surprise attack, in Khrushchev's concept of modern war, appears to be the most severe test to which a military force can be subjected. Khrushchev used it to test his contention that the USSR's strategic position was "unassailable" and that therefore the size of the armed forces could be substantially reduced with no loss to security. His discussion of strategic surprise can only be understood if its context is considered. He first asserted that the firepower *now* embodied in the Soviet strategic missile force was adequate to provide the USSR with a second-strike capability of absolutely devastating proportions. But he conceded that "unassailability" was a "rather relative term" and that it was at least possible that the current favourable balance of forces might change. He therefore examined a hypothetical case based on a deliberately pessimistic assumption about the future course of the arms race: What would be the strategic position of the USSR relative to the West, if the capitalist countries should achieve parity with the Soviet Union in the missile field? Because Khrushchev's reply to this question and his ensuing

remarks on surprise attack are of great importance and require close analysis, they are reproduced below as translated by the author from the original Russian:

> "The question suggests itself, however: since the possibility is not excluded that some capitalist states may equal us in the field of modern weapons, could they not act perfidiously and strike us first in order to exploit the factor of surprise attack by means of such a ferocious weapon as the nuclear-missile and thereby have advantages for achieving victory? No. Modern means of war give no such advantages for either side.
>
> "Let us assume, however, that some state or group of states should succeed in preparing and launching a surprise attack on a power possessing nuclear and missile weapons. Even supposing for a moment that the attacking side really succeeded in striking its blow by surprise, could it at one blow put out of commission all the stockpiles of nuclear weapons, all the missile installations on the territory of the power subjected to attack? Of course not. The state subjected to surprise attack, provided, of course, that it is a sufficiently large state, would always have the means to give the aggressor a due rebuff.
>
> "We take into account that foreign military bases are located around our country. Therefore, we are deploying our missile force in such a way as to ensure duplication and triplication. The territory of our country is immense; we are able to disperse our missile force, to camouflage it well. We are creating such a system that if some means designated for delivering a retaliatory blow should be put out of commission, we would be able to bring into action duplicate means and destroy the targets from reserve positions."

Some Western observers have interpreted these remarks as expressing Khrushchev's belief that surprise attack is not a feasible strategy for either the West or the USSR to employ because it could not preclude unacceptable retaliatory damage. It has been concluded on the basis of this interpretation that Soviet grand strategy is oriented on the acceptance of a state of mutual deterrence.[43] This interpretation, however, is not borne out by the evidence. To arrive at this interpretation on the basis of available evidence requires a number of highly questionable assumptions: (1) that large gaps in Khrushchev's argument may be filled with hopeful *ad hoc* assumptions; (2) that Khrushchev's *deliberately pessimistic estimate* of the future course of the missile race, adopted by him to construct a "worst case" hypothesis, and not his *explicitly expressed estimate* may be regarded as his real view; and (3) that all ambiguities in his remarks may be resolved in favour of the preferred interpretation.

The gaps and ambiguities in Khrushchev's argument are the product of rhetoric and not of carelessness on Khrushchev's part. Khrushchev exercises great care in executing a most difficult task. This task was to achieve diverse and partially contradictory rhetorical objectives within the framework of a reasonable argument that did not explicitly violate commonly accepted facts nor, it may be supposed, Khrushchev's beliefs.

Khrushchev undoubtedly wished to reassure the Soviet people and to warn the West that the implementation of his proposed force reduction would not jeopardize Soviet security, now or in the future. These objectives are compatible, but they require extreme care in verbal expression. For example, while emphasizing that the growing Soviet missile force more than compensates for the proposed reduction in personnel, at the same time he had to reassure his opponents that this force did not threaten their security. Still another objective can be inferred from the extreme care with which Khrushchev chose his words: He evidently did not wish so strongly to reassure his opponents as to deprive his current missile superiority claims and his predictions of future superiority of their political value; and while he did not now wish to assert, or perhaps even to imply, that the Soviet Union had or might acquire a first-strike capability, he nevertheless did not want to *preclude* this possibility or to *foreclose* some future claim under circumstances he might deem more propitious.

The question arises whether Khrushchev believes that the West's current strategic forces could with assurance deliver a second-strike after a Soviet surprise attack implemented by missiles. Khrushchev did not answer this question for he neglected in any of his remarks to assess the capability of a strategic striking force composed primarily of *manned bombers* to survive a surprise attack delivered by missiles. Khrushchev referred exclusively to the survival capacity of strategic missile forces. When he stated that "*modern means of war* do not give either side such advantages," it is clear both from the context of his remarks and from the fact that in the preceding sentence he had used "modern weapons" synonymously for nuclear-missiles, that he was referring only to missiles.

Thus, contrary to what some Western observers have supposed, Khrushchev did not vouch for the capability of the West's current strategic forces to survive a surprise attack by Soviet missiles, which, Khrushchev has claimed, the USSR is mass-producing.

Optimistic Western interpretations of Khrushchev remarks relating to the survival capability of Western forces in the future are based on Khrushchev's pessimistic estimate of the future East-West missile balance. But Khrushchev voiced the USSR's determination to ensure that the hypothetical "missile parity" case he contrived would remain purely hypothetical. "We intend," he said, to "make the most of our lead time" and "to retain our leading position." The U.S. goal, Khrushchev stated, is to equal Soviet missile production within a period of five years, "but it would be naive to imagine that we shall sit with folded arms." Thus, to the extent that Khrushchev's remarks about assured second-strike capabilities are applicable to the West, they look beyond the period of the so-called "missile-gap", which Khrushchev said was not likely to be closed to all.

Assuming, however, that Khrushchev's pessimistic estimate turns out to be correct, can it be inferred from his remarks that he believes missile-parity would in itself preclude retaliation-proof surprise attacks? He seemed to assert this, with but one qualification: the country subjected to attack would always be able to retaliate, "provided, of course, it is a sufficiently large country." Khrushchev was not speaking here of the capabilities of countries to limit population and economic damage, but to ensure the survival of their second-strike missile capabilities. Therefore, he evidently meant that in addition to having a missile force comparable or equal in size to that of a potential attacker, a country must be "sufficiently large" to be able to satisfy certain missile deployment requirements essential to survival. Even a large force of missiles if it had to be concentrated in clusters on "soft" bases, might be highly vulnerable to surprise attack by a missile force of equal or even inferior numerical strength.

This inference is strengthened by the fact that Khrushchev immediately thereafter went on to discuss the deployment of the current and programmed Soviet missile force. He referred explicitly to three different protective deployment measures. The first two measures are facilitated by the "immense territory" of the Soviet Union, as well as by its superior ability to preserve military secrecy. The third measure, duplicating targeting, would be facilitated by quantitative superiority in missiles, such as claimed for the USSR by Khrushchev. The number of missiles required to support a duplicate targeting system would depend on the number and character of the targets to be covered: for example, a fixed number of cities; a rising number of military targets; or a combination of both. Since some Soviet military leaders have emphasized the need to have a pre-emptive capability, the USSR might prefer to create a duplicate targeting system oriented on the counterforce mission. And such a system, if its coverage were extensive and its targets relatively "soft" might be equally compatible with a first-strike strategy.

IV

The explosion of the first Soviet hydrogen bomb in August 1953, only nine months after the first U.S. thermonuclear detonation, brought the USSR to the threshhold of "nuclear parity" with the United States and presented Stalin's successors with a new set of military and political alternatives from which to choose in charting their country's course. During the sifting of these alternatives in 1953-54, the question of the *reliability* of deterrence became the focal point of intensive intra-Party controversy: Did the advent of thermonuclear weapons mean that fear of destroying world civilization would curb imperialist aggressiveness? Was the Soviet Union's nuclear capability sufficiently powerful to deter a Western attack? The victorious Party faction answered these questions negatively and proceeded to intensify the Soviet military build-up. But during the past five years, under the impact of the USSR's greatly enhanced strategic nuclear capability and particularly its acquisition of long-range missiles, the attitude of Soviet leaders toward the reliability of deterrence has undergone a marked transformation. While the possibility of war resulting from accident or miscalculation is not excluded, the Soviet leaders now seem quite confident of their ability to deter a rational, premeditated Western decision to initiate general war. In the new strategic context created by the rapid growth of Soviet military power, the central question for the Soviet leadership is not so much the reliability of deterrence, which remains the West's major preoccupation, as the *adequacy* of a deterrence posture to satisfy the broad requirements of Soviet policy.

Deterrence is an appropriate strategy for a *status quo* power uninterested in territorial expansion or in the acquisition of new spheres of influence. It is doubtless an element in Soviet strategy, too, but it cannot be the whole of that strategy.

The Soviet leaders would probably regard deterrence *per se* as an unworthy objective for their global strategy to pursue and mutual deterrence as an inadequate outcome of their great military and political exertions. At best they can regard a deterrence posture as a necessary means to reduce to tolerable levels the risks associated with political aggrandizement in a world of nuclear weapons. A prolonged state of mutual deterrence can be acceptable to the USSR only if its political effects are less than perfectly symmetrical: a usable residue of intimidation must remain.

It is for this reason that theories of mutual annihilation are so repugnant to the Soviet leaders. Mutual preoccupation with survival, which such theories imply, can lead only to political paralysis; and while the paralysis of the enemy is most desirable, it must not be achieved at the cost of self-paralysis. Nuclear war, the Soviet leaders assert, would be a terrible ordeal for all participants, and even for non-belligerents, but while the Western powers would be "wiped from the face of the earth," the Soviet Union would survive and communism would triumph throughout the world. It has been shown that Khrushchev insists on distinguishing between "great losses" that the Soviet Union might have to endure and the "incomparably" greater losses which a new war would inflict on the West. The anticipated Soviet losses may be more than the Soviet leaders would willingly bear and their acknowledgement of these losses tends to reassure the West that they would not lightly plunge the world into nuclear war. But the gap between predicted Soviet and Western losses may be intended to imply that the range of extreme circumstances which might compel a resort to war is greater for the USSR than for the West. And while Khrushchev has asserted that Soviet missile superiority renders infeasible a Western surprise attack strategy, thus precluding the last remaining chance for the West to achieve a tolerable military outcome, he has not similarly ruled out such a strategy for the USSR.

Khrushchev, in effect, seems to be telling the West: "If it is true that we are both deterred, you are more deterred than we."

1 R. Garthoff, "Soviet Strategy in the Nuclear Age" (Praeger, New York, 1959), p. 245.

2 *Pravda,* March 13, 1954.

3 *Kommunist* (Yerevan), March 12, 1954, as cited in H. S. Dinerstein, *"War and the Soviet Union"* (Praeger, N.Y., 1958), p. 71.

4 *Pravda,* March 11, 1954.

5 V. Tereshkin, "The Great Mass Movement of the Present Day", *Zvezda,* (Leningrad), February 1954, pp. 139-140, as cited in Dinerstein, *op. cit.,* p. 68.

6 "The Peoples Decide the Fate of the World and Civilization", *Kommunist,* No. 4, March 1955, p. 16.

7 *Pravda,* January 1, 1955.

8 *Pravda,* March 27, 1955.

9 V. Platovskii, "The Marxist-Leninist Teaching on the Party and Contemporary Revisionism", *V. Pomoshch' Politicheskomu Samoobrazovaniyu,* No. 6, June 1958.

10 E. G. Panfilov, "Has War Ceased to be the Continuation of Politics", *Voprosy Filosofii,* No. 1, 1957, p. 246.

11 See, for example, Marshal Vasilevsky, *Krasnava Zvezda,* May 7, 1954; N. A. Bulganin, *Pravda,* July 22, 1954; K. A. Voroshilov, *Pravda,* January 1, 1955.

12 The revised doctrine was expounded in greatest detail by Marshal of Tank Troops P. A. Rotmistrov, *Krasnaya Zvezda,* March 24, 1955, and in "On the Role of Surprise in Contemporary War", *Voennaya Mysl;* No. 2, February 1955.

13 Marshal V. Sokolovsky, *Izvestiya,* February 23, 1955, and M. Rotmistrov, "On the Role of Surprise in Modern War", *loc. cit.,* p. 14.

14 *Izvestiya,* March 2, 1960.

15 *Pravda,* January 28, 1959.

16 *Pravda,* March 27, 1958.

17 *Pravda,* June 1, 1959.

18 *Pravda,* July 30, 1959.

19 *Pravda,* January 28, 1959, and October 15, 1958.

20 *Pravda,* August 31, 1959.

21 *Pravda,* February 14, 1956, and January 28, 1958.

22 *Pravda,* March 27, 1959.

23 *Pravda,* November 14, 1959.

24 *Pravda,* December 2, 1959, and January 15, 1959.

25 See *Pravda,* November 19, 1957; May 9, 1959; May 11, 1959; July 30, 1959; and January 15, 1960.

26 *Pravda,* October 11, 1957.

27 Cited in Dinerstein, *op. cit.,* p. 79.

28 *Pravda,* November 7, 1957.

29 See, for example, *Pravda,* November 19, 1957; May 9, 1959; May 11, 1959; and January 15, 1959. Also Marshal Vershinin's interview in *Pravda,* September 8, 1957.

30 *Pravda,* January 15, 1960.

31 *Sovetskii Flot,* December 11, 1958.

32 Major General N. Talensky, "The Question of Military Strategy and Foreign Policy", *Mezhdunarodnaya Zhizn',* No. 3, March, 1958, pp. 34-35.

33 *Pravda,* November 29, 1957, and Major General Talensky, *loc. cit.,* p. 34.

34 *Pravda,* February 4, 1959.

35 See, for example, "A Policy from Positions of Folly", *International Affairs,* No. 12, December 1957; M. Rubinstein, "Science and International Relations", *Mirovaya Ekonomika i Mezhdunarodnye Otnosheniya,* No. 6, June 1958; and N. Inozemtsev, " 'Atomic Diplomacy' of the U.S.A.: Projects and Reality", *Mirovaya Ekonomika i Mezhdunarodnye Otnosheniya,* No. 3, March 1958.

36 [Major General] G. I. Pokrovsky, *Nauka i Tekhnika v Sovremennykh Voinakh,* Moscow, 1956. p. 51.

37 Major General Talensky, *loc cit.,* p. 26.

38 *Sovetskaya Aviatsiya,* August 12, 1958.

39 I. Korotkov, "The Basic Factors Deciding the Course and Outcome of War", in *V Pomoshch' Ofitseram Izuchayushchim Marksistsko-Leninskuyu Teoriyu,* Moscow, 1959, p. 237.

40 Colonel S. Kozlov, "On Some Questions of Soviet Military Science", in *ibid.,* pp. 201-203.

41 Colonel P. Sidorov, "The Creative Character of Soviet Military Science", *Sovetskii Flot,* December 11, 1958.

42 All references to this speech are from the text published in *Pravda,* January 15, 1960.

43 See, for example, Jack Raymond's dispatch from Washington, *The New York Times,* January 16, 1960; C. L. Sulzberger's dispatch from Paris, *The New York Times,* May 16, 1960, p. 30; and "Soviet Attitudes on the Use of Military Power", *Army Information Digest,* June 1960, p. 35.

French Views on a National Policy of Deterrence

BRIGADIER-GENERAL PIERRE M. GALLOIS

Brigadier-General Pierre M. Gallois served with a special French Air Force survey and control squadron in the Sahara desert prior to World War II. During the war he was in the R.A.F. Bomber Command. After the war he was first in charge of navigation in the French Civil Aviation administration; then from 1947 to 1953 he became a member, and later Head, of the Cabinet of the Chief of Staff in the F.A.F. He was appointed to SHAPE from 1954 to 1957 for duty with a nuclear strategy planning group. During the latter period he also became Air Adviser to the Minister of Defence from 1953 to 1954. He retired in 1957. General Gallois is well known as a military strategist and writer in such renowned publications as Interavia, Foreign Affairs, and The Reporter.

THE experts of all the other countries are wondering. The initial French atomic explosions have shown that France, too, is capable of mastering the complex and expensive techniques of the new energy source. But what comes next? What is France planning to do with her newly earned degree in technology?

Does she intend, by means of a few successful tests, to give the world proof of French vigour and might, and then abandon the establishment of a nuclear arsenal? Or is the whole gamut of fusion and fission devices to be introduced one by one into the French defence system in the course of coming years? Was thhe explosion at Reggane merely a stroke of diplomacy? Or was it the first step in a new defence policy aimed at guaranteeing France's security in the "tough and troublous world" that General de Gaulle keeps talking about? Did it presage a retreat back to a purely nationalistic position? Or did it represent a promise of greater cooperation, based on the contribution of considerably enhanced French military strength? And why should such efforts be expended nationally when we have now reached the age of supranational alliances, when the "Atlantic" peoples have formed a coalition in order better to defend themselves, and when the potential enemy, too, is gargantuan?

Friends and enemies of France alike are asking themselves these questions – as are the French themselves moreover. The answer would be easy to provide if we talked about the illusory search for "national grandeur", a concept which has now been left behind by the precipitous pace of historic events, or even if we tried to explain French nuclear efforts in terms of a certain disdain for our ignorance of the hard, present-day financial and technological facts of life. In reality, the problem is more complex. In the pages which follow, we shall try to provide an analysis of the solutions.

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First of all, it should be pointed out that the nuclear age surprised everyone, including the very men who designed and created the first atomic bombs. The West did not realize how much it might have gained from the political exploitation of the atomic monopoly that it held for all practical purposes from 1945 until 1952 or 1953– the very period during which Soviet Russia brought off her most spectacular territorial and political conquests. For the past fifteen years now the atomic experts of the West have been talking about the marvellous economic advances that the new sources of energy were going to bring to mankind. In point of fact, these advances have never been anything more than figments of the experts' imaginations. Progress in this field has been comparatively slow, just as have been all the great industrial upheavals of the past, the complete transformation of economic conditions being achieved only by gradual stages. On the other hand, everything in the field of strategy has

been radically altered, although the fact has not been clearly understood, at least in the West. The whole reference system has been changed, but there is a kind of unwillingness to recognize it. It is difficult for us to realize what a gap really exists between the age of the so-called "conventional" weapons and the present era. It is more normal and satisfying to the human mind to consider our present era as the successor of the previous one, without any discontinuity, and to think of the atomic phenomenon as representing nothing more than an increase in fire power capacity, similar to the improvements that the chemists gradually made in gunpowder by augmenting the amount of energy it released within a given time unit. In reality, the nuclear phenomenon has a wider meaning both militarily and, consequently, politically. The fact that the energy released by a single test explosion on Eniwetok in 1954 was theoretically greater than the amount of energy required to wipe out more than 50 million human lives during all of World War II is more than enough to revolutionize completely all the relationships, antagonistic or otherwise, that exist between the various pressure groups, states and coalitions of states throughout the world. Although many people are now familiar with the physical implications of the new weapons, there are indeed very few who understand their full political significance. Here are a couple of examples, one from each side of the Iron Curtain.

There is scarcely a single head of state or politician who does not deem it well to advocate a permanent ban on nuclear tests. It is quite reasonable that Communist ideologists should demand the cessation of experimental atomic explosions, for the new weapons have been providential in re-establishing some balance between the minority forces and the masses, and have practically neutralized the Communist numerical advantage. They could even impose an acceptance of the *status quo*. For the East, they are therefore to be proscribed. In view of the profound differences in mentality, sense of sacrifice and social development that exist between the peoples of the West and East, and even if it were controlled, nuclear disarmament—and conventional disarmament as well—would leave the balance of power in the hands of the Communists, so that they could do whatever they wished. This is further brought out by the fact that their numerical superiority is also compounded with a practically universal Messiah complex, which, by definition, cannot exist in a purely defensive and conservative society of liberalism. The attitude of many Western political leaders is therefore incomprehensible. No doubt, as good demagogues, they are thinking about winning the votes upon which, in the final analysis, their political lives depend. Instead of trying to enlighten and guide the thinking of voters, they consider it more expedient to go along with the public's views, even when they are dictated solely by emotionalism. The example of this campaign in favour of an atomic test ban has been chosen intentionally. Apart from the danger of adding to the atmospheric pollution and increasing the amount of artificial radioactivity in the air, most of the Free World political leaders sincerely believe that an atomic test ban will prevent wider distribution of such weapons, solve the "nth power" problem, and thereby help to circumscribe the dangers which all mankind is being forced to incur because of the proliferation of nuclear weapons. That, far more than any suggestion of atmospheric radioactivity, is the fundamental argument that our responsible statesmen generally use.

Actually, the argument is of practically no value, and here is why: Let us suppose that a few years from now, without ever once carrying out a bomb test, the Peking government issues an official invitation to groups of top Western scientists, ostensibly to show them China's nuclear achievements. Then, at the end of the visit, suppose that an atomic arsenal is shown to these dignitaries. Assume, for example, that after the Western experts have admired the atomic piles and isotope separation plants, the nuclear development and research centres and the special metallurgical facilities of Red China, some 200 warheads are brought forth and described in detail for them; and assume that the technicians who designed them and partially assembled them explain their calculations on a blackboard, telling how they were developed, furnishing samples of the materials and describing the procedures that were employed. Is it conceivable that after such a demonstration, the Western world (or the world in general, for that matter) could deny China the privileges of a nuclear nation? Even if the weapons had never been tested, even if it were merely probable that they would function correctly, even if the launching and transport facilities for these atomic warheads were still in the embryo stage, the evidence would nevertheless have to be believed. No one would dare provoke the use of such an arsenal, so that, without exploding the smallest A-bomb, China would still be a nuclear power. It would even be enough for her to conduct a few successful space

experiments in order to eliminate any doubt concerning the effectiveness of her ballistic missiles.

There would remain a possibility, of course, that because of the lack of tests, the Chinese atomic bomb would not work. Let us assume that there were only one chance in five that the warheads would function properly. Who would take the risk of speculating with such odds? Furthermore, the specialists are well aware of the fact that, with present-day technological progress, although the development of certain nuclear devices still requires a great many tests, yet the production of mass-destruction weapons is no longer a secret. Consequently, agreement on a test ban will not prevent the proliferation of the new weapons, nor will it solve the "nth power" problem either. Moreover, it is the countries considered to have aggressive designs which will derive the greater advantage from such a ban. The democratic nations will simply abide by the ban—because they cannot do otherwise—whereas the secrecy in which the Communist countries enshroud themselves will permit infractions of any such rule. Above all, however, the freeezing of nuclear technology in its present stage by placing a ban on the testing of the new weapons is equivalent to favouring their offensive employment, inasmuch as the defensive possibilities of the atom have not yet been explored.

By joining the hostile chorus and demanding that nuclear tests be stopped, the West is playing into the enemy's hand without gaining anything at all from it. It has not understood that, owing to the tremendous capabilities of atomic weapons, all that is needed for them to acquire significance is merely a slight possibility that they will work. Under the new logic, the uncertainty is combined with such an exorbitant risk that it becomes equivalent to a certainty. And yet, a nuclear test ban is a part of the policy of most of the Western governments.

The second example of incomprehension comes from the other side of the Iron Curtain, since it concerns a statement by Mao Tse-tung. We all know that the spiritual and political master of New China declared some time ago that his country had no fear of the military forms of American imperialism, and that he could lose 300 million men and still survive. He would then rule over a world that was half destroyed, where the Chinese would easily gain the upper hand simply because of their larger numbers. Everyone accepted the truth of such an argument, and it was frequently advanced in the West to show the pointlessness of American efforts in the field of ballistics and nuclear weapons. And yet, Mao's statement is thoroughly specious. In point of fact, it will not stand up to analysis. The laws of technical and social progress are such today that the urban centre, the city, is the universal prerequisite for intellectual, social and economic progress. Therefore it is hard to see how an enemy of China could wipe out 300 million Chinese with thermonuclear bombs and not simultaneously destroy the centres of population and culture, the industrial areas, the educational and research facilities, and the energy sources of Red China—in other words, all the results of many years of tremendous modernization efforts. In reality, in such a case, China would not only lose a half or third of her population, which does not perturb Mr. Mao Tse-tung, but would also be thrust a thousand years backward in her development—the annihilation of all her efforts. Part of the population could, under certain circumstances, avoid death, whereas nothing much would be left of the stationary and vulnerable targets that urban concentrations and industrial complexes constitute—which is just the opposite of the Chinese Communist leader's ideas about the effects of the new weapons. No country—not even China—can any longer afford to bank on its so-called "capacity to absorb" a thermonuclear attack, and ignore the risks inherent in a resolutely and specifically aggressive policy. Even against China, with her huge population, but in the process of modernization, a nuclear arsenal retains its deterrent capacity. No political leader and no government, either institutional or otherwise, could, unless its very life were at stake, afford to run the risk of having 50 years of efforts annihilated in a few minutes' time by using force against a nuclear power. No doubt the mechanics of subversive warfare are more familiar to Mao Tse-tung than the new laws of nuclear strategy.

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We have dealt at such great length with two of the many obvious paradoxes that the atomic age has brought to light in order to emphasize how difficult it is to determine clearly and accurately what strategy and what policy would be most effective today, and also in order to show that the significance of the recent French efforts in the realm of security has escaped many people, with the result that some people consider them to be somewhat paradoxical too.

However, let us go back to the fundamental factors of the atomic problem and see how they affect the ideas that a nation may have concerning its security. The first widely accepted principle

is that a defensive attitude can no longer be based on possession of purely defensive weapons and forces. It used to be reasonable for an eminently peaceful nation like Switzerland or Sweden to try to impose its neutrality on the rest of the world by setting up a purely defensive military structure. Defensive strategy, defensive weapons and armed forces organized and trained for defensive warfare used to suffice to win respect for Swiss or Swedish neutrality. But that is no longer the case. Such a small number of atomic bombs would be enough to wreak so much destruction that there can no longer be any question of speculating on the effectiveness of even the most impenetrable defensive system. Even when nuclear bombs had to be carried by bombers, it was already impossible to think in terms of a defence system so tight that it could screen out all the "destructive capacity" except that which could be "absorbed"; and now that ballistic missiles have joined the offensive weapons, true defence is still less imaginable. Moreover, it certainly seems that this superiority of the offence over the defence, of the sword over the shield, may last a long while. Consequently, another concept had to be substituted for that of the attrition of the attacking forces by the defending forces: the "deterrent policy" against aggression.

Since the enemy's blows can no longer be fended off, since their violence cannot be diminished or their effects absorbed, we must be able to deal him blows of equal violence, and make him understand that if he uses force, our retaliation will be immediate and will inflict upon him losses that are at least equivalent to anything he might gain by resorting to war.

From the moral point of view, such a formula is repugnant. The Western democracies would prefer to base their security on the "conventional" concept of defence. However, the new technology has its laws, and they must be obeyed. The U.S., with her retaliation concept more than ten years old, and Great Britain, with her White Papers of 1957 and 1958, have subscribed to this policy which they intend to apply both for themselves and on behalf of their allies. Moreover, there is no other policy available. Since the time that the effects of the low birth-rate years were felt in the U.S.S.R. and particularly since the Kremlin began to understand the new "nuclear" logic, Mr. Khrushchev has quite obviously subscribed to similar concepts.[1] By announcing the creation of a strike force, General de Gaulle is adopting the same defence policy as the nations which are stronger and which were therefore able to provide themselves earlier with the means to apply it.

Was it necessary, however, at the cost of enormous sacrifices, to add the meager French contribution to the tremendous American and even British capabilities? Was not the existing collective system based on the Atlantic Pact (Articles 5 and 6 of the Treaty in particular) sufficient, with its American guarantee of defending any member nation or nations that were attacked?

No government leader or person of responsibility in Western Europe would deny the effectiveness of the Pact. They all believe that taking a chance that the North Atlantic Treaty would not be applied would represent a truly exorbitant risk on the part of the Soviets. Furthermore, the system is made even stronger by the fact that American forces are physically "committed" in Europe, where they unconsciously play the role of "hostages". However, the Pact was signed eleven years ago, and the technical strategic and political factors have been changing ever since.

In 1949, the West had an absolute monopoly of the new weapons. It was logical to speculate on the deterrent power of a terrible weapon against which there existed no real defence. The weapon is now shared and consequently somewhat neutralized.

Eleven years ago, the Soviet threat was not so diversified as it has now become. Western statesmen and military leaders had watched on passively as some 90 million Europeans were forcibly incorporated into the Soviet orbit. Above all, they attempted to assemble the means for halting any further thrusts westward. Today, the threat has assumed other forms than a simple drive of armoured columns across the plains of Northern Europe.

When the Treaty was signed in Washington, although the technological and scientific race was already on, it was being run only by the U.S., with the other powers trailing far behind. The geophysical year provided the U.S.S.R. with the occasion to reveal to the world in a spectacular way the quality of its scientists and the scope of its scientific and technological achievements. All of a sudden, many of the dogmas on which the West relied in considering its social and political system to be superior became subject to dispute. Sputnik and Lunik had a twofold effect: First, the West acquired doubts about its supremacy, and second, the uncommitted part of the world turned towards

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[1] Cf. Khrushchev's speech of 14 January, 1960, before the Supreme Soviet.

another pole of attraction. In addition to the regular military budget burden made necessary by a constant enemy military threat, the Western world now had to take on the obligations of a technological race plus assistance to the underdeveloped countries, which were then in a position to strike bargains for their goodwill.

In 1949, the North American continent was still shielded from any direct menace. It had been beyond the range of enemy forces since 1812 and, unless the enemy mounted a tremendous amphibious operation, which would be an easy target for an American atomic counter-attack, the soil of the New World could not easily be threatened. Indeed, the U.S. and Canada had been able to participate decisively in a world war of extermination without suffering any of its effects directly and with less than 1% of the total casualties of that war. Since August 1957 and Mr. Khrushchev's announcement concerning Soviet ICBM's, and especially after the Soviets' space tests and the launching of their experimental ballistic missiles, such invulnerability no longer exists. Like Western Europe, the New World is in the front lines. Ballistic missiles have cut distances, and placed everybody in the same position, or nearly so. This is a very serious change in the strategic situation, and it would appear that, at least in the Atlantic world, its tremendous consequences have not been fully realized. With their background of centuries of almost ceaseless wars and their memories of a very eventful history, owing their survival only to their force or their cleverness, the nations of Europe are perhaps more sensitive to the immediate or even long-range implications of this strategic assimilation of America among the geographically most exposed peoples. They realize that the resulting new situation limits the United States' freedom of action and forces her to run risks that seem incommensurate with the stakes involved. That was clearly the general meaning of the views expressed a few months ago by certain eminent American politicians, diplomats and technicians. The controversy that followed Mr. George Kennan's very intelligent comments on the B.B.C. and the emotion aroused by the words attributed, no doubt erroneously, to Mr. Stevenson, concerning the American military commitment in Europe, have not been forgotten. And the advent of the ICBM is obviously not a factor that will strengthen the positional value of Europe, which is becoming more of a hindrance than a help in the development of a system for guaranteeing the security of the U.S.

Finally, foreseeable technological developments lead us to suppose that America will succeed in making her retaliation forces invulnerable for the main part, because her ballistic missiles are underground, because they are being moved around under the ocean or in the skies, or because they can be launched from their silos before the enemy missiles can reach them, or, even more likely, because of some combination of all these capabilities. Furthermore it is imperative that such a result be achieved. It is essential that no aggressor be allowed to count on the effect of surprise in taking the chance that he will be able to knock out the American retaliation potential before it can be utilized. However, it is probable that the Soviets will do the same. Consequently, the only targets available for destruction on either side will be the cities. At that stage, the use of force would imply self-destruction. Even if the stakes were absolutely vital, it is even now hard to imagine that such an eventuality could come to pass. On the other hand, if the nuclear weapons are not absolutely decisive, it is hard to believe they would be brandished, that blows would be exchanged, or that tremendous destruction would be heaped up on both sides, for a matter of secondary importance. No, under such circumstances, the policy of massive nuclear retaliation on behalf of another country loses its credibility, and some other policy must replace it, or at least it must be augmented by other means whose use is less problematical.

All these events, all these factors and all their consequences have arisen in the past eleven years. It is understandable that a defence system set up under a certain set of conditions should require some readjustment when the conditions have changed. As for General de Gaulle, he has not concealed the fact that he feels it necessary to be able to practise the same deterrent policy also, but on a national basis. In addition to the collective system, he would like a retaliation force, whose likely employment he thinks should be more believable.

The question then arises, however, as to whether such an ambition is within the capabilities of a country the size of France. Everyone in America and Great Britain knows the cost of the Manhattan Project, as well as the current outlays for the British nuclear explosive programme and American work on ballistic carrier missiles. Despite appearances, however, it does seem that French ambitions are limited. And here we come to the second of the two principles mentioned previously.

This second principle is that the new weapons have a certain neutralizing effect on demographic, economic and military power. It goes without say-

ing that, at least for the time being, atomic weapons can be developed and produced only by countries that possess a large pool of scientists and a strong economy. According to the Oppenheimer formula, atomic weapons make rich countries richer more than they make poor countries richer. It is also to be noted that, chronologically, the powers attained atomic status in the approximate order of their industrial and economic capacities. However, among the nuclear countries, even if their weapons are very different in quality and quantity, a certain parity is easily attained. From the standpoint of security, this parity undoubtedly exists between the Soviets and Great Britain, and that is true despite the disparity of their nuclear forces. The fact of the matter is that the quantity and quality of weapons used to be decisive militarily. A country that could mobilize and arm a million men could logically be expected to win over a nation that could only muster up 500 thousand men of equivalent fighting strength. Nowadays, however, a nation with a stockpile of 50 thermonuclear missiles does not have to bow down to a country with 500. Despite the numerical difference, the stronger nation could hardly run the risk of provoking the use of such a devastating arsenal against it. If countries like Switzerland and Sweden are considering basing their neutrality on a small atomic force, it is because both countries know that they do not represent such important stakes that any enemy would be willing to run the terrible danger of provoking their atomic retaliation.

At the present juncture of international affairs, the American experts naturally consider their own country as the one with the most to risk in the new classification imposed by the weapons of mass destruction. If the Soviets had no way to achieve world domination other than a direct test of strength, they might be willing to suffer very heavy destruction in order to eliminate completely the major obstacle which the U.S. represents. Certain American study groups which examined the problem have even come up with figures; they estimate, for example, that if the Soviets had to pay 20 million casualties for the total destruction of the American force, the risk would be worthwhile in view of the decisive results that would be attained. Such arithmetic is probably valid in the atomic age for calculating the dangers involved in resorting to force. If we apply it to nations other than the U.S., we discover what may be called the "proportional deterrent". It is clear that an aggressor determined to win world mastery can accept risks proportional only to the results he expects to achieve. He cannot afford to suffer heavy casualties in order to take over a country of secondary importance. Considered individually, each nation of Western Europe is no more than a pebble in the path leading to world domination. No single one of them is worth heavy destruction and high casualties. A deterrent policy can thus be proportional to the stakes it is trying to defend. Regardless of how important the French may consider themselves, they know that their country does not represent an absolutely decisive obstacle to world conquest, as the situation between the two power blocs now stands. Reducing France by force is not worth sacrificing everything. Even with limited resources, France believes she can establish a balance between the value she represents to a possible aggressor and the "quantity of destruction" she could inflict if she were vitally threatened. In the nuclear age, it is perhaps more difficult for a country of America's size and importance to employ a deterrent policy successfully than a far less powerful nation. The paradox is only a seeming one. Analysis shows that, with a verification of certain conditions, nuclear armament can partially cancel out the advantages conferred on an enemy by his strength and power, and can effectively guarantee the security, perhaps not of the weak, but at least of the "medium" powers against the "very strong" ones.

This concept of the new relationships of forces, occasioned by the new weapons of mass destruction, justifies the French policy of deterrence—as well as the U.K.'s policy—and answers the criticisms that have been made of the French atomic programme. In any event, the nuclear arsenal of a country such as France will always be inferior quantitatively—and probably qualitatively—to that of the Soviets, for example. Theoretically, in order for the French deterrent to be meaningful, it need merely represent a "quantity of destruction" equal to or greater than that which a potential aggressor could afford to incur if he should decide to attack the country. Unlike past systems, the strength of this deterrent force does not have to be measured against the enemy's military capabilities. It may be far less powerful than they are, inasmuch as it is enough for it to correspond to the importance of the country possessing it. What really counts, moreover, is what the enemy thinks of the deterrent, no matter how superior his forces may be. And here we come to another somewhat unexpected feature of the balance that may exist between two nuclear countries, even if they are of unequal nuclear strength. It is their realization of this strange law of equality with inequality that impels the smaller nations to acquire or develop an atomic arsenal—although it

may be limited and proportional to the stakes they represent, or believe they represent.

Such appears to be the logic on which a national policy of deterrence may be founded. First of all, the risk incurred in using these weapons is so great that it is hard to expect any nation to sacrifice itself in order to protect another. Furthermore, a second rank nation need not assemble any tremendous force in order to practise a deterrent policy. The "proportional deterrence", which the American experts quite properly reject in the case of their own country, is perfectly feasible for the protection of a people whose elimination would not upset the world balance of power.

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It is self-evident that the rules of the game of "deterrence by threat of nuclear retaliation" will be applicable only in the most serious cases and as a last resort. Only at the stage when everything was about to be lost would the use of such weapons have to be feared. Employing them, as used to be done with divisions and fleets, to back up the various phases of day-to-day diplomacy would be out of the question. It was possible for the German Kaiser to send in the "Panther" and, by means of the "Agadir coup", let it be understood that his country intended to defend its interests in Morocco. Conventional forces lent themselves to that sort of combined diplomatic and military activity. Their size was determined by what was at stake in conjunction with the international situation of the moment. Today, a nuclear arsenal can obviously not be brandished in defence of secondary interests, for the application of the threat would not be credible. The proof of this statement lies in the fact that Mr. Khrushchev's too frequent threats, although still effective on the masses, are no longer taken seriously in diplomatic circles. No one can believe in the political use of a weapon which everybody knows will not be employed unless the freedom and lives of the people who possess it are at stake —and perhaps not even then.

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The new armament programme being developed by the French government for the coming five years indicates the size of the deterrent force planned, inasmuch as one of its items calls for the production of about 50 supersonic bomber aircraft capable of carrying the national atomic payloads, and inasmuch as it also provides for the development and construction of ballistic missiles. No doubt General de Gaulle feels that this small bomber force is in line with national capabilities and also that it corresponds to the obstacle that France represents to world domination. Clearly, this obstacle is in no wise comparable to that of the United States, so that a deterrent force guaranteeing the integrity and independence of France need not necessarily represent the same destructive power as the Strategic Air Command.

The second stage that is planned, the ballistic missile stage, is more difficult. Incidentally, it is not necessary that France tackle it on her own. In this connection, there is regrettable confusion between the possible employment conditions and the production conditions of the d e t e r r e n t weapons. Although the possibility of a national reflex action is more credible than a collective decision in the case of their employment, the national concept is not mandatory for their development and production. The attitude of the American State Department in considering a wider geographical distribution of IRBM's under dual control is full of interest. Such a policy, if developed and widely applied, would perhaps provide the best of all solutions to the difficult problem of defending the Western world both against all-out aggression and, under certain circumstances, against limited aggression.

The U.S. might, for example, make a certain number of ballistic missiles available to an ally, and their employment might be made subject to dual control, that is to say, each of the countries concerned, the one supplying the missiles and the one on whose behalf they would be used if necessary, would exercise a common physical control over their employment. The transfer would be sanctioned by a bilateral agreement. Provision would be made in the agreement that if certain danger criteria should one day be exceeded, the U.S. would lift its control and the threatened partner could then take the risk of using the weapons as it saw fit. Naturally, the list of dangers that could suscitate such retaliation measures would be quite short. Obviously, they would be acts of outright aggression of such violence and scope that the very existence of the threatened people would be at stake. In all other cases, if the threat were not decisive and if it were not included among the few danger criteria defined by the treaty, the dual control would remain in force and the missiles could not be launched.

This procedure would offer the advantage of satisfying both contracting parties while bringing a certain risk to bear on the would-be aggressor. The sovereignty of the nation thus defended would not be infringed upon, since it could quite

obviously not threaten to use its atomic arsenal except in circumstances extremely grave for itself—which would be the very circumstances covered by such a bilateral agreement. As for the United States, its control would afford it every guarantee against adventurers and the dangers of the untimely employment of mass destruction weapons. And if, in a serious emergency situation, the potential aggressor chose to ignore the deterrent and the United States were held responsible for releasing the second control, what could the aggressor do to America? Would he run the risk of mutual annihilation simply in order to seize a nation of secondary importance, such as the one covered by the agreement?

If a formula of this sort is advanced here, it is because it seems to us as though it might at least partially solve the problem of defending those countries which are unable to provide themselves with everything they need to guarantee their own security. That means almost all the nations of the world, who are less and less able to keep up with the pace now being set in the technological race.

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These ideas are, of course, justified only if we take a very dim view of the world in which we live and in which we shall continue to live. Can we take any other view, however, when differences in living standards are becoming greater and greater and when the powerful forces of public information and propaganda are being used more and more for the preaching of violence and hatred? Without really being responsible for it, the West is involved in an unrelenting test of force, the instruments and forms of which are absolutely new. It is normal for it to use all of its intellectual and technological resources in order to deal with it.

"It is very important to realize fully the fundamental thesis that the development of all the conditions which determine the character of contemporary warfare is now proceeding incomparably more swiftly than ever before. Hence, the tempo of the development of military science must today be also quite different, and this is a factor which must be taken into account in the training of troops and, particularly, in the training of officers. One must remember that the knowledge acquired in military schools and even in senior military academies quickly becomes obsolete. Military men must, therefore, study the military theoretical sciences daily and intensively in order to keep the development of military affairs abreast of the contemporary pace."

—Major General G. I. Pokrovsky, Soviet Army

The Enigma of Modern War

AIR VICE-MARSHAL SIR LAURENCE SINCLAIR

Air Vice-Marshal Sinclair was commissioned from the R.A.F. College, Cranwell, in 1928. After distinguished wartime service, during which he was Air Officer Commanding the Tactical Light Bomber Forces in North Africa and Italy, and Senior Air Staff Officer of the Balkan Air Force, he returned to Cranwell as Commandant in 1950. He became Commandant, School of Land Air Warfare at Old Sarum in 1952 and was appointed Assistant Chief of Air Staff (Operations) in 1953. Air Vice-Marshal Sinclair became Commander, British Forces, Arabian Peninsula in 1955, and was appointed to his present post as Commandant of the Joint Services Staff College in 1958.

Introduction

"VICTORY, in the true sense", wrote a prominent British strategist,* "surely implies that one is better off after a war than if one had not made war". He made this observation prior even to World War II and after that war there must have been many, in Britain at any rate, who would have agreed wholeheartedly with him. Now, in the age of nuclear weapons, the sentiment takes on a particular pungency, for as long as military action remains a possible reinforcement to political policy, it is extremely difficult to calculate what exactly will constitute victory. This, of course, is the very crux of the "balance of terror" and it has led the world powers into complex assessments of how war might be limited so as to offer, in the event, a reasonable chance of the kind of victory which this writer was postulating.

It is with this underlying thought in mind that this article considers limited war within its framework of the total war deterrent; and offers some views on the composition, deployment and use of the forces which may be required.

The Protracted Conflict

We all know well the basis of the struggle between the Communist bloc and the West. We recognize how this struggle has polarised the world's industrial and military power into two ideological camps, the one based on subordination of the individual to the state, the other based on that same individual's freedom. Moreover, as we continue to live in the ambience of this struggle and watch it dictate our everyday way of life, we become acutely aware that the Communist aim of world domination shows no sign of diminishing. Nonetheless, in the interests of true perspective it is worth underlining two aspects of this clash of ideologies; and these can, for convenience, be regarded as analogous to the well-known military factors of time and space.

In the first of these factors lies our need to realize that, in the Communist mind, the time scale is indefinite and indefinible. This is, perhaps, best exemplified by Mao Tse-tung's doctrine of "protracted conflict". His theme of "enemy advances, we retreat; enemy halts, we harass; enemy tires, we attack; enemy retreats, we pursue" aptly illustrates the psychology behind the nagging, shifting policy with which we have increasingly to deal.

The second factor of space is constituted by the wide spectrum of activity over which the Communist advance proceeds; for we have seen how cultural influence, political subversion, economic penetration, guerilla tactics, limited war and the brinkmanship of total nuclear war, each plays its part.

It is a combination of these two factors which, since World War II has set militant Communism on the march, spreading through much of Eastern Europe, through China, North Korea and North Vietnam, and into areas of the Middle East; and which has forced upon the West the defensive aim of containment. In other words, we in the West are faced with an unrelenting tide. This tide we have to some extent dammed by the deterrent power of nuclear weapons but it goes seeping on in the form of cold war and can come up to flood level from time to time in the form of limited war. If, therefore, we begin by examining the "constants" of deterrence and cold war, the configuration of limited war becomes more easily defined.

The Power of the Deterrent

It seems clear that until nuclear disarmament

*B. H. Liddell Hart in his book "The British Way of Warfare".

is achieved, and short of some most unexpected break-through in nuclear progress on either side, there is little likelihood of deliberate total war. There are those who argue that as Russia increases her missile lead over America during the next three years or so, she may be tempted to apply counterforce tactics and to remove the West's striking power in a pre-emptive strike. But such a policy on the part of Russia would surely be hazardous to the point of folly. Russia can never really know, until the day, whether the West's retaliation will be too destructive for her to bear, or even the most delicate calculations behind a pre-emptive strike may prove slightly wrong; and slightly wrong in terms of Western megaton counter may be fatally wrong in terms of Russia's future. If, therefore, any conclusion is safe in this game of nuclear poker, it is that the deterrent as a means of protecting the homelands of the North American continent and Britain will hold good, despite slight shifts towards superiority by either side.

Thus, the more important problem with the deterrent is how far it is valid beyond defense of these homelands, particularly on the occasions when Russia may hold the "counterforce edge", because it is then that she will most certainly exploit it. How, for example, does Western Europe stand under such circumstances? Is it protected from Russian aggression by the Deterrent?

Western Europe is the area in which Russia has in the past posed her most serious threat, and, in consequence, the forces of NATO have been developed to a level where there is no room for manœuvre. It is therefore an area in which one false step could precipitate a crisis, where an incident premeditated or unpremeditated might be most likely to develop into a general war.

But, if the events of 1958 are any yardstick, the Russians are every bit as aware of this as is the West. At that time, temporarily deprived of the initiative both in the Middle East and the Formosa Straits, Russia attempted to regain it in Europe. Yet she was most careful to avoid any dangerous entanglement with NATO's military forces and chose instead to employ proxy action by East Germany over the question of Berlin. When the West held its ground in the ensuing war of nerves, the Russians accepted a sort of postponement-cum-stalemate. It can be argued with considerable force of logic that the deterrent was responsible for this incident remaining within sensible bounds; for the deterrent is the instrument of power behind the shield forces of NATO and thus it is the deterrent which makes creditable the defence policy of Western Europe. Here, in fact, because of the delicate situation which obtains, the deterrent not only prevents total war but, in association with the shield, almost certainly rules out limited war as well.

In the other "sensitive" areas of the world, however, the deterrent has a much less powerful effect. For instance, now that Russia's nuclear strength matches that of America, no longer can the latter resort to threats of massive retaliation. In other words, no longer is Russia debarred from, say, a subtle move into Iraq by fear of a Western threat to use nuclear weapons on Moscow, because for the West to do this would be to invite a suicidal slogging match. The fundamental point here is that in Western Europe the forces and geographical possessions of both sides are locked together, whereas in the Middle East (and the same applies generally in the Far East) uncommitted countries are entangled with the two major antagonists. Both Russia and the West, striving as they are for the allegiance and/or friendship of these uncommitted countries, can hardly expect to gain it by turning them into a nuclear battleground. It might even be said that in the Middle East there exists a kind of disengagement and it is interesting to speculate what a similar situation might mean in Europe. For, desirable though disengagement in Europe might be from a political point of view, it could prove just that opportunity for Russian manœuvring and "nibbling" which, as in the Middle East, weakens military deterrence.

For the present, however, it seems to be in the sensitive areas outside Western Europe that the Communists and the West are most likely to fight a limited war if, indeed, they fight at all.

It follows, then, that within the context of this article, the general conclusions which we can draw regarding the deterrent are three-fold. Firstly, it will continue to protect the homelands of the North American continent and Britain. Secondly, in conjunction with the Western shield forces, it will deter both total and limited war in Western Europe. Thirdly, whilst probably preventing total war from breaking out in the Middle East and the Far East, it will not necessarily be a safeguard against limited war. Lastly, as a corollary to these conclusions, on the occasions where Russia has the edge in nuclear striking power, such advantage will probably tempt her to increase pressure in the limited war areas rather than play for higher stakes in total war poker.

It is evident from what has been said above that the cold war is the everyday application of "protracted conflict" and, in a general policy of all mischief short of war, the Communists have two particular aims. The first is to exploit to the maximum nationalism and anti-colonialism (and the two are frequently found going hand in hand); the second is to disrupt the West's protective alliances, NATO, CENTO, and SEATO. This pin-pricking doctrine is of peculiar advantage to the Communists in that, besides nagging at the West as a whole, it exploits differences of policy as between the Western nations themselves. No matter how firmly the West may close the doors of its house, the family squabbles can still be heard by the neighbours, as witness France's policy in North Africa and that of America towards Communist China. In fact, a brief survey of the problems facing Britain shows typically how difficult it can be for the West to produce a cohesive approach to the cold war.

Britain is as well aware as any other country of the Communist threat and recognizes her inability to cope with it on her own. Believing that her power and influence constitutes an important factor in overall Western strength, she sees certain lines of action lying before her. She must aim, for example, to work in closest harmony with the United States. Yet even the best of intentions in this respect cannot rule out clashes of interest because, fundamentally, her problems are so very different from those of America. Britain is an island nation and the centre of a great commonwealth of countries. Her wealth, in fact her total national productivity, is geared to overseas trade. She has limited raw materials and natural resources and, therefore, to exist she must import materials and export manufactured goods. Thus Britain is irrevocably tied to overseas trade. With her, it is a case of export or die. America, on the other hand, is a vast land with vast resources, with the ability to be self-sufficient. These differences must, inevitably, and indeed do breed a different outlook on life; and a different outlook on life cannot but detract from complete harmony in foreign and defence policies.

Again, the British Commonwealth as a whole has potentially a great deal to contribute to the strength of the West. But the individual policies of its members cannot, because of the intangible nature of the Commonwealth ties, always be subjugated to the common cause. Thus, India must tread warily with China and Canada must pay due regard to the policies of her American neighbour.

Another typical example of Western difficulty is to be found in Britain's relations with her remaining colonies. Here, Britain has a responsibility to the world for ordered progress. She must, for instance, lead these colonies towards independence with enough speed reasonably to satisfy the demands of nationalism yet not so quickly that subsequent instability will let in Communism.

Problems of this kind force Britain to adopt an overseas strategy which may not necessarily be in the best interests of the West as a whole, because the wide dispersion of forces involved could detract from the rapid concentration of force necessary to meet serious outbreaks of trouble which could arise from the "protracted conflict". Yet, on the other hand, the mere fact that Britain must adopt such a strategy is not without advantage, for it means that she continually has to deal with problems of world-wide deployment and so gains experience which can be of value to her allies. It is, therefore, worth looking briefly at the manner in which Britain is tackling this strategy today.

In addition to her own purely national requirements, Britain also has to consider her obligations to CENTO and SEATO and the basis of her strategy is a series of garrison forces. These, consisting of elements of all her three Services, are to be found in Hong Kong, Malaya, Singapore, the Persian Gulf, Aden, Somaliland, East Africa, Cyprus, Libya, Malta, Gibraltar and the West Indies. Fundamentally, they exist only in sufficient strength to meet the day-to-day threats and need reinforcing when it becomes necessary to counter any increased external pressure. To cope with such pressures in the first instance, theatre reserves are stationed in Malaya, East Africa and Cyprus; and behind these theatre forces is the strategic reserve held in the United Kingdom.

Clearly, the key to success in any such system is mobility, especially when one acknowledges the speed with which incidents can be generated by the cold war tactics of the Communists. Effective air reinforcement is therefore essential and to this end each of Britain's overseas theatres has its own medium range transport force, which in turn is backed by a long-range force positioned in the United Kingdom. For reinforcement in tactical air support, an element of the UK-based fighter force is mobile and can be deployed rapidly though, obviously, adequate and available overseas bases are a prerequisite for its efficient use. But adequate sea power is also a necessity and, here, carrier aircraft, a Commando carrier and

amphibious forces all play an important part. Behind these "fire brigade" forces stands Bomber Command which, though based in the United Kingdom, can swiftly and effectively put in a heavy punch should it be needed.

It can be argued that this concept has serious limitations in an age where political foibles may restrict or withhold the use of overseas bases and/or overflying rights; and there is considerable truth in this assertion. However, the trend of Britain's foreign policy is such that she is becoming less and less likely to embark alone on military ventures other than in defence of her own possessions or in the interests of internal security. This being so, her strategy is predominantly tied to that of her allies and it is in this context that her deployment of forces makes sense.

If, with this very brief sketch of Britain's capability in mind, we now consider Allied resources, the picture of the West's global strength, as it exists in the daily stirrings of the cold war, becomes apparent. Here immediately, the might of America stands out from the backcloth; her tremendously powerful fleets with their air strike forces, her Marine Corps and her far-ranging bomber represent military power which is as formidable as it is versatile. To fill in the background of the picture are the forces and resources of the Commonwealth countries, plus those of the other members of the Western alliances; and so we see in total a vast military potential, diverse and world-wide. It is a formidable instrument of power to back the political and economic manœuvring which, at the present time, forms the main medium for the protracted conflict.

At first sight, therefore, it appears to possess, in its own field, a capability analogous to that of the deterrent; that is to say, it might be supposed that, just as the deterrent blocks total war, so do these world-wide forces of the West pin cold war into the political and economic fields. But there is one factor which seriously upsets this desirable hypothesis; it is that whereas there is cohesive wielding of the deterrent by the West, such cohesion is lacking, and indeed is virtually impossible, in the cold war forces. This is a serious handicap when we remember the ambiguous, shifting nature of the threat. It is not difficult for any astute adversary, and Russia is all of this, to spot that these are chinks in the West's armour; and it is through these chinks – the places and occasions where Western policies diverge most – that Russia and China, by the nature of their ideology, will probe.

The sum of military power in the world today is therefore like some enormous fist seeking to contain the glutinous substance of peace; and whenever it is clenched too fiercely, limited war may squeeze out between the fingers.

The Dilemma of Limited War

If this, then, is the setting for limited war, what is likely to be its nature? It is on this question, of course, that there is great divergence of view, because of the enigma of whether nuclear weapons will be used or not; and it is apposite to examine some of the arguments which have been put forward.

Firstly, it is maintained in some quarters that in any sizeable war nuclear weapons will inevitably be used because they are a logical progression in fire power, because they are no more revolutionary, in fact, than the crossbow, gunpowder or the aeroplane. The introduction of fractional-yield weapons is often quoted by this school of thought to reinforce its view that nuclear war can be limited.

A contrary argument here is that once nuclear weapons had been used, it would be impossible to limit their size and range and thus the area and intensity of the conflict. No side, it is said, having committed itself to war and faced with the danger of losing, could be expected to deny itself the use of its full range of weapons. The sum of argument on this point seems to be that, though it may appear logical to use any weapon in war, it is no use trying to fight to a book of rules.

Secondly, there is the concern of those who see grave danger in the Communist trait of fighting by proxy. It is maintained that small powers are now getting, or can quickly be given, first-class conventional armaments and that, in a limited war, such powers could be given virtually unlimited reinforcements by the Communists and, futhermore, if needs be could be stiffened by Communist volunteers. Therefore, unless the West was prepared to be dragged into a long, indecisive and possibly gradually-extending war, the only alternative would be to try for a quick, limited victory by using nuclear weapons.

The antagonists of this view argue mainly on moral grounds and maintain that if we in the West are fighting on the side of right against evil, we cannot justify the use of nuclear weapons because to do so would be to risk bringing down mass destruction on the whole world.

These are sincere and understandable views and they cannot be discounted in the formulation of the West's political and military policies. But the main difficulty, militarily, would appear to lie in

the dilemma which might face a commander if he were confronted with an enemy possessing nuclear weapons but could not use his own first. This could well be a typical situation in the future if the forces of UNO were sent to the aid of a small power which had been the victim of Communist aggression. Under these circumstances, the commander must either deploy his ground forces in a conventional manner, in which case he lays himself open to destruction by nuclear attack, or alternatively he must deploy in a nuclear posture, thereby giving his enemy the opportunity to huff him by attacking conventionally. It is in this respect that the geographical nature of Western strategy imposes its own handicap, for wherever we in the West may fight a limited war, it seems certain that our forces will have to be deployed on foreign soil. This presupposes that they must be maintained from an overseas base or an afloat stockpile by a complex line of communication involving the use of ports, beaches and airfields; and all these are vulnerable targets for nuclear attack. This is the penalty we pay for being tied to what is fundamentally a maritime strategy. In contrast, the predominantly land strategy of our political enemies confers an advantage in that overland supply can be diversified so as to avoid dependence on a few vital points. It seems certain, in fact, that whenever there is a remote nuclear threat in limited war (and this threat will always be poised, no matter how remotely, so long as we are engaged against Russia's proteges) our logistic system will be the tender spot which aggravates the dilemma of the commander.

The sum of these arguments, and the many others which go with them, is difficult to make but it is clear that the dangers surrounding limited war are very real. They stem from the uncertain nature of limited war itself, from the clouded nature of what may be the outcome of the many minor conflicts in which we could become embroiled. These dangers can become untenable unless we are prepared for a whole field of eventuality. Our forces to meet such eventuality must be a logical projection from our existing deployments for the deterrent policy and cold war, the latter, as we have seen being largely determined by the needs of individual nations. They need so shaping that we can readily apply a suitable version of the NATO shield principle. This calls for highly mobile and efficient ground forces in sufficient strength to meet any scale of challenge which opposing local forces could make. These ground forces require an air backing, based as practicable in carriers or on land, which is capable not only of countering the enemy air threat but also of providing a heavy bonus of conventional fire power for ground support. On the analogy of the shield forces this may not, however, be enough. Therefore, there must also be available an initially discreet nuclear threat, ready to be declared and used in the tactical theatre. All these forces derive their ultimate validity from the global threat of nuclear striking power, permanently ready to deter full-scale intervention by the Communist Powers and thus, we must hope, with the power to keep local conflict limited.

Conclusion

The foregoing is but a brief survey of what we all recognize to be a most complex problem. Yet, overall, one encouraging conclusion can be drawn from it. This is that the policy of deterrence itself is not necessarily, as so many people argue, a threat to mutual suicide, for it narrows down the field of conflict between East and West; and this is an important consideration when related to Communism's determination to engage us over the widest possible field. If, as a result, limited war appears to become our most vulnerable front, then it seems logical to attempt an extension of the nuclear umbrella. This, admittedly, means providing both conventional and nuclear forces for limited war; and no one can deny that it is an expensive policy. But there seem to be two potent reasons why we must accept such a policy; firstly, there is always likely to be in the future the remote nuclear threat mentioned above; and, secondly, if this policy can limit limited wars or perhaps eliminate them altogether, the expense is justified. The pessimist will say that this can only lead us to near-bankruptcy and consequent defeat in the economic field. But if we have such lack of faith in our Western system, in our way of life and in our love of freedom; and if we are not prepared to make the sacrifice necessary for adequate defence, then we are already well on the way to defeat.

In the enigma which faces us today, we can do worse than take heed of Sir Winston Churchill when he said, "I do believe that the creed of Communism, which rests upon the foreign domination of states and the persecution of individuals, will never prove a more attractive way of life than the national and personal freedom which is the foundation of the Western World . . . Let us therefore have faith in ourselves and in our ideals, and right will surely triumph".

Effective and Secure Deterrence: The Oceanic System

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IN the first part of this paper I shall set forth the principal facts governing the military situation of the Western World and draw certain conclusions relating to the nature of an effective deterrence to war. In the second part some specific applications are made to an "Oceanic System" of defence.[1]

The *first* fundamental fact of the day is the deep antagonism between the free world and the communistic bloc, each side threatening the other by virtue of the mere possession of large amounts of heavy nuclear weapons and a high, indeed increasing, capability to deliver them on chosen targets in the countries of the opponents.

Whatever the motivations of the antagonism, the present distribution of weapons and delivery capabilities alone make it imperative for the West to seek a defence against possible aggression.

The *second* fundamental fact is that direct, active defence against heavy nuclear weapons has, for all practical purposes, vanished. Even with our present active defences against massive bomber attack it is certain that a major attack will succeed in destroying military bases and especially countless cities. No active defence whatever exists against the ballistic missiles that are taking the bombers' place and none can be expected to be produced and deployed in strength in the foreseeable future. Hence it is necessary to find other, indirect means of "defence" in the creation of a *deterrent power*. This power will not be directed against the enemy's attacking force, nor necessarily against the bases from which it originates, but rather against the possession he values most—his cities, his industries, his people, his very life.

The deterrent will be called *effective* if the guaranteed consequences of an aggression are unacceptable to the enemy. He will then be deterred from carrying out an attack. He will have to try to gain his objectives by other means than large scale thermonuclear war. This deterrence will last as long as (a) he cannot prevent the consequences from occurring, or (b) he lowers his evaluation of these consequences to himself. For example, the consequences may be 50 million of his people killed; if at one time he thinks that this is too high a price to pay in order to destroy the United States and gain world domination, then the United States' deterrent is effective. If at another time he thinks this is a price worth paying, the deterrent is then no longer effective (if the United States' power has remained limited to that above number).

The valuation a country puts on its own losses is the most uncertain element in determining the effectiveness of the deterrent. The United States will be well advised not to use its own yardstick in estimating what losses the other side may consider acceptable in order to be able to rule the world. In addition, there may develop a wide difference between the human losses Soviet Russia would find unacceptable, but which China would tolerate.

The traditional deterrents in military operations have been (a) active defence against enemy operations and (b) counter stroke against the sources of his military power. Whenever active defence was insuperably strong an enemy would be successfully deterred from an attack. Active defence having practically vanished, there remains possibly the counter stroke. But even here the effects are dubious, since the powerful megaton weapons the enemy is bound to use in large numbers in an attack on the United States' homeland make a decisive single-blow more and more likely. Once he

has struck, there are no sources of continuing military value left and there is no need for continuing operations. Consequently the counterforce has to become a retaliatory *force* which seeks to deter the enemy by being poised to destroy his most precious soft targets, i.e., the cities, the industrial machine and the population of the enemy country. Possible retaliation is then the deterrent on which we must rely.

Retaliation is therefore a substitute for active defence, and for strictly military counter operations. Retaliation signifies the breakdown of the balance of normal military operations by one country against normal military operations carried out by another. Deterrence lies at present in a different plane, where it will remain for the foreseeable future until unpredictable scientific discoveries are made which would change conditions profoundly once more. No such discovery is now in sight.

The *retaliatory force* will constitute an *effective, convincing deterrent* only under specific conditions. These are:

(a) the force must be able to act when so ordered;

(b) a sufficient part of its power must be able to get through whatever active enemy defences are encountered, in order to inflict the critical unacceptable damage.

Condition (b) is easier to fulfill than condition (a).

(c) the enemy must know that the force is able to inflict unacceptably high damage upon his country;

(d) the enemy must be convinced that the retaliatory force will indeed be used at some point of his aggression even if he should be capable of inflicting grave damage to the United States homeland.

The enemy will, in case of large scale aggression, direct all his efforts towards nullifying the retaliatory force, making (a) impossible.

Retaliatory forces will have different degrees of *vulnerability*. A vulnerable retaliatory force has the following properties:

(a) in order to act it has to receive warning of an enemy attack in a time interval that is longer than is required to dispatch the force (planes or missiles);

(b) it has to strike with its entire power; no part of it can be held back for graduated retaliation lest it be destroyed—and the total retaliation fall below the critical level.

A vulnerable retaliatory force invites enemy surprise attack, and is exposed to false signals. If the wrong signal is acted upon, disaster is certain: if in case of attack the force fails to rise in time, the force is destroyed; if it is dispatched with no possibility of re-call (as is obviously the case for ICBM's) when an attack is falsely reported, Russian retaliation is certain and the destruction of our cities is assured. The converse is true for the Soviet Union which, if in possession of a vulnerable retaliatory force, is subjected to precisely the same conditions.

Thus vulnerable retaliatory forces make accidental large scale thermonuclear war a distinct possibility. The probability of accidental war rises steadily as the transition to quickly dispatched missiles is accomplished. All the forces presently active work inexorably in this direction.

A *vulnerable retaliatory force* is a poor deterrent because it is essentially suitable—though perhaps not originally intended—for a *pre-emptive strike*, i.e., for an attack on the opponent who is at that moment reported to, or believeed to be engaged in crucial preparations for a surprise attack of his own. It is thus not a retaliatory force in the true sense at all, with a retaliatory force's proper function of deterring war by virtue of its mere existence. Rather it is a counter stroke force.

It is unlikely that the development towards the capability of almost instantaneous dispatch by the enemy of obliterating masses of ICBM's will leave any time interval in which a pre-emptive strike could be technically carried out.

If it is not to be used for a pre-emptive strike, a vulnerable "retaliatory" force can only be used for a *first strike*, completely unprovoked even by the imminence of the enemy's military strike preparations. Neither the United States nor any western country will even consider or undertake this kind of preventive war first strike. Hence a vulnerable United States' striking power which demands exactly this type of behaviour, is entirely inappropriate.

An *invulnerable retaliatory force*, has, on the other hand, the true properties of a *secure, effective deterrent*: this force is secure because it is not subject to destruction by sudden surprise attack. Hence, if the country is attacked in one form or another, retaliation can be graduated over time and in weight, thus also leaving opportunity for political response. The deterrent is effective because the opponent knows that the consequences of our possession and using the retaliatory forces cannot be avoided. Hence the needed strength

is determined only by the amount of damage unacceptable to the opponent or combination of opponents, and there is no need to make the force arbitrarily larger.

The question whether an "invulnerable" force can be constructed is a technical one; at present it can be answered in the affirmative. In fact, there exist now several forms in which invulnerability can be reached. The optimal answer will demand a mixed system, i.e., one that consists of several widely different components, each one of which having its own characteristic form of near invulnerability. In Part II the "Oceanic System" is discussed, describing such an arrangement.

"Invulnerability" is, of course, a relative concept. In the long run technological progress may make obsolete the present forms of invulnerability. If a mixed system is in use, several discoveries may have to be combined to invalidate the system as a whole—a remote chance at the present time.

If an effective, secure deterrent is created by one side only, the danger of large scale, accidental war still exists and there continue to prevail justified fears on the side that does not possess an invulnerable force. That side still faces the need to have its force react (possibly on the basis of false signals, or falsely interpreted true signals) with the totality of its power, at once, as if by reflex. In addition, the vulnerable side invites an attack from the securely placed opponent.

Hence, if only one side possesses an invulnerable retaliatory force, there exists no *mutual* stability.

Mutually effective, secure deterrents are required in order to stabilize the bi-polar relationship now given in the conflict between East and West.

It follows that stability of the conflict situation can be obtained only when each of the two antagonists possesses an effective, convincing and secure deterrent in the form of invulnerable retaliatory forces of a strength whose use would be wholly unacceptable to the respective opponent.

In such a situation additions to this strength are no longer meaningful since they add nothing to the power to deter an aggressor. Conversely, it might even be possible to reduce, by means of negotiations, an excess power above that needed for rendering unacceptable damage. While this would not materially influence the mutual deterrent situation, it might have a beneficial influence on the world by demonstrating that it is possible to initiate arms limitiation and possibly by creating an atmosphere in which further true reductions might be accomplished.

The conclusion that emerges from these considerations is that the United States must make the greatest immediate effort to make its deterrent secure and effective. There can be no question but that the Soviet Union is already on the way towards obtaining such a deterrent for itself. If she reaches that position before the United States has obtained the proper deterrent, she will be tempted to exploit the inherent advantage possibly by attack, certainly by increasing demands and threats. There is mounting evidence of the latter.

Stability of mutual deterrence can be maintained only if no "jumps" in military technology occur and remain the property of only one side. Should the Soviet Union make and introduce discoveries that would nulify the invulnerability of the American retaliatory force, the present unstable situation would return. Should the United States make and exclusively introduce similar discoveries, a corresponding result would follow.

Invulnerability of effective retaliatory forces *on both side* implicitly removes the principal underlying forces that accelerate the present arms race. The present arms race is self-generating in the sense that each side is forced, by the mechanics of the situation, constantly to keep up to a level of power that is determined not by the intentions of the two blocs, but rather by the inherent effects and possibilities of technological changes in weaponry.

Once invulnerability is achieved, then by contrast the only condition has been reached under which serious consideration can be given to disarmament. The first aim of disarmament negotiations must be to stop that part of the arms race which is due to each side's desire to be always "stronger" than the other. Their second aim must be to limit the power of the mutual deterrents by agreement, and if possible eventually to decrease the whole level of armaments to a significant degree. At present no methods are known by which a decrease can be effected.

Arms limitation and disarmament can successfully be advocated only by a power that is in a secure, strong position, not by one exposed to a devastating attack that it is unable to fend off either by direct active defences or to prevent by the indirect deterrent of retaliation.

No matter what military deterrent system the principal opponents possess, basic scientific discoveries that have conceivably major influence upon the deterrent power, either by overcoming that of the opponent, or by creating a new form of

power for their own country have tremendous importance. Since basic research cannot be stopped, or even retarded, in the modern world, the obvious conclusion is that basic research be carried out in the open, for all men to see. To achieve this should become one of the first aims in all disarmament negotiations. Giving everyone free access to all scientific work through publications and visits to all laboratories anywhere in the world, will make it exceedingly difficult, if not impossible, to introduce new weapons and develop new devices in an asymetrical manner, i.e., for one side to create and keep a weapons monopoly.[2]

The preceeding statements have reference to the deterrent against large scale thermonuclear war. It is apparent, however, that the outbreak of other armed conflicts will also have to be prevented. This is important because of the ease with which, by the use of nuclear weapons of increasingly larger yield, even originally strictly local hostilities can be stepped up in intensity. In former wars intensification of fighting and enlargement of the affected geographical area required time-consuming and voluminous preparations.

Once big wars are prevented by a secure, mutual deterrent, conflicts are most likely shifted to other areas: to borderline wars, to limited conflicts in which, though the stakes may be exceedingly high, the survival of the big powers is not directly at stake. It is therefore necessary to create a further deterrent power against conflicts of this type. This may or may not involve the building of large conventional forces, of small commando-type nuclear armed contingents, etc. The point is that the mutual, heavy nuclear overall deterrent, even though secure, is not enough. It has to be complemented by a limited war capability which the United States is lacking at the present time. It is only by a combination of both deterrents that the outbreak of wars can be avoided.

It is not only possible but necessary to extend the concept of the secure, effective deterrent beyond the case of thermonuclear exchange to include these kinds of conflicts. To build such deterrence will involve different weapons systems and operations, but the principle remains the same, i.e., the deterrent is only effective if it successfully blocks an aggressor from engaging in hostilities, rather than punishing him afterwards.

The United States would be at a severe disadvantage if the attempt were made to negotiate arms limitation and disarmament without working at the same time towards an adequate limited war deterrent, even though possessing (by assumption) a secure, effective deterrent against the large scale thermonuclear attack. Without limited war capability the United States would lay itself wide open to actions by the Communist countries which even an ideally designed overall deterrent could not prevent or check since this is not part of its proper function.

II

There are several ways to make a deterrent force "invulnerable". The choice depends on the state of technology, the capabilities of the enemy, the geographical situation and the amount of economic effort one is willing to make. As explained above there is need for a mixed system whose components are as widely different from each other as is compatible with an advanced technology and the geographical structure of the countries under consideration. The principal components of the mixed force shall be briefly considered.

The United States can make its force invulnerable by "hardening," i.e., by the embedding of missiles in concrete shelters and the placement of planes underground. But this has the simple consequence that these sites will come under correspondingly heavier attack. Their locations in the United States and the allied countries are perfectly known to the enemy. With modern missile technology it is easy to nullify any degree of hardening by the dispatch of more missiles with more and more powerful nuclear warheads. Hardened bases draw heavier fire, mostly ground bursts producing deadly fall-out that spreads through the continent. Thus the more invulnerable we make our force *in this manner* the more we expose our own people to this deadly side-effect of a possibly "legitimate," purely military action of the enemy.

Since hardening is ineffective and undesirable we must choose *mobility*. Indeed, we must go further and place the major part of the retaliatory force outside our country, outside the countries of our allies, on the vast expanses of the world's oceans, in fact under the waters. We then combine through the use of nuclear-powered, missile-firing Polaris submarines the tremendous advantages of mobility with invisibility; and we can distribute individual units *randomly*, thereby making surprise attack on any even remotely substantial part of that force impossible. I call this the *Oceanic System of Defense*. A new dimension of sea power has opened up in our age, carrying us far beyond the conventional tasks of navies. It will take a long time before this system can be neutralized by new

weapons developments — there is nothing on the horizon that would indicate an effective countermeasure.

The Oceanic System will also produce a great easing of political tensions: our allies will feel safer, and will not consider themselves primarily advance missile bases, but rather part of a truly unified alliance based on a common political philosophy and conception of life. The enemy will feel safe against accidental attack. At the same time he will be sure that no attack on the United States and her major allies can ever pay off for him. Both sides being in this situation, an effective mutual deterrent has been created (assuming, as we must, at present, approximate equality in strength and nuclear power) and the chances for new political arrangements and even effective arms control and limitation are improved.

The Oceanic System can be extended easily to NATO and should remove some of the difficulties that perplex that organization. These rest essentially in the exposure of the countries that allow nuclear bases to be placed within their borders and in the question of control over the nuclear warheads. With greater emphasis on the Oceanic System, a NATO retaliatory force does not reside in any one country but is at sea and the submarines and other vessels can be manned by joint NATO forces.

The Oceanic System finds its best expression in the Polaris force, but it is not restricted to it. For example, the Polaris missile and its successors can be placed on barges (surface or submerged), on freighters, etc. To bring the system nearer to perfection, the most important task is to increase the range of the missile by a factor of two or three at least. Another possibility is the use of nuclear-powered seaplanes from which ballistic missile can be fired. The United States is lagging in this development which should have been pushed hard because it is supplementary to the Polaris force. The seaplanes are clearly superior to landbased planes also using ballistic missiles, since they too can be randomly distributed and are much less dependent on fixed bases and installations. But as long as manned aircraft are to be used in the mixed deterrent system they should, if possible, also be fitted for missiles.

The mixed force will also have to make use of missiles based on railroad cars and trucks. This method too embodies the principle of constant mobility and allows for a certain degree of the essential randomization of that mobility though less than is possible at sea. Furthermore, this part of the force is by necessity held within the borders of the United States and Canada, as well as in Europe which is a further drawback or limitation. The communication and command problems of the system are formidable, hardly less than those of Polaris. These difficulties can be overcome and at any rate a mobile system is to be preferred over a static system of hardened sites, even if each one of them should be composed of only very few missiles. The political difficulties of adopting a truck and railroad based missile system for the NATO countries of continental Europe appear to be very much greater than those of a NATO contribution to an Oceanic System—a point that should be carefully considered in any evaluation of the two.

Clearly, no single device alone suffices. The deterrent should have several components, as already mentioned and they should, if possible, be widely different in character. But they should embody the principle of mobility, of smallness of individual units, and of random distribution of the various units. Modern mathematical techniques exist to compute the optimal "mix" and to determine the probabilities with which the different locations and routes should be used in deployment. Such a composite system is virtually invulnerable against any mass and surprise attack. It makes, therefore, the greatest contribution towards the effective and secure deterrent which the Western world needs.

If a balance has been struck preventing the outbreak of the so-called "thermonuclear exchange," but if the struggle and cleavage between the two blocs still continues, the area of possible active conflict will shift. The danger that the communists will seek advantage through other wars, limited in scope, occurring far from the centres, is bound to rise. These wars, too, have to be prevented. This requires the creation of a limited war capability nullifying the communist's superiority in manpower. No other devices will do this except recourse to small nuclear weapons . This is nothing but another application based on historic experience that the most modern, proven weapons will always be used where they offer a clear-cut advantage. The western bloc is singularly ill-fitted in respect to limited war capabilities although it would have been easy to have been well prepared now. The inability to react strongly in limited situations with methods and techniques specifically tailored for them, increases the overall dangers: the alternative to localized provocations is either to give in or to respond with all-out war. None

of these courses is acceptable. But it is far more likely that "small" concession is made after "small" concession only to discover in the end that all was lost by installments.

One of the great dangers of limited wars in which small nuclear weapons are used is the ease with which larger ones can be introduced. The intensity of war can now be stepped up almost instantly, while formerly, lengthy preparations were necessary. It is therefore important to realize that this technical ability is also held in check when the overall deterrent against large scale war is truly effective.

Assume now that the limited war threat is met but that the conflict still persists. It is clear that it is then shifted to still other areas: the economic, political and ideological. There is no doubt that we have to meet the challenge in these fields. Can we? The comparison of standards of living is largely irrelevant since it is the relative economic power that matters: the power to grow and economic power that is put into defence. In both respects we are making a poor showing compared to the Russian efforts, though we outproduce her easily in the amenities of life. This is merely a matter of choice: if we are in grave danger—as we are sometimes told and which we have good reason to believe is much greater than publicly admitted—then we can increase our power to any degree required by the activities of the communistic bloc; if we persist in the soft life, we will be overwhelmed.

There is strategic advantage in a rising standard of living in Soviet Russia: the leaders may feel that they have more to lose. The truly dangerous opponent is a poor fanatic with a powerful weapon; a richer opponent has more to lose. We saw above that the valuation of the probable own losses is an important component in the determination of the degree of deterrence exercised by the other side. Without changing anything in the West, its deterrent power would increase if Russia raises her wealth. But for the time being her efforts to expand basic power far exceed those which would result in an early rise in living standards. If Russia some day should consume per capita as much butter, meat, sugar, etc. or even more, as the United States, so much the better. But when she has an approximate consumption of steel as we have, this is a different story, since she now uses already far more steel for armaments and basic growth industries than we do—we who make great quantities of furniture, washing machines and automobiles of that strategic material: they contribute exactly nothing to our strength.

The delicate balance we are striving for, if ever attained can be easily disturbed. The principal causes are a possible intensification of effort on one side, or a sudden slackening, or important scientific discoveries affecting the conduct of war. The public cannot easily realize how tremendous and speedy the latter are in spite of the great publicity given to many technological innovations. The reason is that it is difficult for anyone to have a reasonably comprehensive picture and to form adequate ideas. Even scientists working closely with defence problems are amazed to see how rapidly the picture changes, how new ideas are advanced, how devices, seemingly fantastic only a few years ago, are superseded by some still more astonishing. This progress in weaponry (or is "change" a better word?) cannot be stopped. It goes on in both blocs. Here is the most deadly part of the race for survival in which the countries are engaged. In this process a fair amount of tight secrecy is unavoidable. At present a great asymmetry exists since we part freely with valuable information (allegedly needed to preserve the democratic form of life) while Soviet Russia controls information so closely that we are lacking even some basic, almost trivial, data of the type Russians can read in typical American newspapers and magazines. The disadvantage arising from this asymmetry is obvious but allowed to persist.

Even small errors, minor provocations, can produce the greatest war the world would ever see. We must never lose sight of this fact, never be carried away by wishful, idealistic thinking so characteristic of large parts of the Western World. Yet we have to talk continuously with the other side, always probing for agreements that can, however, be made safe only if our deterrent is secure and convincing. Our weapons technology has a novel influence upon the range, type and extent of conversations with the communist bloc that is only poorly understood by the political negotiators. Here is one of our weakest and most dangerous points; perhaps the same is true also for the other side. It is the totally different capabilities of modern weapons—their reach, their power and their instantaneous readiness—which now places negotiators in completely unfamiliar positions. It is therefore necessary to take a fresh look at the techniques of negotiations in the hope that we may arrive at a solution of the awesome problem of how to make a bargain stick when both sides are poised for the kill but suddenly realize that they have some common ground left on which to secure

each side's survival. Though perhaps recognizing the common interest, they know of no way how to drop their weapons.

A great thermonuclear disaster has to be compared with the alternative of surrender or peaceful, gradual defeat. The question is what the latter would mean. It would be nothing short of ludicrous to assume that this would merely involve some slight changes in government and in the terminology in which national goals are formulated and professed, perhaps accompanied by a tight control of press, radio and television, abolition of private ownership of the means of production, end of the stock market, etc. It would mean much more: enslavement of the spirit of freedom, forced labour for the benefit of the hungry millions of Asia, great migrations into the United States and Canada from the overpopulated areas of the world and domination of the world from Moscow (until a Moscow-Peking clarification takes place) with no hope of any outside power ever coming to the rescue. There is none. There will be none. The submission would be final; the identity of the western nations would be destroyed and life be organized according to ideals—if such they be called—which we reject now on the basis of convictions and experiences developed over the past centuries.

So there is a point where a high chance of death and destruction is preferable to the certainty of enslavement and the reduction of material welfare. At this point one will fight. Even certain death will be preferred to the alternative, certain fate that would await the Western World in surrender. It is, of course, possible that neither will happen. The world may carry on another 5-10 years, only to discover that by then new devises exist which demand still different arrangements making another precarious, temporary period of survival possible. Perhaps after some further time the principal governments may have discovered new methods with which to settle differences, to divert aspirations, to make binding agreements. All these are intellectual tasks of the first order of magnitude and no one can foretell whether they will be accomplished in time. Our present stumbling efforts in political science give little hope that this will be the case.

The probability that a large scale, devastating thermonuclear exchange will occur is greater than that it will not occur. I am well aware of the difficulties of making reliable probability statements about singular events. Nevertheless I believe that the above observation is justified on the basis of all past history and of the knowledge of the present armament distribution and conflict situation in the world.

It is even less doubtful to justify a concluding observation: No war has ever been averted by recourse to moral and religious constraints. On the contrary, many of the most cruel and bloody wars were fought over such issues. There is no hope that now, suddenly, new moral values can be evolved and become effective enough to take us away from the highly probable disaster. The only way now visible to stop war is a deterrence which will mean destruction for the aggressor, not only a probable destruction as at present. And the aggressor must *know* that his destruction is certain.

Notes

[1] The entire complex of problems is examined in detail in my book: *The Question of National Defense* (New York, Random House, 1959).

[2] cf. Morgenstern, Oskar: Goal: "An Armed, Inspected, Open World", *Fortune* Magazine, New York, July 1960.

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Defence Against Ballistic Missiles

G. R. LINDSEY

After graduating from the University of Toronto in 1942, Dr. George R. Lindsey served overseas with the Royal Canadian Artillery, specializing in radar detection and production for anti-aircraft purposes. Following the war he obtained his M.A. in nuclear physics at Queen's University and earned his Ph.D. from Cambridge University for his work in the same field. Dr. Lindsey served as Senior Operational Research Adviser at Air Defence Command Headquarters before assuming his present duties as Director of the Defence Systems Analysis Group, Department of National Defence, Ottawa.

CHARACTERISTICS OF THE INTERCONTINENTAL BALLISTIC MISSILE

IN ORDER to discuss defence against the ICBM it will be necessary to consider certain technical characteristics of the offensive weapon.

Figure 1 illustrates the trajectory of an ICBM launched from point L towards a target I, 5500 nautical miles away. The flight can be divided into three phases, of which the first is the launch or boost phase.

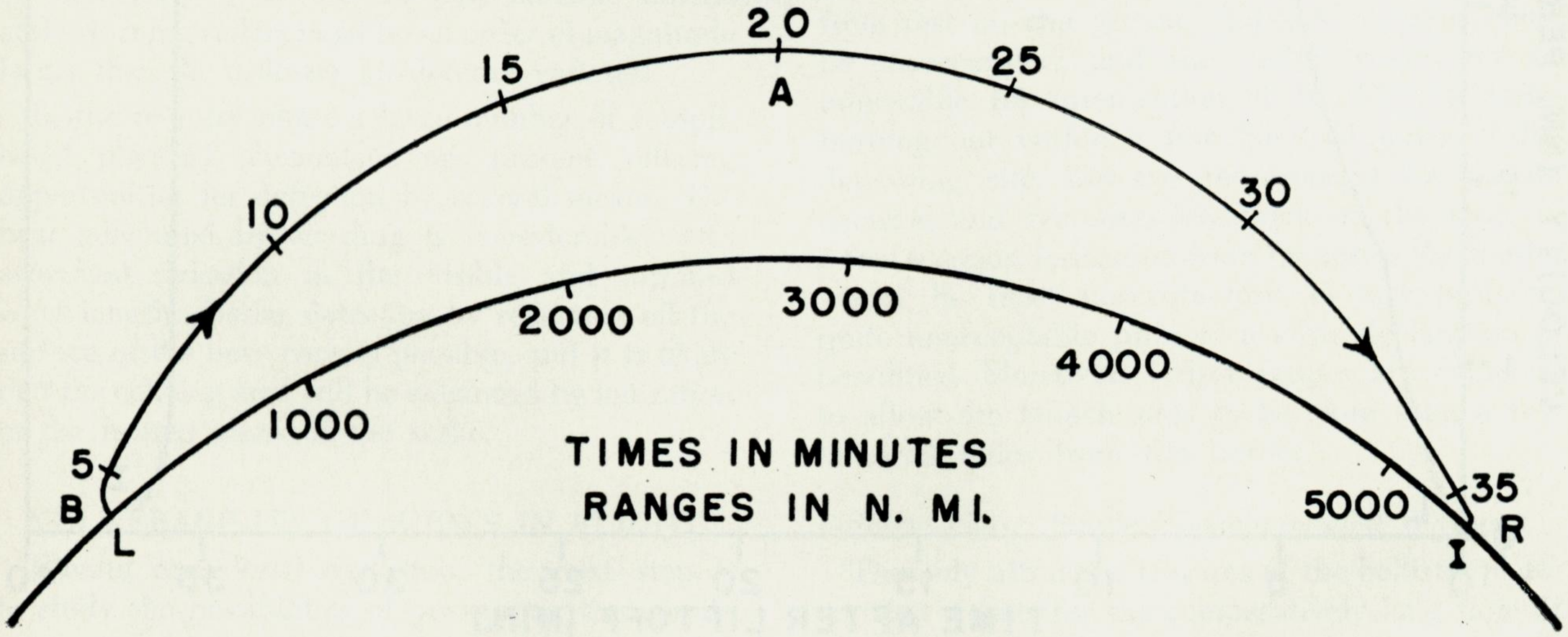
The Boost Phase

Throughout this portion the rocket motors accelerate the vehicle from an initial state of rest to a final burnout velocity of about 3.7 nautical miles per second, which is sufficient to project it all the rest of the way to its target without any further propulsion. Most, although not all, ICBM's employ successive stages of propulsion, with the largest rocket motor performing the initial acceleration, after which it is separated from the later stages and discarded. Second- and possibly third-stage rockets supply further acceleration in sequence. Each stage will be separated after its motor has burnt out. For all but the last stage, separation represents an increase in efficiency, since the useless weight of the burnt-out rocket is not required to be accelerated further by the later stages, and is left behind as the next stage develops its thrust. The last stage will probably be separated from the warhead, but will accompany it throughout the ballistic phase, since it has the same velocity and direction as the warhead.

The trajectory will be vertical at first, but must curve over until it is only 23° from horizontal at burnout. Accurate guidance is vital throughout all of the boost phase, and successful delivery at the target depends on exact adjustment of the velocity and direction at burnout.

FIGURE 1

5500 NM. ICBM TRAJECTORY



The boost phase will occupy about five minutes, and will end at burnout (B on Fig. 1) with the warhead and last propulsion stage at an altitude of one to two hundred miles, with a similar distance made good over the earth towards the target.

The Ballistic Phase

In the ballistic phase, which lasts for about thirty minutes, the warhead and final propulsion stage follow a long, slowly-curving arc, determined only by the forces of gravity and inertia, with no guidance acting.

Figure 2 plots velocity against time, and shows that the velocity drops slightly between burnout at B and apogee (A, the highest point on the trajectory), but increases thereafter to a maximum value of about 3.9 nautical miles per second at R, the end of the ballistic phase.

The ballistic phase BR occurs in the near-vacuum beyond the earth's atmosphere, but at the end of its trajectory the warhead will encounter air of increasing density.

The Re-entry Phase

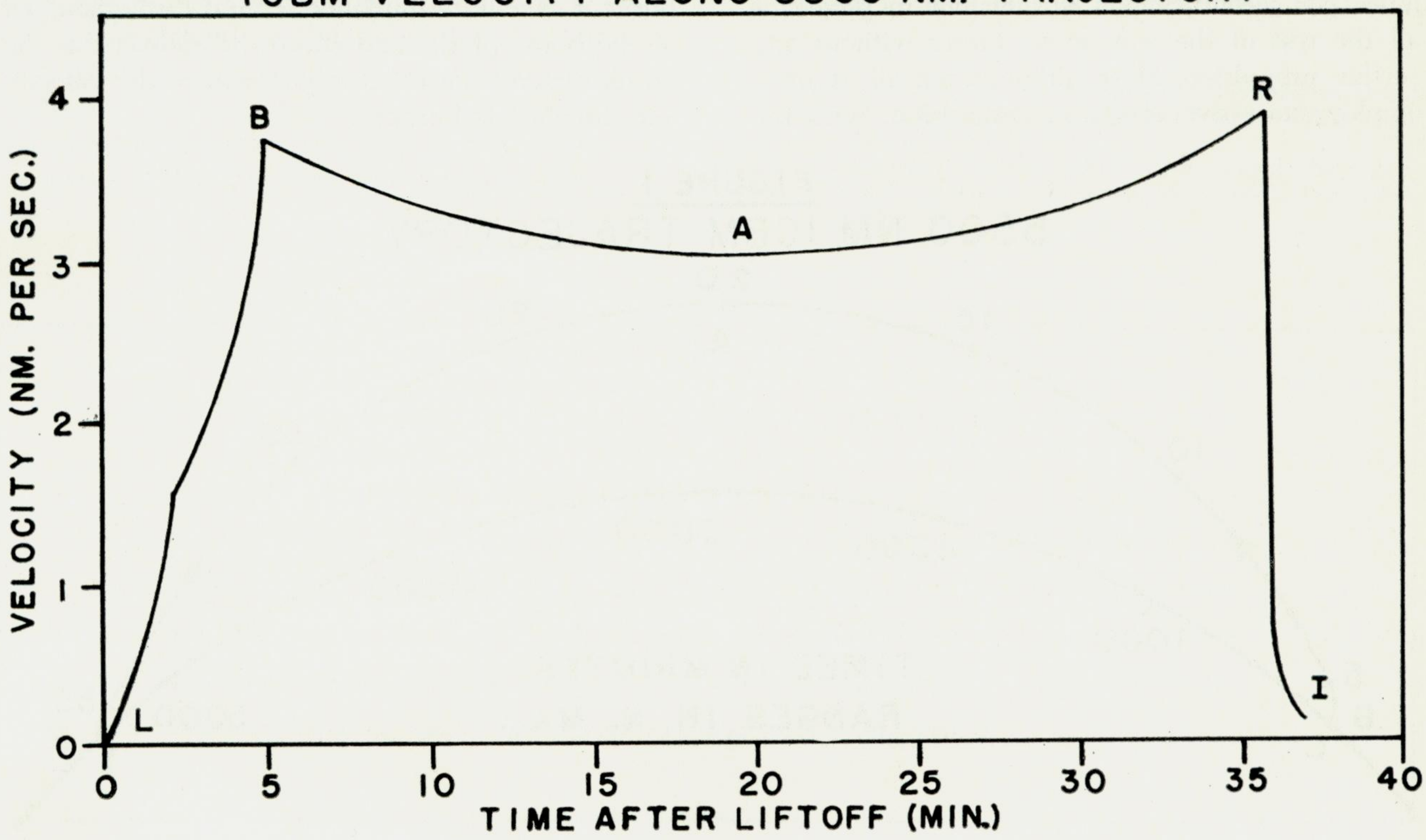
The re-entry phase consists of the last portion of the trajectory RI, during which air drag exerts a significant force. The deceleration produced by the air drag will depend on the design of the re-entry body. A light body of a shape offering high air resistance will be decelerated by relatively thin air at high altitude and, if it retains its shape, will lose almost all of its velocity and descend to earth at much less than 1 nm per second. A heavy, streamlined body, on the other hand, will not experience severe deceleration until it has descended into the dense air at lower altitudes. If its weight-to-drag ratio is sufficiently high, it will strike the ground with a substantial fraction of the 3.9 nm per second velocity which it had just before re-entering the atmosphere.

The sharply-dropping segment RI on Figure 2 shows the deceleration for a body of intermediate weight-to-drag ratio. Beginning at an altitude of 40 nm, which is passed 35.6 minutes after launching, it loses velocity at a very high rate. However, after half a minute it has decelerated to 0.25 nm/sec, and its descent through the last mile down to earth takes another 1.5 minutes. A heavier, more streamlined body could pass from an altitude of 40 nm to earth in about 0.5 minutes, and still have a velocity in excess of 0.25 nm/sec at impact.

A point of great practical importance is that rapid aerodynamic deceleration is always accompanied by violent heating. Unless special precautions

FIGURE 2

ICBM VELOCITY ALONG 5500 NM. TRAJECTORY



are taken, the body will be melted and disintegrated before reaching the ground. ICBM nose cones must be designed to dissipate or absorb this heat without damage to the nuclear weapon.

DETECTION OF ICBM'S

The three phases will now be examined to see what possibilities are offered for detection and tracking by a defensive system.

The outstanding characteristic of the boost phase is the immense release of energy from the propulsion rocket. Sufficient heat is generated to enable a sensitive infrared detector to indicate at ranges of thousands of miles along a direct, non-absorbing path. Clouds and water vapour do absorb infrared energy, so that ranges would be severely limited until the rocket rose above the tropopause, and the detectors will have to be airborne or satellite-borne. Since the last-stage rocket will burn out at an altitude of one to two hundred miles, earth curvature will limit the possible range of detection from aircraft to the order of a thousand miles, and ranges of several thousand miles will demand that the detector be carried in a satellite several hundred miles up.

The ICBM will provide a substantial radar target while the large booster rockets are attached, but as successive stages are separated, the remainder will become much harder to detect.

In the ballistic phase, with no rocket exhaust, detection by radar offers the best possibility. The last propulsion stage will offer a much larger radar target than the nose cone, and the two are likely to be close together. The echoing areas will probably be smaller than for aircraft targets. If ranges much longer than the two or three hundred miles attainable by ordinary aircraft-watching radars are necessary, it is evident that ballistic missile early warning radars must be an order of magnitude larger than the ordinary air defence varieties.

In the re-entry phase a large number of complicated physical phenomena are present, offering opportunities for detection by several means. The heat generated by air drag is considerable, with attendant radiation in the visible and infrared wave-lengths. Radar detection by reflection off the surface of the nose cone is possible, and it is likely that the echoing area will be enhanced by ionization in the heated gases of the wake.

VULNERABILITY OF ICBM'S IN FLIGHT

Having considered detection, the next step is to study the possibilities of preventing the missile from accomplishing its objective, by means of active intervention on the part of the defence.

The ICBM is most vulnerable before and during the boost phase. With the large rockets attached, tons of flammable fuel on board, and a complex mass of pumps, valves, and electronic guidance equipment, penetration by a small fragment is likely to produce lethal damage. The loss of fuel or oxidizer may cause premature burnout and drop the warhead short of its intended target. A directional deflection of one degree in any direction at burnout will cause a shift of more than fifty miles in the point of impact.

In the ballistic and re-entry phases, destruction of the warhead or enclosing nose cone is required. This is a small, tough target, moving at very high velocity. Guidance has been completed, so that the opportunity to deflect the missile has passed.

THE PROBLEM OF INTERCEPTION

Boost Phase

In addition to advertising its presence by vast heat radiation, and being most vulnerable in the boost phase, the ICBM is moving more slowly. The difficulty is that the launch site is likely to be hundreds of miles inside the territory of the owners, and that the boost phase will be completed within five minutes, while the missile is still over its own territory.

If the first minute is spent in rising above the troposphere, the defender has only four minutes to make detection, decide to react, fire a counter-missile, and complete interception before the ICBM has burned out. The counter-missile would have to cover a longer trajectory than the ICBM in considerably less time, which would demand an immensely powerful propulsion system if launched from rest on the ground. Infrared homing could be incorporated, and the design would not be impossible for interception of ICBM trajectories burning out within a few hundred miles of the defending site. But the requirement for instant decision and readiness to attack on the basis of a few seconds' indication from far across the border would be most unsatisfactory, in fact probably quite unacceptable prior to a clear declaration of hostilities. Moreover, ICBM ranges are sufficient to allow the launch sites to be more than a few hundred miles from the border.

Ballistic Phase: Single Unaccompanied Warhead

The only attractive features of the ballistic phase are that it lasts for the comparatively long time of

about half an hour, and prediction of the future path of the warhead is simple.

Tracking would probably have to be by radar, perhaps detecting the final propulsion stage and following it until the smaller nose cone was close enough to observe and follow. Interception near or beyond apogee would require the counter-missile to have performance superior to the ICBM in terms of propulsion, and considerably superior in terms of guidance and manoeuvrability. The required accuracy would almost certainly demand ground radar tracking and command guidance to be followed by homing by a long-range radar carried in the counter-missile. Evidently the task of intercepting near or beyond apogee would demand a weapon system very much more expensive than the ICBM.

If interception were attempted towards the end of the ballistic phase, by counter-missiles launched from the vicinity of the target area, many of the objections disappear. Ground-based radar with a detection range of 500 miles would allow over two minutes for the cycle of active defence.

The range at which interception can be achieved depends on the acceleration of the counter-missile. Since there is much less time available for its acceleration than the five minutes taken in the boost phase of the ICBM, and since the counter-missile starts the interception from rest while the ICBM is moving at its maximum velocity of nearly 4 nm/sec, it is evident that, unless the counter-missile is given a propulsion system much more powerful than that of the ICBM, it will not cover as much distance as the ICBM does during the interception. If the counter-missile is launched when the ICBM is at a range of 400 nm, and covers half as much distance as the ICBM, then interception of a trajectory aimed directly at the battery will take place at a range of 1/3 of 400, or about 130 nm. At this range, command guidance from the ground-based radar would probably provide sufficient accuracy to make homing equipment on the counter-missile unnecessary.

The purpose of a counter-missile battery is to defend a target area against all ICBM trajectories able to impact anywhere in the area. The range at which counter-missiles can intercept a trajectory aimed to impact directly on their own battery is a rough measure of the radius of the target area which they are able to protect. A defensive installation able to protect an area with a radius of about 130 nm could cover several important targets, and would justify the considerable expense of the large radar installation. Counter-missiles of half the velocity of the ICBM, and employing command guidance only, would not be exorbitantly expensive, and could be provided in substantial numbers.

Re-entry Phase: Single Unaccompanied Warhead

If the re-entry phase commences at an altitude of 40 nm, then the ICBM is only about 60 nm from impact (measured along the trajectory). If the counter-missile were launched at this instant, it could not hope to intercept the ICBM at a range greater than 20 nm.

Advantages are that several means of detection may be available, and that aerodynamic control of the counter-missile is possible. Disadvantages are that it will be necessary to predict the deceleration of the ICBM without knowing its weight-to-drag ratio, and that the area protected by one defensive installation will be quite small. Also, the assumption of instant firing is unrealistic, but since the interception range is reduced by more than a mile for every second's delay in firing, hardly any delay can be tolerated.

Ballistic or Re-entry Phase: Warhead Accompanied by Decoys

The only promising stage at which to attempt interception appears to be in the late portion of the ballistic phase, when an interception range of something like 130 nm may be possible.

Development and installation of such a system in enough strength to provide a substantial measure of defence would be a major program occupying several years, and would inevitably become known to the potential attacker long before its completion. He would have time to consider and install in his ICBM's devices to counter the active defence.

The defence as outlined detects the warhead at 500 nm range, and launches the counter-missile when the warhead is 400 nm from impact. Anything that the offence can do to delay the launching of the counter-missile will reduce the range of interception at the rate of about 1.3 nm per second of delay.

In the absence of air drag, all objects proceeding with the same direction and velocity at burnout follow the same ballistic trajectory. It will be recalled that the last propulsion stage will accompany the warhead for this reason. For the cost of a few pounds of explosive, this empty and otherwise useless rocket can be shattered into a shower of miscellaneous fragments, all of which will then follow ballistic trajectories very close to that of the warhead. The defending radar will be confronted with many targets of varying size, some larger and

some smaller than the nose cone. The time and force of the explosion can be gauged to disperse the fragments far enough apart to prevent simultaneous destruction of several by one counter-missile, but close enough together that each offers an apparent threat to the target area.

Unless the defence has some method of distinguishing the nose cone from the other objects, all it can do is to launch as many counter-missiles as possible and hope to guess which is the nose cone, which does not provide an economical or effective protection for the target.

Once the cloud re-enters the atmosphere, the objects with low weight-to-drag ratios will be decelerated first, and many of these will be burned up. The nose cone will have a higher weight-to-drag ratio than any fragment, so that opportunity for discrimination is offered here. However, the nose cone is likely to be well below 40 nm altitude at this point, so that the situation is worse than that discussed earlier for re-entry of an unaccompanied warhead. The range of interception of a trajectory aimed at the battery would be less than 1/3 of 40, or about 13 nm.

If the confusion produced by fragmentation of the last stage rocket is not deemed sufficient, the attacker can add specially designed decoys simulating the nose cone more closely in such properties as weight-to-drag ratio, radar echoing area, or heat radiation.

Conclusions Regarding Active Defence

The future of systems of immense complexity and expense, such as those under discussion, is inevitably determined by considerations of economics. It would not be correct to say that active defence against the ICBM is impossible. A certain measure of protection could be provided, for a very small target, by the installation of a large number of batteries of the general type described. But the significant conclusion is that, based on today's knowledge, an active defence cannot hope to compete with the offence, if the investments are of comparable magnitude.

PASSIVE DEFENCE

Since active defence looks unpromising, it is natural to turn to passive defence, of which the classical types include structural strengthening, concealment and dispersal. It is necessary to consider various types of targets, and to distinguish small military targets, such as airfields or missile sites, from large cities or industrial areas.

The Destructive Radius of a Nuclear Explosion

The cost of an ICBM makes it most unlikely that it would be used to deliver anything less destructive than a nuclear warhead, so that the various harmful effects of instantaneous gamma rays, heat radiation, and delayed radiations from fallout will be present

TABLE A

Blast Damage Radius of a Nuclear Explosion

	AIR BURST		SURFACE BURST	
PEAK OVERPRESSURE:	2 PSI	5 PSI	20 PSI	100 PSI
EXPLOSION YIELD	BLAST RADIUS FOR INDICATED OVERPRESSURE			
10 KILOTONS	1.3 nm	0.7 nm	0.25 nm	0.12 nm
100 KILOTONS	2.7	1.6	0.54	0.27
1 MEGATON	5.8	3.4	1.2	0.57
10 MEGATONS	12.6	7.1	2.5	1.2
EQUIVALENT WIND:	60 knots	140 knots	400 knots	>1100 knots

STRUCTURE	EFFECT OF OVERPRESSURE
Wood Frame Houses	—moderate damage—→ ←—completely destroyed—
Parked Transport Aircraft	———moderate damage—→ ←—completely destroyed—
Brick Apartment Houses	———moderate damage———→ ←———completely destroyed———
Light Reinforced Concrete Surface or Underground Shelter with 3 ft. earth cover	———undamaged———→ —damaged←—collapsed——
Blast-resistant Reinforced Concrete 3-story Windowless Building	———undamaged———→ ←—damaged—→ ←destroyed
PEAK OVERPRESSURE:	2 5 10 20 50 100 PSI

TABLE B

Vulnerability of Very Strong Shelters

PEAK OVERPRESSURE:	SURFACE BURST			
	100 PSI	1000 PSI	4000 PSI	35000 PSI
EXPLOSION FIELD	BLAST RADIUS FOR INDICATED OVERPRESSURE			
1 MEGATON	3500 ft.	1500 ft.	1000 ft.	500 ft.
10 MEGATONS	7500	3200	2200	1100
100 MEGATONS	16400	7000	4600	2300
SHELTER				
Basement-type construction flush with surface	→			
50 to 300 ft. down	——undamaged——			
300 to 1000 ft. down	——undamaged——			
2000 ft. down	——undamaged——			
PEAK OVERPRESSURE:	100	1000	4000	35000

as well as blast. However, with some exceptions, blast is likely to be the most destructive agency to structures and to personnel not in the open.

The radius of blast damage is indicated in Table A.[1] Ordinary city buildings, parked aircraft, and in fact most structures not specially strengthened to withstand blast will be damaged by an over-pressure of two pounds per square inch and completely destroyed by 5 psi. The associated wind velocities are 60 and 140 knots. The area receiving pressures of these magnitudes is maximized by bursting the warhead some thousands of feet above the ground.

Protection by Hardening

One method of reducing vulnerability is to enclose personnel and vital equipment in structures specially strengthened to withstand blast. For example, light reinforced concrete shelters, either underground or on the surface, with three feet of earth cover, will withstand 15 psi without damage, but collapse at 35 psi. Reinforced concrete three-story windowless buildings of blast-resistant design will withstand 15 psi without damage, but are completely destroyed by 70 psi.[1]

The practical economic limit to blast-resistant structure flush with the ground surface comes at 200 to 300 psi, and anything intended to withstand greater over-pressure would have to be buried deep.[2] The relationship between depth and vulnerability is dependent on the type of soil and rock, and the design of the tunnels. Ground shock may be more dangerous than peak overpressure. The orders of magnitude are indicated in Table B, where the bombs are now 1, 10, and 100 megatons, and the damage radii are measured in feet instead of miles.

Protection of the population of large cities by shelters of moderate hardness would make a substantial reduction in the casualties produced by bombs of less than megaton size, but could be defeated by use of large yields or several bombs. For example, using Table A, for a city of circular shape and radius 5 nm, hit by one 100-KT bomb burst at the centre, the areas receiving 2, 5, 20, and 100 psi are 23, 8, 0.9 and 0.23 sq. nm. However, one 10-megaton bomb at the centre would produce more than 5 psi over the entire 79 sq. nm, 20 psi over 20 sq. nm, and 100 psi over 4.5 sq. nm. Protection against 5 psi can be obtained by elementary preparation of the basements of ordinary dwellings, but shelters capable of withstanding 100 or even 20 psi require special construction costing some hundreds of dollars per person protected.[3]

If fifteen vital installations were distributed more or less uniformly throughout a circular area of radius 5 miles, all would receive more than 2 psi from a single megaton airburst above the centre of the area, and more than 5 psi from a single 10-megaton airburst. But if the installations were hardened to 25 psi, it would require fifteen 1-megaton surface bursts (or four 10-megaton surface bursts), each within less than 1 nm of its aiming point, to destroy all fifteen.

Hardening can prevent one ICBM from destroying several targets by decreasing the damage radius to something less than the spacing between targets. But as long as the ICBM accuracy is well within

the limits of the decreased damage radius, any one selected target can still be destroyed by one ICBM assigned to that purpose. If the target is made so hard that the damage radius becomes less than, or comparable with, the inaccuracy of delivery, then one ICBM aimed at the target produces a probability of less than 100% of destroying it. If the attacker is sufficiently anxious to destroy the target, he can assign a number of ICBM's to it alone, and build up the cumulative probability of destruction to a value approaching 100%.

The Significance of ICBM Accuracy

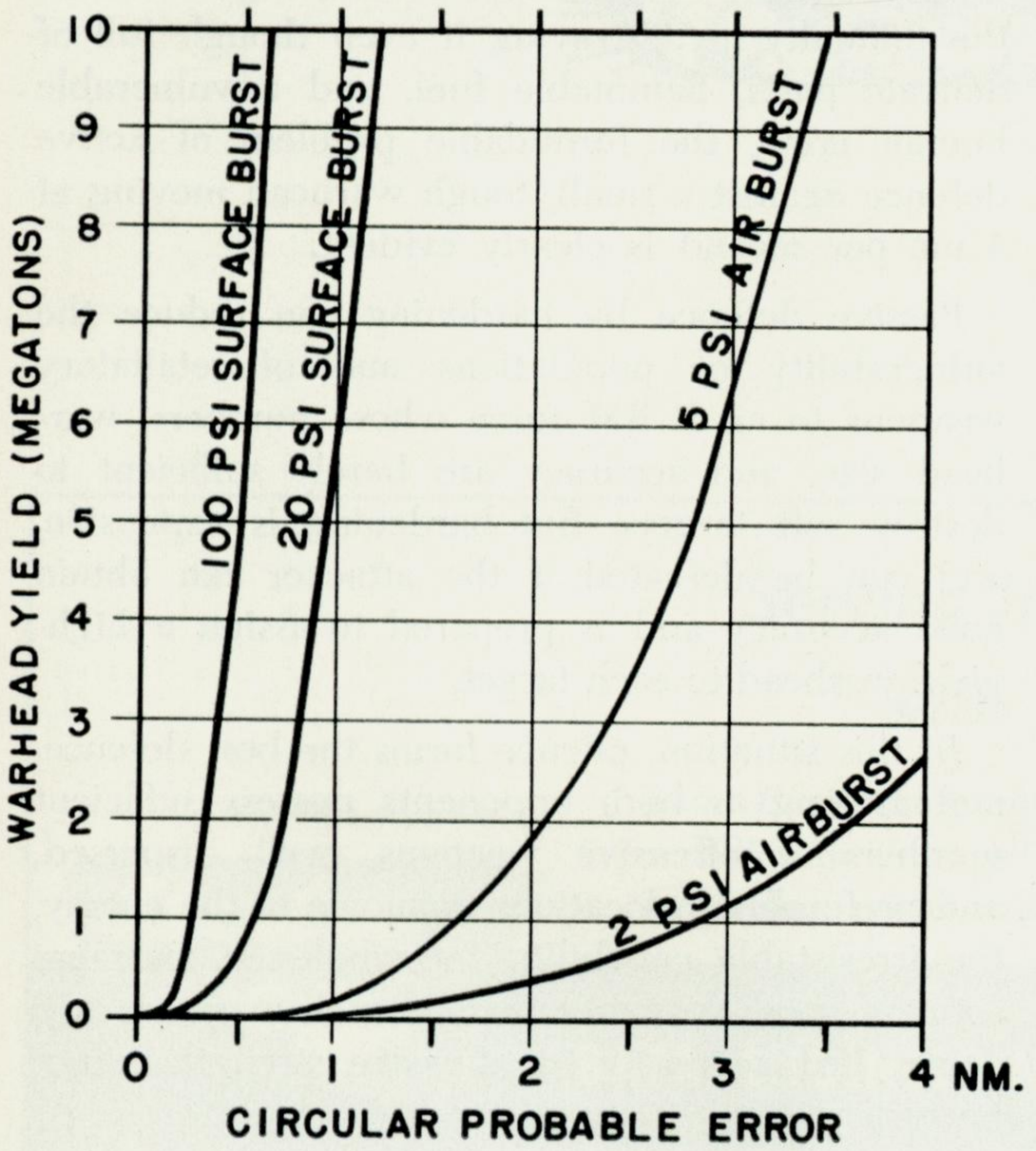
The accuracy of delivery is usually measured in terms of a circular probable error (CEP) which represents the radius of the circle, centred on the aiming point, inside of which 50% of the rounds will impact.

It is evident that the probability of destroying a particular point target with one shot is dependent on a combination of three factors: the strength of the target, the energy of the explosion, and the distance by which the point of detonation is likely to miss the target. Figure 3 shows the combinations which produce a probability of 95% that one shot will deliver an overpressure of at least the indicated amount at the aiming point.

To consider a soft target, note the lowest curve labelled "2 psi airburst". It is seen that a CEP of several miles can be tolerated if the warhead is in the megaton class. Even for 5 psi targets, 2-megaton warheads allow the CEP to be nearly 2 miles.

FIGURE 3

YIELD-CEP COMBINATIONS FOR 95% DAMAGE PROBABILITY



The situation is quite different for the hard targets. To maximize the radius to which any overpressure in excess of 15 psi is delivered, the attacker should fuse the warhead for a surface burst. The 20 and 100-psi Surface Burst curves of Figure 3 rise very steeply, indicating that the probability of destruction is much more sensitive to accuracy than to warhead size. To destroy a 100-psi target, the attacker must have a CEP of better than 3/4 nm, unless he is prepared to mount a warhead far larger than 10 megatons.

Thus it is seen that defence of a very important target by hardening may be successful if the attacking ICBM's have a large CEP, say more than 1 nm. But if the CEP's are less than 3/4 nm, and the attacker knows the location and is prepared to devote several large-yield missiles to the destruction of the single target, then it cannot be saved by hardening of any ordinary kind.

Protection by Concealment

Since the ICBM has no ability to seek and find its target, its success is dependent on previous knowledge of the target location.

The free travel and good maps of the western world make concealment of the location of cities or major airfields impossible. It is just possible that the exact location of small military weapon installations within a large secure area could be kept secret. But the only really promising method of denying the enemy the knowledge of the location of important weapons seems to be to make them mobile, and keep them airborne, at sea, under the sea, or moving so often that the enemy intelligence cannot keep up to date. This solution merges into dispersal, which will be discussed separately.

Protection by Dispersal

Dispersal consists of separating targets by a distance in excess of the damage radius of one bomb, so that no bomb will destroy more than one target. It is evident from Table A that the effectiveness of spacings of less than a few miles depends on the hardness of the targets and the size of the warheads.

Dispersal of cities, or even of factories, is probably too drastic to consider. Dispersal of aircraft within the confines of one airfield will not make an important reduction to vulnerability, unless accompanied by hardening. But dispersal of aircraft

on zero-length launchers, or of missile launching sites, is quite practical. The necessary minimum spacing would be much reduced by some degree of hardening.

Dispersal probably constitutes the most effective means of reducing the vulnerability of weapons themselves. But it greatly increases the vulnerability of communications within the system, and thus introduces new and serious difficulties in control of retaliation.[4]

DEFENCE BY DETERRENCE

From what has been said, it may be concluded that, with present knowledge, active defence against the ICBM is uneconomical, passive defence will increase the number and warhead size of the ICBM force needed to destroy a given set of targets, but no measures exist that can guarantee the survival of anything on the surface of the earth against an enemy who knows where it is, and is prepared to employ ICBM's to encompass its destruction.

Under these circumstances, the natural course to pursue is to recognize that offence reigns supreme, and to make the main strategic effort one of opposing offensive potential with offensive potential. If B's objective is to deter his opponent A from striking first, the character of B's offence need only be sufficient to ensure that enough of it can survive a surprise attack by A to deliver unbearable devastation on A's cities. This will not ensure that B survives the war as a viable civilization, but it should ensure that A does not start the war at all.

This policy amounts to the ancient, and not particularly honourable, custom of the holding of hostages, to be murdered in the event of attack. It is not the mark of a Great Power well able to defend itself. However, in the face of a technical situation in which no power is able to defend itself, the possession of such a deterrent by both opponents does make the prospect of hostilities so unpleasant as to render their intentional initiation most unlikely.

An advantage of this situation is that it remains stable through quite a wide range of relative offensive strength. If the side with the smaller number of ICBM's has them well dispersed, and especially if a portion are in a location unkown to the opponent, then a moderate number will probably be sufficient to constitute an effective deterrent. There are, of course, degrees of deterrence, and the problem is one of extreme complexity, for which an adequate discussion would require a much longer article than this one.[4, 5, 6, 7]

THE RESULT OF EFFECTIVE DEFENCE

If the confronting of offence with offence produces a stable, if slightly uneasy, balance, it is of interest to consider the consequences of a discovery by one of the opponents of an effective method of defence procurable at bearable cost.

If one side, A, managed to install an effective defence for his cities, he would have released his hostages from B's threat. The balance would be upset; A could contemplate the delivery of a surprise attack; B would know this, but B could not consider delivering an attack. Until B provided defence for his cities, he would be in a position of serious weakness.

For this reason, it is essential for both opponents to pursue research into possible methods of defence, for fear that an effective solution does exist and will be found by the enemy.

CONCLUSION: THE DOUBLE PARADOX ANTI-ICBM DEFENCE

Interception and destruction of an ICBM in flight appears to be extra-ordinarily difficult. When one considers the difficulty in intercepting a jet aircraft moving at 0.1 nm per second and confined to heights of no more than 10 nm, together with the difficulty in destroying it even though full of delicate parts, flammable fuel, and a vulnerable human crew, the formidable problem of active defence against a small, tough warhead moving at 4 nm per second is clearly evident.

Passive defence by hardening can reduce the vulnerability of populations and of retaliatory weapons to an ICBM force whose numbers, warhead size, and accuracy are barely sufficient to destroy soft targets. But hardening is expensive, and can be defeated if the attacker can obtain good accuracy and is prepared to assign a high-yield warhead to each target.

In this situation, offence forms the best defence, and as long as both opponents possess sufficient numbers of offensive weapons, well dispersed, and preferably in locations unknown to the enemy, the irresistable capability for wholesale massacre forms a good assurance that no such massacre will occur. Precise parity in offensive strength is not necessary.

But this stability depends on the technical supremacy of offence over defence. The most aggressive move that could be made would be to develop and install an effective defence. Both sides will be compelled to seek the knowledge that would make this possible, since prior installation by one side would unbalance the stalemate.

To make another comparison with ancient customs, an agreement between two kings was often sealed by the exchange of esteemed relatives to serve as voluntary hostages against bad faith. Sudden unilateral disappearance of one group from the other court could only be interpreted as preparation for war.

A logical, if ironical, development of the late 1960's might see one of the Great Powers inviting a United Nations inspection to verify that none of their offensive equipment was being converted to the dangerous role of AICBM defence, and thus constituting a threat to World Peace.

[1] "The Effects of Nuclear Weapons", U.S. Department of Defense, 1957.

[2] "Why Go Deep Underground", by Herman Kahn, Rand R-341, March 1959.

[3] Report on a Study of Non-Military Defence, Rand-322-RC, July 1958.

[4] "The Delicate Balance of Terror", by Albert Wohlstetter, Foreign Affairs, January 1959.

[5] "The Nature and Disability of War and Deterrence", by Herman Kahn, Rand P-1888-RC, January 1960.

[6] "The Feasibility of War and Deterrence", by Herman Kahn, Survival, 2. 59. March-April 1960.

[7] "Strategy in the Missile Age", by Bernard Brodie, Oxford University Press, 1959.

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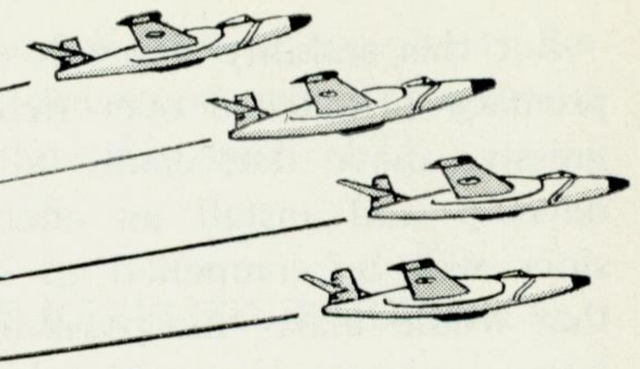

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Political Aspects of the Strategic Force

MELVIN CONANT

After receiving his M.A. from Havard University's Far East program, Melvin Conant completed additional graduate work on the British Commonwealth, Soviet foreign policy, and the National Security Council. He participated in international conferences on Canadian-American relations in 1947, and on the Far East in 1947, 1953, and 1954. He is currently studying the political and military effects on American allies of the location of U.S. strategic forces on the North American continent. Since submitting his article in June 1960, Mr. Conant has been given a temporary appointment as a civilian member of the faculty of the U.S. National War College.

IN recent years, it has become increasingly apparent that quite apart from the military merits of improved or new weapon systems, their introduction into the Western Alliance may have political consequences which outweigh or even erase their intended military advantage. The necessity of anticipating and appraising both the probable political, military and economic effects of a particular weapon system is generally acknowledged today even if there is little agreement on how, and by whom, final judgments should properly be made. Certainly the time has passed when weapons and their delivery systems could be regarded as very largely a matter of concern only to the military experts.[1] Since the American contribution to the development and production of new weapons is a vital one for the Alliance, the United States has a unique responsibility to assess the spectrum of consequences likely to ensue from the refinement or introduction of major weapon systems. A particularly important example of the need for early and continuing evaluation of the likely political effects of weapons is found in the major developmental periods, since the end of World War II, of United States' strategic strike forces.

At the close of World War II, these forces consisted for the most part of a large number of aircraft, carrying conventional explosives, and based very largely on United States-controlled territories in the Central and West Pacific. For the duration of the European phase of the war these aircraft had operated for the most part directly from airfields in the British Isles. Pacific Ocean Carrier task forces also formed a significant part of the strategic force and seemed at that time to be the most highly developed system combining impressive striking power, defensive strength and a high degree of mobility (including virtual freedom from non-American supply and repair bases). The immediate postwar dissolution of much of these strategic forces deprived the United States of vital weapon systems whose swift reconstruction became a matter of highest priority as the intransigence and hostility of the Soviet Union heralded the commencement of the Cold War. However, strategic planning for strike forces on the periphery of the U.S.S.R. differed greatly from earlier wartime concepts with the support and operating requirements of these forces being of a wholly different order. Furthermore, the nature of atomic and nuclear weapons altered fundamentally the number, design and tactics of the aircraft to be employed. The first and urgent requirement was the rapid construction of a complex global system of air bases.

I

The essential purpose of this network of strategic bases was to permit aircraft to undertake successive missions deep into the Soviet Bloc, from many directions, utilizing different bases in a "cross-weave" pattern. Because of the relatively limited range of American high-speed jet bombers of the B-47 type the United States was almost wholly dependent upon its allies to provide real estate for bases. Of all the world-wide network outside the United States proper, very few important bases were under American control; only these did not require secret and continuing negotiations over the circumstances which would permit their use in time of an emergency alert or war. A list of the host countries on whose territory these bases were located illustrates the degree of dependence by the

United States on its allies for the geographical dispersal of SAC facilities: Canada, Iceland, Greenland, Great Britain, Spain, Portugal (Azores), Morocco, Libya, Saudi Arabia, Turkey, the Philippines. Overseas bases under exclusive American control included Okinawa, Central Pacific bases, Alaska and Puerto Rico.

While the need for a complex pattern of overseas air bases necessitated acquisition of bases and air transit rights throughout a very large part of Eurasia, as long as the United States retained its atomic monopoly and an impressive delivery capability the risks run by host countries in permitting use of their territories seemed minimal in contrast to the risks they were to run in later years. In addition, the tasks of reconstruction from war damage and the promise of extraordinary economic assistance from the United States helped still effective political opposition abroad to the military requirements of United States' strategic air operations.

Until 1950, the United States' monopoly of atomic weapons and possession of a long range bomber force simplified negotiations with several of these powers, especially Britain. In most cases, however, it was quickly apparent that very complex and often insoluble political issues affected base negotiations. Many of these issues reflected the anti-colonial trend of the so-called "middle belt" of the world. The intensity of independence movements forced the United States to plan a relatively brief stay in many of these countries as their struggles for freedom made increasingly doubtful the security of the bases themselves. What hope could the United States have that these bases would be instantly available in the event of a central war? These were key considerations in North Africa and the Far East which affected the location of bases, terms of use, and the permanence.

Generally speaking, United States military requirements for the most efficient use of overseas bases included free access of aircraft and support units to the base area at all times. It was important to have the right to launch aircraft from the base for purposes of maneuver, and in time of an emergency alert or war, it was essential to have the right of repair and refuelling, and an acceptance of the principle that United States' aircraft might well be involved in successive missions on the "cross-weave" pattern. Finally, the police security of the base proper from local attack or sabotage was, of course, a further consideration.

In some instances, the terms governing the use of the bases were defined carefully with the realization that a decision as to the base's availability in a crisis, if made at all, would be reached after consideration by the host country of many complex political, military and psychological factors. In other cases there were informal understandings on the circumstances which would call the base into action. In such cases, the decision by the host state would stem almost wholly from a military evaluation of a threat from the Soviet Union at the time it was made. Bases in Britain and Canada were examples of this category. Still another category included bases whose use would, for all practical purposes, be a matter of United States' emergency decision almost regardless of any limiting agreements or understandings reached beforehand. Examples of the last would include, bases in Greenland, Iceland, the Azores, and Libya. Still other arrangements were necessary for peacetime air transit rights (and landing privileges) for aircraft passing over neutralist states.

A fundamental issue confronting all allies of the United States, and others granting SAC facilities or transit rights, was that of the political control over SAC operations. From 1952 on, there could scarcely have been doubt that the employment of a SAC air fleet in any part of the world would have resulted in central war involving sooner or later every state useful to SAC operations. This awesome threat of "automatic involvement" was, and remains today, a most critical issue. For its part, the United States never considered sharing its exclusive control over strategic air fleets with any close ally or any alliances. NATO was clearly one group which might have been given some degree of authority or control over SAC—all the more so since SAC was for almost a decade the only effective weapon in NATO defense. But never, at any time, did the United States delegate any responsibility for SAC; its employment—timing and area of operations—has been a decision reserved for the United States alone.

Furthermore, for the Americans, domestic as well as international political issues affecting allies complicated enormously the task of strategic air war planning in the designation of target systems to be assigned to air units involving one or more bases. When by 1952 the Soviets gave evidence of possessing a long range bomber command (and the assumption had necessarily to be made that it could deliver atomic and eventually nuclear weapons), the vulnerability of U.S. strategic forces came into question. It became important to reduce the number of SAC aircraft on bases overseas, to station the bulk of strategic forces in the North

American continent and to deploy in peacetime only a limited number of SAC units for brief periods overseas. In wartime, SAC aircraft could be moved rapidly to those bases from which most missions were to begin. As Soviet capabilities continued to increase, the United States thought it advisable to lessen its operational dependence on overseas bases close to the Soviet Bloc. The factor which contributed most to a lessening of the American reliance on these overseas bases, was the perfection of in-flight refuelling. It increased the operating range of strategic bombers (and later tactical air) permitting longer missions, reconnaissance or approaches to targets but, above all, it allowed the United States Strategic Air Command to achieve its objective: the wholesale reduction of its strike forces located overseas, where they were increasingly vulnerable to Soviet surprise attack, and where, in many cases, they had been assigned to bases whose security and availability in an emergency were increasingly in doubt.

By 1957, B-47 medium jet bombers, refuelled going and returning, could reach about two-thirds of all key Soviet targets from the continental United States and American-controlled bases in the Pacific. The KS-97 and the Jet KC-135 tankers freed the B-47 bomber from its dependence upon an extensive complex of overseas bases and permitted effective intercontinental operations. With this achievement, there was no sudden world-wide abandonment of overseas bases, but their value to the United States was both clearly less and different. From the time a truly impressive intercontinental capability had been acquired (with the B-52), many overseas bases involved in strategic air operations shed old functions and gained a new one of acting largely as recovery sites for aircraft returning from their initial (and, presumably, only) foray into the Soviet Bloc. The Nash Report (1957) on the overseas base system was described publicly and in part as urging every effort to preserve the overseas system if only to have facilities for contingencies short of central war. The unreliability of many of the bases was clearly of concern to the Committee which did not, however, recommend abandonment but rather the existence of a "secondary" string of SAC facilities to back up the major base complexes. (The Nash Report was also cited as recommending several key changes in overseas Status of Forces' agreements, urging a reduction of acreage of vast SAC airfields, etc., to allay local resentment overseas at the American military presence[2]). Nevertheless, the facts were clear: the United States was freed from the necessity of having allies willing to accept large numbers of SAC aircraft and to grant permission for the continuation and operation of large bases; in-flight refuelling was an impressive technical and operational achievement which had profound political repercussions.

II

Foremost among these—especially in Europe—was the belief that improvements in strategic air operations and weapons technology provided not only a military rationale for the withdrawal of American forces from an increasingly vulnerable base system but it provided further excuse for a resurrected concept of a "Fortress America". Very few military spokesmen in the United States expressed the view that a "Fortress America" was possible or desirable, but the European could not fail to notice that each major development in strategic operations had as its consequence a "withdrawal" or "retreat" to the sanctuary of the North American continent. The military argument that a growing Soviet capability to launch long range strategic strikes compelled a change in the disposition of American forces was of less interest than the political judgment that the United States was engaged also in retreat to a new kind of isolationism. The significance of frequent "showing of the flag" by long range demonstration flights involving the rapid transfer of SAC and transport aircraft from United States' Zone of Interior bases to distant overseas objectives went virtually unremarked. Of course, outside the European area, many host countries were relieved to find fewer aircraft deployed in their territories; there was very little comprehension and even less discussion of those political aspects of the strategic withdrawal which were of growing concern to the European.

Europeon apprehension rested on the assumption that for many Americans their role in World War II, and especially their involvement in a succession of postwar economic and political crises, were events still considered exceptional and outside the theme in American history of continental isolation from European affairs. The fact that since the sharp debates of 1950-51 almost no American political leader of any stature has advocated a consolidation of forces within the continental limits of the United States—a Fortress America—does not dissuade many Europeans from their particular interpretation of the trends in American strategic planning since the Korean War.[3]

To many thoughtful Europeans, the United States appears to have been losing out relatively to the Soviet Union in the military aspects of the Cold war.[4] From a position of absolute monopoly of atomic weapons in the period 1945-1949, it appeared to the European that there had been no significant advance in the military strength of the United States which offset the growing power of the Soviet Union: in 1949, their explosion of an atomic device; in 1951, evidence of a long range bomber fleet able to attack Europe and almost all SAC bases overseas; in 1953, an assumed Soviet capability to strike at the continental United States if only with one-way missions; the setting off of a thermonuclear device in the same year and, possibly in 1958, a Soviet decision that the production of manned bombers was to be cut in favor of intermediate and long range missiles. Along with all of these went the retention of a very large and unsurpassed Soviet conventional ground force and a numerically unmatched underseas fleet. In early 1957 the U.S.S.R. had commenced its warnings to allies of a nuclear attack upon them if they permitted the United States to continue to use overseas bases and to acquire missile sites abroad.

The European compared this increase in Soviet power with what he regarded as an American failure to exert the effort necessary to keep strategic superiority, failure cloaked in a succession of handy phrases whose true military meaning was obscure but which, apparently, had domestic political value within the United States. Secretary of Defense Wilson could not have expressed the point more clearly when he said, "we recognize that while our military strength must be adequate, it must not be excessive to a degree that could seriously impair the economic vigor of our country or the will and ability of the American people to support it."[5]

As each new strategic concept was heralded in the United States, it could be, and was, interpreted elsewhere as being more of an excuse or a rationalization of a failing military position. From paramountcy with its exclusive atomic-nuclear force, the United States, in its "New Look" of 1953-54, announced its policy of massive retaliation—modified to read "graduated deterrence", amended to read "adequacy or sufficiency of force"—but not superiority or "over-kill"—and, most recently, a policy which concedes numerical missile superiority to the U.S.S.R. in 1960 and for several years ahead but asks for a United States "invulnerable retaliatory force", able to survive a Soviet strike but not suited to a pre-emptive attack of its own. Were these policies derived from strength? The European knew that these successive "doctrines" were advanced at the same time the White House was insisting upon a reduction of defense expenditures; it seemed to some of our allies only prudent to ponder not only the military implications of changes in the operating requirements of strategic forces but strategic doctrines as well and to consider in both aspects their political consequences.

First among their concern was the political issue of command and control. As long as the United States retained its strategic force monopoly or possessed a clear advantage over Soviet strike capabilities, the issue of command and control did not loom large. The assumption was that in the event of a major threat to NATO the United States would certainly respond and vigorously so. From the beginning, members of NATO had reservations about an exclusive American control of the strategic forces (the British determined they ought to acquire a nuclear strike force of their own and so did the French). But the unwillingness of the United States to discuss any sharing of the command to implement SAC, coupled with the shrewd doubt of states that a collective decision to employ SAC would be any more reliable, relegated to the background the issue of the United States' exclusive control over strategic strike operations. Once, however, it became known that the Soviets could use their own forces to strike at Europe (or elsewhere) and to threaten or hit the United States, the political aspects of the problem of command and control gained sudden importance. The most vital was, of course, the question: would the United States' president (it would theoretically be his decision) stand up to a Soviet threat to NATO, or a threat to a single and perhaps minor member of the alliance; would the President launch a pre-emptive strike to forestall an expected Soviet attack on NATO (or on a minor member of the alliance); and finally, in the event of an attack on a minor member of the alliance, would he order retaliatory forces into battle? The European answer to the questions was neither a resounding nor a quiet affirmative; there was hope, of course, but there was doubt as well. Since almost all of American strategic forces were outside the European theatre, with the exception of the U.S. fleets stationed in the Mediterranean, and the bulk of them on the North American continent, the automatic involvement of SAC units as a consequence of an attack upon Europe was no longer certain; the European holding of strategic forces "in hostage" to guarantee American involvement was no longer possible. (United States' ground forces in Europe remained

a guarantee of American involvement in case of a direct Soviet attack upon a NATO country in which they were stationed.) The publication in "Foreign Affairs" of an important and widely discussed article, "The Delicate Balance of Terror" by Albert Wohlstetter, did nothing to assuage the fears of many that the United States was in an exceedingly difficult race with the U.S.S.R.[6]

The political crisis of confidence within NATO became a matter of very great concern to the United States and an effort was made to restore a measure of it by the offer to provide intermediate range ballistic missiles to members of NATO. The purpose was to give them a semblance of a strategic defense force (the nuclear warheads to be under American control) and to strengthen their confidence in United States involvement in the event of of crisis. The slow reaction time, reliability, accuracy and vulnerability of these missiles left much to be desired. The European did not feel reassured when the U.S. Secretary of Defense announced that the IRBM missiles *Thor* (emplaced in Britain) and the *Jupiter* (Italy and Turkey) were not to be improved upon significantly, and would not be used by the United States. The Defence Department would concentrate its program for the next years on the production of intercontinental ballistic missiles, to be located in United States territory, and on the Fleet Ballistic Missile System ("Polaris") to be emplaced in nuclear submarines whose operating range would be limited by the physical endurance of their crews; no allied facilities were required for their mission. As far as strategic weapons were concerned, the trends of the past decade were not to be reversed; the withdrawal of strategic forces from overseas bases—and now from overseas missile sites—would continue.

III

The doubts and apprehensions of many Europeans over the consequences of these trends are real and expressed publicly with increasing frequency. Are they justified? Starting with their appraisal of the political meaning of changes in United States' strategic forces over the past decade and half, they ask of Americans if 1) the withdrawal of strategic weapons to the continental United States, as a result of the rise of Soviet military power, made unlikely a decision by the President to use these weapons in defense of the Western Alliance, and 2) within the United States, are there to be long-term political consequences of the withdrawal of strategic forces from overseas?

With respect to the first, in the face of mounting Soviet strike capabilities and in the absence of any conspicuous resolve of the President to call for an extraordinary effort to right the balance, it seems irrefutable that the "retreat"—as some Europeans describe it—of strategic forces has increased greatly the chance of successful Soviet nuclear blackmail against a member of the Western Alliance. In the period when the principal American strategic reliance was on manned aircraft, and the major Soviet threat to that force took the form of medium jet bombers and intermediate range ballistic missiles, a withdrawal to more distant, continental bases did, in fact, clearly strengthen the defense of the Alliance's only significant strategic force. As long as the U.S.S.R. still could not damage the United States heavily the American resolution to come to NATO's aid with strategic forces was relatively unimpaired. However, when the Soviet arsenal began to include intercontinental ballistic missiles, and the North American continent came under the threat of a direct and devastating attack, the European was right to ask if the defense of the Alliance was weaker *because* of its distant, American continental base and exclusive United States control. It is only reasonable for allies to find that the use of the strategic force in response to a massive Soviet threat to almost any area outside North America is not highly creditable and that the Soviets are today in a position to gain much through relentless exploitation of Western weaknesses, both political and military. Five years ago, a list of areas overseas "essential" to the strategic defense of the United States would have included many territories about the world; today, such a list would be drastically shorter and might not include much more than the north polar lands and possibly Britain. Given the great technological resources, production facilities, and wealth of the United States, the maintenance of an impressive strategic force is its unique military responsibility and role on behalf of the free world, a role which it has preferred to date to play alone. There is understandable apprehension overseas and in Canada that the United States is behind in the strategic race with the Soviet Union, and from the European point of view a measure of the gap comes in the narrowing down of areas regarded by the United States as essential to its own security. From the strategic point of view, a very large part of NATO is no longer "essential".

The second question being asked by allies relates to the political effects within the United States of the withdrawal of strategic weapons from overseas; will the location of these weapons on the North

American continent (or in submarines of great operating range) produce a wave of American isolationism which, growing from the assumed military feasibility of a Fortress America, will erode the political and economic interests of the United States in the Western Alliance? If no answer can be given now, a warning can be. An economic recession, a diplomatic defeat inflicted by the Soviets and made possible by a split within the Western Alliance, or through the intransigence of a major ally, could lead to a serious loss of American confidence in the value and reliability of its allies with consequent major cuts or "savings" in United States foreign military and economic aid. Disenchantment today with the results of past expenditures and the prospects of a seemingly bottomless maw of world requirements in the future indicates a degree of public skepticism if not yet hostility, towards these programs.

In fact, these two vital questions bearing on the deterrent and American attitudes towards its allies may be said to grow out of the changes in the United States strategic force—is composition, location, and presumed effectiveness. These questions are, therefore, inseparable. The danger to the West is that some major allies, *anticipating* a further deterioration in the effectiveness of Western defense will believe themselves compelled to seek new means—essentially diplomatic—for reaching separate arrangements with the Soviet Union; and that, on the other hand, some Americans *anticipating* a Fortress America, will try to reduce incautiously the scope of American assistance abroad, neglecting other non-military aspects of the national interest which require a close and continuing association with partners in the free world.

With respect to these dangers, the United States' responsibility is particularly grave: (1) Its overall defense effort must be of such magnitude as to restore allied confidence in the strength of the American strategic force. (2) The United States must devise ways and means of extending to its allies a significant nuclear-missile retaliatory capability of their own (held separately or collectively) and (3) The command of these weapons or their warheads cannot be in every circumstance subject to an American veto.[7] There are far-reaching military implications embedded in these recommendations but in each the political aspect looms larger for the current crisis of confidence in the strategic force is not so much the result of any technological lag vis-a-vis the Soviet Union as it is the consequence of a political estimate of the creditability of the force.

[1] For a lengthy discussion of this issue, see *Developments in Military Technology and Their Impact on United States Strategy and Foreign Policy,* Report to the Committee on Foreign Relations, United States Senate, 1959, U.S. Government Printing Office. A most cogent appraisal of the Soviet Union is presented in the analysis *U.S.S.R. and Eastern Europe* by a Columbia-Harvard Research Group in a report to the Committee on Foreign Relations (1960); it should be read in conjunction with the report on *Developments in Military Technology.*

[2] *The New York Times,* December 22, 1957.

[3] For a useful summary of changes in strategic planning and weapons systems, see *United States Defense Policies Since World War II,* Legislative Reference Service, The Library of Congress, 1957, U.S. Government Printing Office.

[4] European views cited here have been expressed frequently to the author, in the course of visits to West Europe and Canada, by men with military, diplomatic and political interests.

[5] *United States Defense Policies,* op. cit., p. 53.

[6] Published in "Foreign Affairs", January, 1959, New York.

[7] A French view of the problem of command and control will be found in *Stratégic de l'Age Nucléaire,* by General Pierre M. Gallois; Calmann-Lévy, Paris, 1960.

I have read somewhere the remarks of Frederick the Great when speaking about officers who relied solely on their practical experience and who neglected to study; he is supposed to have said that he had in his Army two mules who had been through forty campaigns, but they were still mules.

—Montgomery, in his *Memoires.*

The Second World War — A Summing-Up
Key Factors and Turning Points

CAPTAIN B. H. LIDDELL HART

Captain B. H. Liddell Hart has written more than twenty-seven volumes dealing with military history, strategy, tactics, and the general policy of National Defence. A brilliant biographer, he has produced studies of Scipio Africanus, Sherman, Foch and Lawrence, the military writers of the 18th and 19th Centuries (Marshall de Saxe to Clausewitz, touching on Guibert, Bourcet and Jomini) and finally the great captains of history, up to and including those of 1914-1918, in a remarkable book entitled "Reputations". As an historian, he has published two works on the war of 1914-1918, two on that of 1939-1945 and one on the value of the study of history. There is little doubt that he will go down in history for his early recognition of the principles of mechanized warfare, and in particular the exploitation of armour. His theories on tank strategy greatly influenced German planning of the "blitzkrieg" strategy. General Chassin of the French Air Force has called Captain Liddell Hart, "the greatest military thinker of the 20th Century whose ideas have revolutionized the art of war".

THIS CATASTROPHIC conflict, which ended by opening Russia's path into the heart of Europe, has been aptly called by Churchill "the unnecessary war". In striving to avert it, and curb Hitler, a basic weakness in the policy of Britain and France was their lack of an understanding of strategical factors. Through this they slid into war at the moment most unfavourable to them, and they precipitated an avoidable disaster of far-reaching consequences. Britain survived by what appeared to be a miracle—but really because Hitler made the same mistakes that aggressive dictators have repeatedly made throughout history.

The Vital Pre-War Phase

In retrospect it has become clear that the first fatal step, for both sides, was the German re-entry into the Rhineland in 1936. For Hitler, this move carried a two-fold strategic advantage—it provided cover for Germany's key industrial vital area in the Ruhr, and it provided him with a potential springboard into France.

Why was this move not checked? Primarily, because France and Britain were anxious to avoid any risk of armed conflict that might develop into war. The reluctance to act was increased because the German re-entry into the Rhineland appeared to be merely an effort to rectify an injustice, even though done in the wrong way. The British particularly, being politically-minded, tended to regard it more as a political than as a military step—failing to see its strategic implications.

But a further, and decisive, factor was French military unreadiness for prompt "fire-extinguishing" action. In *The Remaking of Modern Armies*, 1927, and subsequently, I argued that the pattern and doctrine of the French Army was dangerously out of date and lacking in flexibility—so "rigid" and "ponderous" that "under the test of a future war it might break down altogether"—and that the most urgent need for France was to create "a mechanized striking force of highly trained long-service volunteers, to form a spearhead"—prior to the mobilization of the conscript mass.

Charles de Gaulle took up this argument and proposal, making them the theme of his striking little book of 1934, *Vers l'Armee de Metier*. Paul Reynaud urged the same idea—the need for a

mechanized spearhead of professional troops. But nothing was done to carry it out.

That military factor—the lack of such an immediately available spearhead—was primary in point of time. It became a check on any riposte to Hitler's Rhineland move before political hesitation on the part of the British Government increased the restraint.

In his 1938 moves Hitler again drew strategic advantage from political factors—the German and Austrian people's desire for union, the strong feeling in Germany about Czech treatment of the Sudeten Germans, and the widespread feeling in the Western countries that there was a measure of justice in Germany's case on both issues.

But Hitler's march into Austria in March laid bare the southern flank of Czechoslovakia—which to him was an obstacle in the development of his plans for eastward expansion. In September he secured—by the threat of war and the resultant Munich agreement—not merely the return of the Sudetenland but the strategic paralysis of Czechoslovakia.

In March 1939 Hitler occupied the remainder of Czechoslovakia, and thereby enveloped the flank of Poland—the last of a series of "bloodless" manœuvres. This step of his was followed by a fatally rash move on the British Government's part—the guarantee suddenly offered to Poland and Rumania, each of them strategically isolated, without first securing any assurance from Russia, the only power which could give them effective support.

By their timing, these guarantees were bound to act as a provocation—and, as we now know, until he was met by this challenging gesture Hitler had no immediate intention of attacking Poland. By their placing, in parts of Europe inaccessible to the forces of Britain and France, they provided an almost irresistible temptation. Thereby the Western Powers undermined the essential basis of the only type of strategy which their now inferior strength made practicable for them. For instead of being able to check aggression by presenting a strong front to any attack in the west, they gave Hitler an easy chance of breaking a weak front and thus gaining an initial triumph.

The only chance of avoiding war now lay in securing the support of Russia—the only power that could give Poland direct support and thus provide a deterrent to Hitler. Despite the urgency of the situation, the British Government's steps were dilatory and half-hearted. But beyond their own hesitations were the objections of the Polish Government, and the other small powers in Eastern Europe, to accepting military support from Russia—since these feared that reinforcement by her armies would be equivalent to invasion.

The most extraordinary feature of this period was the statesmen's belief that the Guarantee given to Poland, which was a strategic absurdity, could be a deterrent to Hitler. All Britain's political leaders approved of it, and the only one who voiced a warning of its folly was Lloyd George.

Very different was Hitler's response to the new situation created by British backing of Poland. Britain's violent reaction and redoubled armament measures shook him, but the effect was opposite to that intended. His solution was coloured by his historically derived picture of the British. Regarding them as cool-headed and rational, with their emotions controlled by their head, he felt that they would not dream of entering a war on behalf of Poland unless they could obtain Russia's support. So, swallowing his hatred and fear of "Bolshevism", he bent his efforts and energies towards conciliating Russia and securing her abstention. It was a turn-about even more startling than Chamberlain's—and as fatal in its consequences.

On August 23rd Ribbentrop flew to Moscow, and the pact was signed. It was accompanied by a secret agreement under which Poland was to be partitioned between Germany and Russia.

This Pact made war certain—in the intense state of feeling that had been created by Hitler's rapid series of aggressive moves. The British, having pledged themselves to support Poland, felt that they could not stand aside without losing their honour—and without opening Hitler's way to wider conquest. And Hitler would not draw back from his purpose in Poland, even when he came to see that it involved a general war.

Thus the train of European civilization rushed into the long, dark tunnel from which it only emerged after six exhausting years had passed. Even then, the bright sunlight of victory proved illusory.

The First Phase of the War

On Friday September 1st, 1939, the German armies invaded Poland. On Sunday, 3rd, the British Government declared war on Germany in fulfilment of the guarantee it had earlier given to Poland. Six hours later the French Government, more reluctantly, followed the British lead.

Within less than a month Poland had been

overrun. Within nine months most of Western Europe had been submerged by the spreading flood of war.

Could Poland have held out longer? Could France and Britain have done more than they did to take the German pressure off Poland? On the face of the figures of armed strength, as now known, the answer to both questions would, at first sight, seem to be "yes".

The German Army was far from being ready for war in 1939. The Poles and French together had the equivalent of 130 divisions against the German total of 98 divisions, of which 36 were in an untrained state. Out of the 43 divisions which the Germans left to defend their western frontier, only 11 were active divisions, fully trained and equipped, whereas the French General Staff planned to deploy 85 there. It is thus natural that the German generals, when interrogated after the war and in their memoirs since, have all declared that their western front would have been broken if the French Army had made a serious effort to attack it.

But Hitler's strategy had placed France in a situation where she could only relieve pressure on Poland by developing a quick attack—a form of action for which her Army was unfitted. Her old-fashioned mobilization plan was slow in producing the required weight of forces, and her offensive plans dependent on a mass of heavy artillery which was not ready until the 16th day. By that time the Polish Army's resistance was collapsing.

Poland was badly handicapped by her strategic situation—the country being placed like a "tongue" between Germany's jaws, and Polish strategy made the situation worse by placing the bulk of the forces near the tip of the tongue. Moreover, these forces were out of date in equipment and ideas, still placing faith in a large mass of horsed cavalry—which proved helpless against the German tanks.

The Germans at that time had only six armoured and four mechanized divisions ready, but thanks to General Guderian's enthusiasm, and Hitler's backing, they had gone further than any other army in adopting the new idea of high speed mechanized warfare that had been conceived twenty years earlier by the British pioneers of this new kind and tempo of action. The Germans had also developed a much stronger air force than any of the other countries, whereas not only the Poles, but the French also, were badly lacking in air-power, even to support and cover their armies.

Thus Poland saw the first triumphant demonstration of the new *blitzkrieg* technique, by the Germans, while the Western allies of Poland were still in process of preparing for war on customary lines. On the 17th September the Red Army advanced across Poland's eastern frontier, a blow in the back that sealed her fate, as she had scarcely any troops left to oppose this second invasion.

The responsibility for the French Army's incapacity to deliver a prompt attack lies partly with its successive chiefs from Pétain to Gamelin, who were all wedded to slow-motion ways of warfare, and partly with the political leaders, who clung to the belief that a massive army raised by conscription was the cheapest and safest form of national defence assurance. Both the military and the political leaders ignored or discounted the arguments and warnings uttered by de Gaulle and Reynaud.

On the other side of the Channel, a few progressive military thinkers had urged that the best contribution that Britain could make to the defence of the West was by the early intervention of a strong air force and a small and highly efficient mechanized force of two or three armoured divisions—offset French weakness in these means. That view momentarily gained favour in 1937. But after Munich, the French political and military chiefs pressed their allies to adopt conscription in order to produce a large army on the old lines. Their views were shared by the British General Staff, which was also wedded to old style ways, and by a growing proportion of the Cabinet.

Eventually, after Hitler's move into Prague, the British Government abandoned its former military policy and introduced conscription. That decision diminished the effective contribution that Britain might have made, by absorbing industrial resources to equip the mass army now projected. When war came a force of four infantry divisions was sent to France while a build-up of 55 divisions was planned. By the spring of 1940, 13 British infantry divisions had arrived in France, but no armoured division—which would have been far more effective in the circumstances. (The one tank brigade that was on the scene counter-attacked at Arras with such effect, on the mind of the German Command, as to cause a pause in the panzer drive towards Lille and Dunkirk.)

The rapid overruning of Poland was followed by a six months' lull—christened "the Phoney War" by onlookers who were deceived by the surface appearance of calm. A truer name would have been "The Winter of Illusion". For the leaders, as well as the public, in the Western countries spent

the time in framing fanciful plans for attacking Germany's flanks—and talked about them all too openly.

In reality, there was no prospect of France and Britain ever being able, alone, to develop the strength required to overcome Germany. Their best hope, now that Germany and Russia faced each other on a common border, was that friction would develop between these two mutually distrustful confederates, and draw Hitler's explosive force eastwards, instead of westwards. That happened a year later, and might well have happened earlier if the Western allies had not been impatient—as is the way of democracies.

Their loud and threatening talk of attacking Germany's flanks spurred Hitler to forestall them. His first stroke was to occupy Norway. The captured records of his conferences show that until early in 1940, he still considered "the maintenance of Norway's neutrality to be the best course" for Germany, but that in February he came to the conclusion that "the English intend to land there, and I want to be there before them". A small German invading force arrived there on April 9th, upsetting the British plans for gaining control of that neutral area—and captured the chief ports while the Norwegians' attention was absorbed by the British naval advance into Norwegian waters.

Hitler's next stroke was against France and the Low Countries on May 10th. He had started to prepare it the previous autumn, when the Allies rejected the peace offer he made after defeating Poland—feeling that to knock out France offered the best chance of making Britain agree to peace. But bad weather and the doubts of his generals had caused repeated postponements from November onwards. Then on January 10th a German staff officer who was flying to Bonn with papers about the plan missed his way in a snowstorm, and landed in Belgium. This miscarriage caused the offensive to be put off until May, and it was radically recast meanwhile. That turned out very unfortunately for the Allies, and temporarily very lucky for Hitler, while changing the whole outlook of the war.

For the old plan, with the main advance going through the canal-lined area of central Belgium, would in fact have led to a head-on collision with the best part of the Franco-British forces, and so would probably have ended in failure—shaking Hitler's prestige. But the new plan, suggested by Manstein, took the Allies completely by surprise and threw them off their balance, with disastrous results. For while they were pushing forward into Belgium, to meet the Germans' opening assault there and in Holland, the mass of the German tanks—seven panzer divisions—drove through the hilly and wooded Ardennes, which the Allied High Command considered impassable to tanks. Crossing the Meuse with little opposition, they broke through the weak hinge of the Allied front, and then swept on westwards to the Channel coast behind the backs of the Allied armies in Belgium, cutting their communications. This decided the issue—before the bulk of the German infantry had even come into action. The British Army barely managed to escape by sea from Dunkirk. The Belgians and a large part of the French were forced to surrender. The consequences were irreparable. For when the Germans struck southwards, the week after Dunkirk, the remaining French armies proved incapable of withstanding them.

Yet never was a world-shaking disaster more easily preventable. The panzer thrust could have been stopped long before reaching the Channel by a concentrated counterstroke with similar forces. But the French, though having more and better tanks than the enemy, had strung them out in small packets in the 1918 way.

The thrust could have been stopped earlier, on the Meuse, if the French had not rushed into Belgium leaving their hinge so weak, or had moved reserve there sooner. But the French Command had not only regarded the Ardennes as impassable to tanks but reckoned that any attack on the Meuse would be a set-piece assault in the 1918 style, and would take nearly a week to prepare after arrival there, thus allowing the French ample time to bring up reserves. But the panzer forces reached the river early on the 13th May and stormed the crossings that afternoon. A "tank-time" pace of action bowled over an out of date "slow-motion".

But this *blitzkrieg* pace was only possible because the Allied leaders had not grasped the new technique, and so did not know how to counter it. The thrust could have been stopped before it even reached the Meuse if the approaches had been well covered with minefields. It could have been stopped even if mines were lacking—by the simple expedient of felling the trees along the forest roads which led to the Meuse. The loss of time in clearing them would have been fatal to the German chances. A French friend of mine, then in charge of a sector on the Meuse, begged the High Command for permission to do this, but was told that the roads must be kept clear for the advance of

the French cavalry! These cavalry duly pushed into the Ardennes, but came out more rapidly, and routed, with the German tanks on their heels.

I have particularly good reason to gauge how easily this fatal thrust could have been checked. As is well-known, General Guderian, the German panzer leader, described himself as my "pupil and disciple" in this "new method of warfare". Having thought it out in the 1920s, it did not require any great effort to discover the antidote well before 1940. It was hard, however, to get it understood by generals who were still thinking in terms of 1918. By 1942 all armies had learned how to check a *blitzkrieg* attack—but a lot would have been saved if they had learned before the war.

After the fall of France, there was a popular tendency to ascribe it to the poor state of French morale, and to assume that the fall was inevitable. That is a fallacy—a case of "putting the cart before the horse". The collapse of French morale only occurred after the military break-through—which could so easily have been prevented.

The Second Phase of the War

Britain was now the only remaining active opponent of Nazi Germany. But she was left in the most perilous situation, militarily naked while menacingly enveloped by a 2,000 mile stretch of enemy coastline.

Her army had only reached Dunkirk and avoided capture through Hitler's strange action in halting his panzer forces for two days when they were a bare ten miles from that last remaining escape-port, then almost unguarded—a halt order inspired by a complex of motives, including Goering's vainglorious desire that the *Luftwaffe* should take the final trick.

Even though the bulk of the British Army had got away safely, it had lost most of its arms. While the survivors of the sixteen divisions that came back were being reorganized, there was only one properly armed division to defend the country, and the Fleet was kept in the far north out of reach of the *Luftwaffe*. If the Germans had landed in England any time during the month after the fall of France there would have been little chance of resisting them.

But Hitler and his service chiefs had made no preparations to invade England—nor even worked out any plans for such an obviously essential follow-up to their defeat of France. He let the vital month slip away in hopeful expectation that Britain would agree to make peace. Even when disillusioned on that score, the German preparations were half-hearted. When the *Luftwaffe* failed to drive the R.A.F. out of the sky in the "Battle of Britain", the army and navy chiefs were glad of the excuse thus provided for suspending the invasion. More remarkable was Hitler's own readiness to accept excuses for its suspension.

The records of his private talks show that it was partly due to a reluctance to destroy Britain and the British Empire, which he regarded as a stabilizing element in the world, and still hoped to secure as a partner. But beyond this reluctance there was a fresh impulse. Hitler's mind was again turning eastward. This was the key factor that proved decisive in preserving Britain.

If Hitler had concentrated on defeating Britain, her doom would have been almost certain. For although he had missed his best chance of conquering her by invasion, he could have developed such a stranglehold, by combined air and submarine pressure, as to ensure her gradual starvation and ultimate collapse.

Hitler, however, felt that he could not venture to concentrate his resources on that sea-and-air effort while the Russian army stood poised on his eastern border, as a threat to Germany on land. So he argued that the only way to make Germany's rear secure was to attack and defeat Russia. His suspicion of Russia's intentions was all the more intense because hatred of Russian Communism had so long been his deepest emotion.

He also persuaded himself that Britain would agree to peace once she could no longer hope for Russian intervention in the war. Indeed, he imagined that Britain would have made peace already if Russia were not inciting her to fight on! When, on July 21st, Hitler held his first conference to discuss the hastily drafted plans for invading England, he revealed the turn of his mind, saying: "Stalin is flirting with Britain to keep her in the war and tie us down, with a view to gain time and take what he wants, knowing he could not get it once peace breaks out." From this came the conclusion: "Our attention must be turned to tackling the Russian Problem."

Planning was initiated immediately, though it was not until early in 1941 that he took the definite decision. The invasion was launched on June 22nd—a day ahead of Napoleon's date. The panzer forces quickly overran the Soviet armies that were immediately available and within less than a month had driven 450 miles into Russia—three-quarters of the way to Moscow. But the Germans never reached there.

What were the key factors in their failure? The

autumn mud and snow were the obvious ones. But more fundamental was the Germans' miscalculation of the reserves that Stalin could bring up from the depths of Russia. They reckoned on meeting 200 divisions, and by mid-August had beaten these. But by then a further 160 had appeared on the scene. By the time these in turn had been overcome, autumn had arrived, and when the Germans pushed on towards Moscow in the mud, they again found fresh armies blocking the route. Another basic factor was Russia's continued primitiveness, despite all the technical progress achieved since the Soviet Revolution. It was not only a matter of the extraordinary endurance of her soldiers and people, but the primitiveness of her roads. If her road system had been developed comparably to that of the West, she would have been overrun almost as quickly as France. Even as it was, however, the invasion might have succeeded if the panzer forces had driven right on for Moscow in the summer, without waiting for the infantry—as Guderian had urged, only to be overruled on this occasion by Hitler and the older heads of the army.

The winter in Russia proved a terrible strain and drain on the German forces—and they never fully recovered from it. Yet it is evident that Hitler still had quite a good chance of victory in 1942, as the Red Army was seriously short of equipment, while Stalin's grip on it had been shaken by the heavy initial defeats. Hitler's new offensive swept quickly through to the edge of the Caucasus oilfields—on which Russia's military machine depended. But Hitler split his forces between the double objectives of the Caucasus and Stalingrad. Narrowly checked here, he wore down his army in repeated bull-headed efforts to capture "the City of Stalin", becoming obsessed with that symbol of defiance. Forbidding any withdrawal when winter came, he doomed the army attacking it to encirclement and capture when Russia's newly raised armies arrived on the scene late in the year.

The disaster at Stalingrad left the Germans with a far longer front than they could hold with their depleted strength. Withdrawal was the only saving course, as the generals urged, but Hitler obstinately refused to sanction it. Deaf to all arguments, he constantly insisted on "no retreat". The parrot-cry could not stem the tide, and merely ensured that each eventual retreat would be enforced by a heavy defeat, at higher cost because it was delayed too long.

Hitler's forces were suffering, increasingly, the consequences of strategic overstretch—which had proved the ruin of Napoleon. The strain was all the worse because in 1940 the war had been extended to the Mediterranean—by Mussolini plunging into the war to take advantage of France's downfall and Britain's weakness. That had offered the British a chance for counter-attack, in an area where seapower could exert its influence. Churchill was quick to seize the chance—in part, too quick. Britain's mechanized force in Egypt, though small, soon smashed the out of date Italian army in North Africa, beside conquering Italian East Africa. It could have driven on to Tripoli, but was halted in order that a force could be landed in Greece—a premature and ill-prepared move that was easily repulsed by the Germans. But the Italian breakdown in North Africa led Hitler to send German reinforcements there, under Rommel. However, having his eyes fixed on Russia, Hitler sent only enough to bolster up the Italians, and never made a strong effort to seize the eastern, central, and western, gates of the Mediterranean—Suez, Malta, and Gibraltar.

So in effect, he merely opened up a fresh drain, on Germany's strength, which ultimately offset the success of Rommel's counterthrusts in postponing for over two years the clearance of North Africa. The Germans were now stretched out along both sides of the Mediterranean, and the whole coastline of Western Europe, while trying to hold a perilously wide front in the depths of Russia.

The natural consequences of such overstretch were postponed, and the war prolonged, by Japan's entry into the war—in December 1941. Her intervention had all the greater effect because most of Britain's available force had been poured into Africa that autumn in an unsuccessful effort to crush Rommel and conquer Italian North Africa.

For that effort, Britain paid a heavy penalty (which reacted on her Allies too)—the forfeit of her positions in the Far East. The Chief of the Imperial General Staff, Dill, had emphasized in May that "it has been an accepted principle in our strategy that in the last resort the security of Singapore comes before that of Egypt". He had deprecated the defence of the Far East in favour of an early offensive in Africa. But others confidently declared that Japan would not besiege Singapore at the outset even if she did enter the war.

The neglect of the Far East defences was the more extraordinary because it had long been an axiom of British policy that if Japan's oil supply were cut off by an embargo she would be bound to strike back. In July, that drastic step was taken by Roosevelt and Churchill simultaneously, to enforce their demand for a Japanese withdrawal from

Indo-China. Yet both Britain and the United States were caught napping when Japan at last struck on December 7th—and nothing adequate had been done to strengthen the defence of Singapore during the five months' interval.

The only compensation, which eventually outweighed all else, was that the simultaneous attack by the Japanese on America's Pacific bases brought her weight into the war. That in the end proved fatal not only to Japan but to Hitler.

But the Japanese stroke at Pearl Harbour, with naval aircraft, temporarily crippled the U.S. Pacific Fleet. The immediate sequel was that it enabled the Japanese to overrun the Allied positions in the South-West Pacific—Malaya, Burma, the Philippines, and the Dutch East Indies. In this rapid expansion, however, they became stretched out far beyond their basic capacity for holding their gains. For Japan was a small island state, with limited industrial power.

The Third Phase of the War

Once America's strength developed, and Russia survived to develop hers, the defeat of the Axis powers—Germany, Italy, and Japan—became certain, as their combined military potential was so much smaller. The only uncertainties were—how long it would take, and how complete it would be. The most that the aggressors, turned defenders, could hope for was to obtain better terms of peace by spinning out time until the "giants" became weary or quarrelled. But the chances of such prolonged resistance depended on shortening fronts. None of the Axis leaders could bear to "lose face" by voluntary withdrawal, and so clung on to every position until it collapsed.

There was no real turning point in this third phase of the war, but only an incoming tide.

The tide flowed more easily in Russia and in the Pacific, because in these areas an ever-growing superiority of force was combined with ample space for manœuvre. In Southern and Western Europe the tide met more checks because space was more cramped.

The Anglo-American forces' first bound back into Europe—in July, 1943—was eased by the way that Hitler and Mussolini poured troops across the sea into Tunisia in the hope of holding a bridgehead there to block the converging advance of the Allied armies from Egypt and Algeria. Tunisia turned into a trap, and the capture of the whole German-Italian army there left Sicily almost denuded of defence. But when the Allies pushed on from Sicily into Italy—in September, 1943—their advance up that narrow and mountainous peninsula became sticky and slow.

On June 6th, 1944, the main Allied armies, which had been built up in England for a cross-Channel invasion, landed in Normandy. Here success was certain if they could firmly establish themselves ashore in a bridgehead big enough to build up their massed strength and swamp the Germans' barricading line. For once they broke out, the whole width of France would be open for the manoeuvre of their armies, which were fully mechanized, whereas the bulk of the German forces were still on a horse-transport basis.

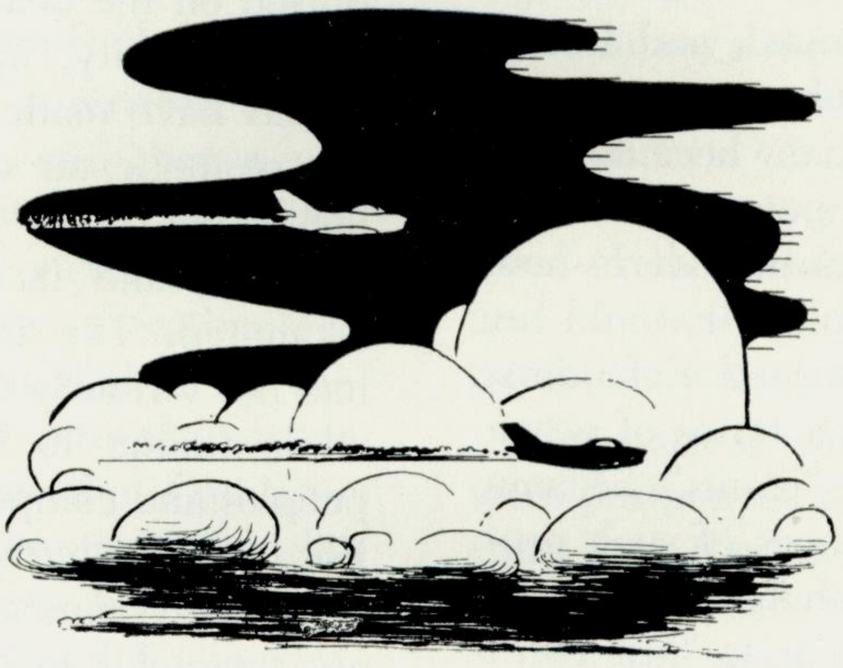
The Germans' defence was thus doomed to eventual collapse unless they could throw the invaders back in the sea in the first few days. But in the event the move-up of their panzer reserves was fatally delayed by the paralyzing interference of the Allied air forces, which had a 30 to 1 superiority over the *Luftwaffe* in this theatre.

Even if the invasion of Normandy had been repulsed on the beaches, the Allies' now tremendous air superiority, applied direct against Germany, would have made her collapse certain. Until 1944 the strategic air offensive had fallen far short of the claims made for it, as an alternative to land invasion, and its effects had been greatly overestimated. The indiscriminate bombing of cities had not seriously diminished munitions production, while failing to break the will of the opposing peoples and compel them to surrender, as expected. For collectively they were too firmly under the grip of their tyrannical leaders, and individuals could not surrender to bombers in the sky. But in 1944-1945 airpower was better directed—applied with ever-increasing precision and crippling effect to the key centres of war production that were vital to the enemy's power of resistance. In the Far East, too, the master key of airpower made the collapse of Japan certain, without any need for the atom bomb.

The main obstacle in the Allies' path, once the tide had turned, was a self-raised barrier—their leaders' unwise and short-sighted demand for "unconditional surrender". It was the greatest help to Hitler, in preserving his grip on the German people, and likewise to the war-party in Japan. If the Allied leaders had been wise enough to provide some assurance as their peace terms, Hitler's grip on the German people would have been loosened long before 1945. Three years earlier, envoys of the widespread anti-Nazi movement in Germany made known to the Allied leaders their

plans for overthrowing Hitler, and the names of the many leading soldiers who were prepared to join such a revolt, provided that they were given some assurance about the Allied peace terms. But then, and later, no indication or assurance was given them, so that it naturally became difficult for them to gain support for a "leap in the dark".

Thus "the unnecessary war" was unnecessarily prolonged, and millions more lives needlessly sacrificed, while the ultimate peace merely produced a fresh menace and the looming cloud of another war. For the unnecessary prolongation of the war, in pursuit of the opponents' "unconditional surrender", proved of profit only to Stalin—by opening the way for Communist domination of Central Europe.



The success of a commander does not arise from following rules or models. It consists in an absolutely new comprehension of the dominant facts of the situation at the time, and all the forces at work. Every great operation of war is unique. What is wanted is a profound appreciation of the actual event. There is no surer road to disaster than to imitate the plans of bygone heroes and fit them to novel situations.

—WSC, "Life of Marlborough"

A Lesson of the Past

(The Twentieth Anniversary of the Fall of France)

JOHN GELLNER

Wing Commander John Gellner, D.F.C., LL.D., R.C.A.F. (ret.), practiced law in Brno, Czechoslovakia, until the German occupation of that country. He joined the R.C.A.F. in early 1940, and during the war flew with Bomber Command. In 1955 he joined the faculty of the R.C.A.F. Staff College where he served until his retirement in 1958. Wing Commander Gellner has established an international reputation as a free-lance writer and lecturer on political and military affairs.

THE PRESENT tendency to reject military history as an indispensable, or even a useful, subject of study for an officer—it has been practically eliminated from the curricula of our staff colleges—has its origin in the Second World War. In the first three years of the latter, the Western allies tried to conduct operations in accordance with an obsolete doctrine. They suffered a succession of defeats at the hands of the Germans and Japanese who, certainly on land, less on the sea, and least of all in the air, were ahead of us in their conception of the science and art of modern war. As a consequence of such bitter experience, the belief developed that it was dangerous to look into the past in things military, because by doing so one could be tempted to emulate it. This is, of course, entirely false. The military establishments of the Western powers were largely obsolete in 1939 not because they were conceived on the basis of studies of concepts developed in the First World War, but because they were founded on an uncritical, a blind, acceptance of these concepts. In other words: it was not the fact that we studied the lessons of 1914-18 which led to defeat 22 years later, but that we did not recognize—or in the case of those in authority, often refused to recognize—their true meaning.

Similarly today, we could learn a good deal from the past. This would benefit us, not bring us in danger of preparing once again for the last war.

The twentieth anniversary of the disastrous campaign in France, in 1940, offers an opportunity to demonstrate that the study of the lessons of military history pays dividends, now as ever. It will also serve as a handle on which to hang the contention that because, quite irrationally, we shirk away from the past, we often stumble into those very pitfalls which we are trying to avoid.

The Campaign in the West, 1940

On May 10th, 1940, when they opened their attack in the West, the German forces were organized and deployed for the type of war they intended to wage: a lightning war of manœuvre. The French and the British, on the other hand, wanted to wage defensive warfare, with attrition the ultimate goal. This in itself was not a bad grand stategy, except that it was not backed by a composition and disposition of forces which could have usefully served it.

Let us examine the disposition of the allied forces, first. The central idea of the French High Command (the British apparently did no more than agree) was "the continuous frontier battlefield pre-arranged in times of peace". It was an archaic concept which Napoleon I had already called good enough only to prevent smuggling. It was not even carried out systematically. There were two strong wings and a woefully weak centre. On the right flank, the whole of General Prételat's 2nd Army Group, 33 divisions in all, was crowded along the Maginot Line which itself was manned by the equivalent of at least six or seven divisions. This was a measure of sheer folly. For the Line was so strong—contrary to general belief, it was really the one part of the French military establishment which fulfilled all expectations—that it was well able to resist all attacks even if defended by its permanent garrisons only, assisted perhaps by a light screen of the, so-called,

"interval troops". This was proven in late June when, after the abandonment of the Line, 22,000 men left behind in the principal fortresses, completely isolated and assailed from all sides by German forces many times their number, resisted without too much difficulty for ten days, and laid down their arms only on express orders from the French High Command. At any rate, only 17 German divisions opposed Prételat's 40, and they were second-line troops, either reservists from age groups which had fought in the First World War, or young conscripts with still sketchy training.

On the left flank, the British Expeditionary Force, and the French First and Seventh Armies comprising most of the French armoured and mechanized formations, advanced to a line from the mouth of the river Meuse, in southern Holland, to the river Sambre, in southern Belgium. Here, there were about 30 of the best allied divisions which were to provide the backbone to some 20 Belgian holding a line even further to the East, along the Albert Canal. The Germans had no superiority in this sector, and would probably have made no progress had the Allied position not been outflanked in the South.

In the centre, behind the Meuse and facing the rolling heights of the Ardennes, were two weak French armies, the Second (General Huntziger) and the Ninth (General Corap), 12 divisions of which some were of the lowest category (Class "B"), with a screen of cavalry on the right bank of the river. Advancing upon them through the hills was the flower of the German Army, von Rundstedt's Army Group "A" (altogether 50 divisions, among them seven of the 10 German panzer, and all five mechanized divisions), with Sperrle's whole Luftflotte 3 in support. About 1,700 tanks were massed in one gigantic battering ram to pound a French infantry which was short in training, short in anti-aircraft and anti-tank weapons, and hopelessly outnumbered.

To anybody with an open mind, this weak French centre would have looked like a veritable invitation for an attack. But the French High Command did not have an open mind. For it, Marshal Pétain's ruling of 1934 had the strength of a dogma: "The Ardennes forests . . . are impenetrable if certain dispositions are made. As this front would have no depth, the enemy *will not* deploy there. . . . This sector, therefore, is not dangerous". *Roma locuta, causa finita.* It mattered not that a man like Liddell Hart had said as far back as in 1929 that "the impassibility of the Ardennes has been much exaggerated", that in fact it was a "delusion". Not even the evidence of their eyes weighed as heavily with the doctrinaires among the French generals as the pronouncement of the sage, of whom it was said—not before 1940, mind you, for until then almost everybody believed in him—that "after Verdun (he) learned nothing more, because he could not be persuaded there was anything more for him to learn". It was left to the Germans to prove that black is black even if the most famous man would want to make it white.

The strict adherence to the principle of the "continuous frontier battlefield" resulted in a tremendously long front line; this in turn made it necessary for the Allies to put practically all their forces into it. Theoretically, there were 22 divisions in High Command reserve, but as seven of these were committed in advance to back up the left wing (*lot belge*) and five to guard against a German flanking movement through Switzerland (*lot suisse*), only 10 were available to provide a counter-attack force at the decisive point. And even these were dependent for movement mainly on the railways. Thus a breach in the lines as that effected by the German Panzer divisions in the central sector, at Sedan and Dinant, was bound to become a calamity when it should have been only a dangerous incident.

The composition of the Allied forces was as much out of tune with their mission—waging a war of attrition—as their deployment. With Germany master of Eastern Europe and, on paper at least, allied to the Soviet Union, simply to stand pat could not possibly have brought about the strangulation of Hitler's empire. There was a need to accelerate the process, above all by systematic and punishing air attacks on German industries and communications. The other side could, of course, play at the same game. Still, unless the destruction that would have been wrought by German retaliation was accepted, the whole concept of the war of attrition did not make sense. The French leaders, however, wanted to have the best of both worlds: they wanted to win the war without taking the offensive on the ground *and* without unleashing serious aerial warfare. This is why they stayed the hand of the R.A.F. Bomber Command. This may also have been the reason—although this is difficult to understand—why they neglected, as if deliberately, the build-up of the French bomber forces. As a result, the Allies were about equal to the Germans in the number of fighter aircraft—the respective figures for the French Air Force alone, as against

the Luftwaffe were, on May 10th, 743 to 1,016—but there were no less than 12 German bombers for every French (1,710 against 144). Even the small R.A.F. component was stronger in bomber aircraft than the whole F.A.F.

Nor was the organization of the Allied forces at all fitted to a strategic concept that envisaged battles in which the enemy was supposed to bleed itself white in constant fruitless attacks. For that, the Allies would have needed highly mobile and heavily armed counter-attack forces; huge numbers of anti-tank guns; effective anti-aircraft defences; and a strong tactical aviation. They had nothing of the kind.

True, the Allies had more armoured vehicles than the Germans, and, in some respects, better ones. In quantity, the Wehrmacht had a little less than 2,000 real tanks (that is, tanks with guns of at least 20 mm calibre) against about 2,400 Allied. Almost one fifth of the German panzers were captured Czechoslovak "Type 35's" and "Type 38's", and only the 278 "Panzer IV's" were better than the French mediums, the "Somuas". The Germans had nothing that would quite match the French "B" tanks, of which there were 325 (the British tanks, incidentally, were inferior both to the German mediums, the "Panzer IV's", and the German and Czechoslovak light/mediums, the "Panzer III's" and "Types 35 and 38"). Where the German tanks were in the main more manoeuvrable and faster, the Allied were better armoured. There was, however, a great difference in the use the two sides made of their armoured forces: the Germans had them tightly organized in 10 armoured divisions and used them in mass; the French had less than one fourth of theirs in three armoured divisions, while 27 out of their 51 tank battalions were dispersed all along the front. Even this does not convey the true picture. Not even the independent armoured battalions were as a rule kept together. Tanks were used singly and in pairs to guard a bridge here, a cross-road there, so that at no single point was there enough of them to deliver a real blow.

This shocking misuse of the Allied armour was again the result of faulty doctrine. Pétain did not believe in tanks. In 1934, before a senatorial commission, he declared bluntly: "What would be the use of a great mass of tanks arriving in the region of Paris? Lorry-borne troops and a few armoured cars would be enough to checkmate an invasion by the German armoured corps". And four years later, in an article in the "Revue des Deux Mondes". he uttered these famous last words: "As for tanks, which are supposed to guarantee a short war—their failure is startling".

As for artillery, the Allies had a crushing superiority over the Germans in guns which they hardly needed, those for bombardment of fixed positions and counter-battery work, while they were weak in anti-tank and anti-aircraft weapons. Of tactical aviation, they had woefully little. It was as if they had expected the Germans to attack, but by the methods and the means of defensive warfare.

These startling weaknesses (we have discussed only those which are relevant to the central theme of this article; there were others) were, of course, realized on the Allied side, and that long before the Germans launched their attack in the West. Some of the British generals were deeply worried, although apparently not the Commander-in-Chief, Lord Gort. Among the younger French officers there were many who were critical of the official French doctrine. The most outspoken of them was a 50 year old colonel commanding an armoured regiment, one Charles de Gaulle. But there was no way of moving the fossilized pedants at the top, who moreover enjoyed the confidence of the government and of the nation. Sighed de Gaulle, who, three years earlier, had been sent to the wilderness of a provincial garrison from his post of secretary-general of the Supreme Council of Defence, because he had dared to speak his mind: "The clash of ideas, as soon as it involves the established errors and the men in office, assumes the uncompromising mood of theological disputes".

In the Battle of France, in 1940, the forces of the opposing sides were about equal in strength. The strategic situation was, if anything, more favourable to the Allies. They lost because of the dull inflexibility of mind of their commanders who, in Jean Dutourd's biting words, had for too long "prospered like cockroaches between the disjointed floor boards of the staff college". Things turned out as they always do in war, which, above all, is a contest of wits and wills, not of bodies and machines. Napoleon I put it in these words: "There are no bad regiments, only bad colonels". And Montgomery said: "Failure in war is always due to one of two causes: to faulty command or to bad staff work, or sometimes to both". Let us not for a moment think that, just because weapons have become so powerful in these last years, the French campaign of 1940 was the last in which the defeat of the potentially stronger side was caused by intellectual failures, and for no other reasons.

The Lessons That Have Not Been Learned

It would be too easy to attribute to senility or

stupidity the stubborn and truculent adherence of the French generals to a patently wrong doctrine. Pétain, Weygand, Gamelin, to name but the three leading figures, were profound military thinkers and had been successful commanders (Pétain) and top staff officers (Weygand, Gamelin) in war. They had, however, in the highest degree, a quality which in the military man is usually an asset but also sometimes a weakness: the ability to reduce every problem to utter simplicity. They were looking for a single, straightforward solution, for a universal system of warfare, that *"méthode a priori"* which in the 'Twenties and 'Thirties the French Staff College proclaimed as its crowning achievement.

As the conduct of war is still an art more than a science, there is in fact little hope that a universal system of warfare, something which in this field would be comparable to Einstein's "energy equals mass times square of velocity of light", will ever be found. And should waging war ever become a branch of scientific knowledge, it is not likely that professional soldiers would shine in it, for they are (in Liddell Hart's words) "practitioners . . . so occupied in administering immediate remedies and compounding drugs that they have not the freedom for research. . . . Even a staff college training is more akin to walking the wards than to work in a laboratory". The day is, of course, not in sight when war will become a pure science. In the meantime, it is highly dangerous to approach the problems of warfare entirely in the scientific fashion, with a view to finding an ultimate solution, for this must produce precisely that doctrinaire attitude which was the downfall of the French military leadership in 1940.

Unfortunately, this is just the way we are going in the West, in defiance of the experience of the past which, without any justification, we choose to reject. Whether consciously or not, we are again in quest of the universal system of warfare. But because the military men are patently incapable of finding all by themselves the present-day equivalent of the French *"méthode a priori"*, they are now enlisting the help of real researchers from the academic world. It is, in fact, frightening to observe how similar the attitude of the professional soldier/civilian expert team of 1960 is to that of the military prophets of 1940. Said General Weygand around that time: "I believe that the Army of France today is better than at any moment in history. It possesses matériel of the highest quality, fortifications of the first order, excellent morale, and a remarkable High Command. None of us desires war, but I affirm that if anyone insists on us gaining a new victory we shall gain one". Says Bernard Brodie, one of the leading military theoreticians of our days (in his recent book, "Strategy in the Missile Age"): "Today the American armed forces are eagerly exploiting science and scientific techniques . . . to predict . . . the tactics and strategy of future wars . . . in this respect the armed forces of the United States are considerably in advance of those of other nations, including our enemies". This is not vanity or arrogance—Bernard Brodie is an emminently objective and, if anything, humble man—but the expression of a strong belief in one specific method for solving military problems.

The "appeal to authority" is a common logical fallacy. It is made as often and as persistently today as ever in France and Great Britain before the Second World War, and for the very same purpose: to silence critics. It is paradoxical that, in things military, it is sometimes more difficult in a democracy to oppose authority than in a dictatorship. The reason is that, with us, a military policy becomes governmental policy—and thus shifts onto the political plane—as soon as it is adopted. Politicians are notoriously averse to admitting to a mistake, yet it is they who are answerable to the electorate for the policies devised by the military. They can not easily disassociate themselves from these policies. And attacks on the latter soon acquire a political flavour. This in itself is conducive to the forming of a rigid doctrine as something well-defined to which both military leaders and politicians can stick.

In a dictatorship, there is always the possibility that the power-drunk tyrant may fancy himself a military genius, in which case military policy becomes even more inflexible (as often as not, irrationally so) than ever in a democracy. But if the dictator refrains from interfering in the conduct of military operations, as Hitler did during most of the French campaign and, indeed, until the Germans encountered their first reverses in Russia, then the military leaders can find themselves remarkably unfettered. Here again, reading up on the French campaign of 1940 pays dividends. We may then ask ourselves whether a general in a democratic country could have opposed the basic war plan as Manstein did (and with full success) in the Winter of 1939/40, or could have simply disregarded an ill-conceived order to halt as Guderian did on May 18th.

If the history of the wars fought in this century by the great Western democracies teaches us any-

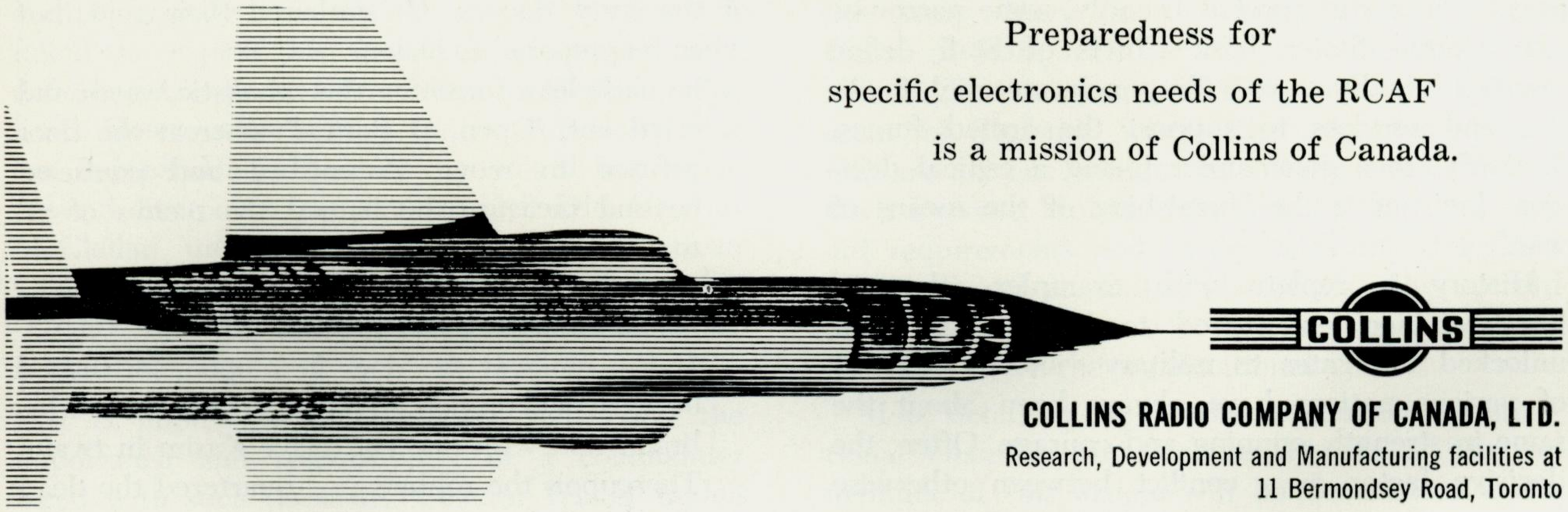
thing, it is that a way must be found whereby, on occasions when this is desirable, a military policy can be judged (and, if necessary, modified) on purely military grounds.

The combination of the quest for a universal system of warfare and of truculent insistance on authority has again brought the West militarily to an impasse, perhaps not as absolute as that which doomed the Allies in 1940, but nevertheless highly dangerous. It is the total reliance on nuclear weapons for national security, a policy which is still with us (in NATO it was really adopted only as late as 1957) although it has been a military absurdity ever since the Soviets were able to establish a "balance of terror". Even if the West returned now to a policy of balanced military forces—and there are strong signs that it is—it would be difficult to make good the ground lost in the years when our capability for waging conventional war was dissipated. Yet, only two or three years ago, it was as hopeless to try and budge the officially backed proponents of "all or nothing", as twenty years ago the men-in-office with *their* universal system of warfare.

The Battle of France, in 1940, was one of the most decisive in history. The consequences of our losing it are still with us, and with a vengeance. To think what our position would be today had we won, makes one sick at heart: Europe would undoubtedly today be a fairly stable continent, with Russia contained behind the *"cordon sanitaire"* formed by friendly Eastern European nations instead of standing menacingly in the very heart of Europe. Japan would not have gone to war with the United States, and there would thus be an effective counter-weight to the growing strength of China. The Western Powers would be dominant in the world, which would not be the worse for it. All this was forfeited because of mistakes made by the military, and sanctioned by the political, leadership of the Western democracies. Even more can be lost in our days if we persist in the complacency and dogmatism which characterized the conduct of military affairs on our side, in 1940. It does not look as if we have really rid ourselves of these fatal qualities, or, indeed, that we have learned much from what befell us twenty years ago. In military circles we certainly have not made an effort lately to learn from military history. It would pay us if we did.

If men could learn from history, what lessons it might teach us! But passion and party blind our eyes, and the light which experience gives is a lantern on the stern, which shines only on the waves behind us!

—Samuel Taylor Coleridge



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Transport—The Hidden Factor In Decision Making

MAJOR-GENERAL FRANK S. BESSON, JR.

Major-General F. S. Besson, Jr., was educated at the U.S. Military Academy and the Massachusetts Institute of Technology. He joined the U.S. Army in 1932. Throughout his career he has held many important posts in Army transportation and logistics, and in 1954 became Assistant Chief of Staff for Logistics, SHAPE. He is presently Chief of Transportation, U.S. Army.

"Ali Baba waited until the forty thieves departed. Then he thought within himself: 'I, too, will try the virtue of those magical words and see if at my bidding the door will open and close.' So he called out aloud:

'OPEN, O SESAME'

And, no sooner had he spoken, than straightaway, the portal flew open and he entered within."

From *Ali Baba and the Forty Thieves*, translated from Arabic by Sir Richard F. Burton.

WAR, wrote Clausewitz in his famous essay, is a "veritable chameleon," changing in nature with the environment.[1] Because war is so variable and unpredictable, Clausewitz emphasized that generals need courage and brains to make important decisions properly. One World War II British military authority, Field Marshal Wavell, noted that many commanders can make sensible decisions in the fields of strategy and tactics, but it is in logistics that they often go wrong.[2] In decision making, logistics is often the "open sesame" to victory.

Logistics means different things to different people. Some interpret it broadly, some narrowly. The United States Joint Chiefs of Staff define logistics broadly as providing men, materiel, facilities and services to support the armed forces. Similarly, to a commander facing a critical decision, logistics is the "furnishing of the means of war."

History is replete with examples where a logistical decision proved to be the key that unlocked the gates to military victory. Warriors of various nations have always been about the same in strength, cunning and courage. Often, the decisive factor in a conflict between otherwise equal military forces has been the ability of a commander to exploit logistical situations. Alexander the Great, though famous for his skill in battle, had an instinctive sense of logistics. Hannibal, moving elephants across the Alps, ravaged Italy for twenty years, while providing for his troops in many devious and brilliant ways. Attila, though called a barbarian, moved his horsemen from the depths of Central Asia to the heartland of the Roman Empire. Wellington in Spain humbled the French chiefly because, as he himself put it, "supply and transport are the wings with which armies can rise to action." The Allied Powers won the two World Wars of the twentieth century largely because of ability to move men and material to far flung battlefronts.

It would indeed be a boon to military students if historical examples were so clear cut that generals could turn the pages of history and find the "open sesame" which would unlock for them the portals of victory. But not even in the Arabian Nights did things work so simply. In this intriguing tale, Ali Baba's brother-in-law, Kasim, learned the magic formula well enough to enter the treasure cave of the forty thieves. He gathered their gold, but when he prepared to leave,

"he had clean forgotten the cabalistic words and cried out, 'Open, O Barley!' whereat the door refused to move. Astonished and confused beyond measure, he named the names of all manner of grains save sesame!"

Then the robbers returned and Kasim made a desperate attempt to save his life.

"At the moment the door flew open, he rushed out . . . whereupon a robber at once bared his brand and with one cut, clave Kasim in twain. Thereupon the robbers . . . quartered the dead

body of Kasim and hung it to the door within the cavern, two parts to the right jamb and as many to the left that the sight might be a warning of approaching doom for all who dared enter the cave."

Truth is sometimes stranger than fiction and history also offers many gruesome examples of commanders who thought they had entered the doorway to conquest. But in the end, the remains of their mutilated armies served as a warning of approaching doom to military leaders who had not learned well enough the logistical "open sesame" to victory.

Twenty-five hundred years ago, Cambyses of Persia conquered Egypt and plunged deeper into Africa. But he could not maintain his sea and desert supply lines. Today, a tablet in a Berlin museum tells how the Ethiopians destroyed his army. About eight hundred years ago, Crusaders carved out four "Latin Kingdoms" on the fringe of a vast Moslem hinterland in Asia Minor. But Christendom did not support the Knights at the end of the long supply line in the Eastern Mediterranean and the great enterprise ended in failure. In 1904, logistical blunders brought about the Russian debacle and gave Japan an easy victory.

Napoleon, to whom is attributed the well-worn aphorism, "an army travels on its stomach," is certainly among the great logisticians. Yet he lost his logistical gamble in Spain, and the decimation of the Grand Army in the frozen wastes of Russia is one of the spectacular logistical failures in history. The "open sesame" of logistics unlocked the gates, but when the time came to reap the harvest of victory, he found he had not used properly the "magic formula" of supply and transportation.

Here, then, is the cruel dilemma of decision making. On one hand history says, "he who hesitates is lost." On the other hand history warns "fools rush in where angels fear to tread." Did Pompey finally lose out to Caesar because he failed to exploit his logistical advantage after defeating Caesar at Dyrrachium in 48 B.C.? Was Lord Howe over-cautious in the American War for Independence, because he would not move beyond his points of sure supply? Did General McClellan unnecessarily prolong the American Civil War while he painstakingly built up his "Grand Army of the Potomac" before committing it to action?

It is impossible to emphasize sufficiently the importance and responsibility of a commander faced with such decisions. General Walter Bedell Smith wrote in his book *Eisenhower's Six Great Decisions:*

"It should be established just how utterly the military system makes this matter of decision the responsibility of one man . . . the commander. Only thus can be made clear the awful responsibility which one man accepts when he occupies the position of supreme commander in a major theatre of war. . . . When I was a young officer, I once heard it said that the loneliest post in the world was that of a commander . . . about to go into battle."

While the commander can call on his staff for advice, he must make the decision alone, in full realization that the lives of his soldiers and the safety of nations hang upon his judgement. And in this vital process, logistics in general and transportation in particular, are often the hidden factors in decision making.

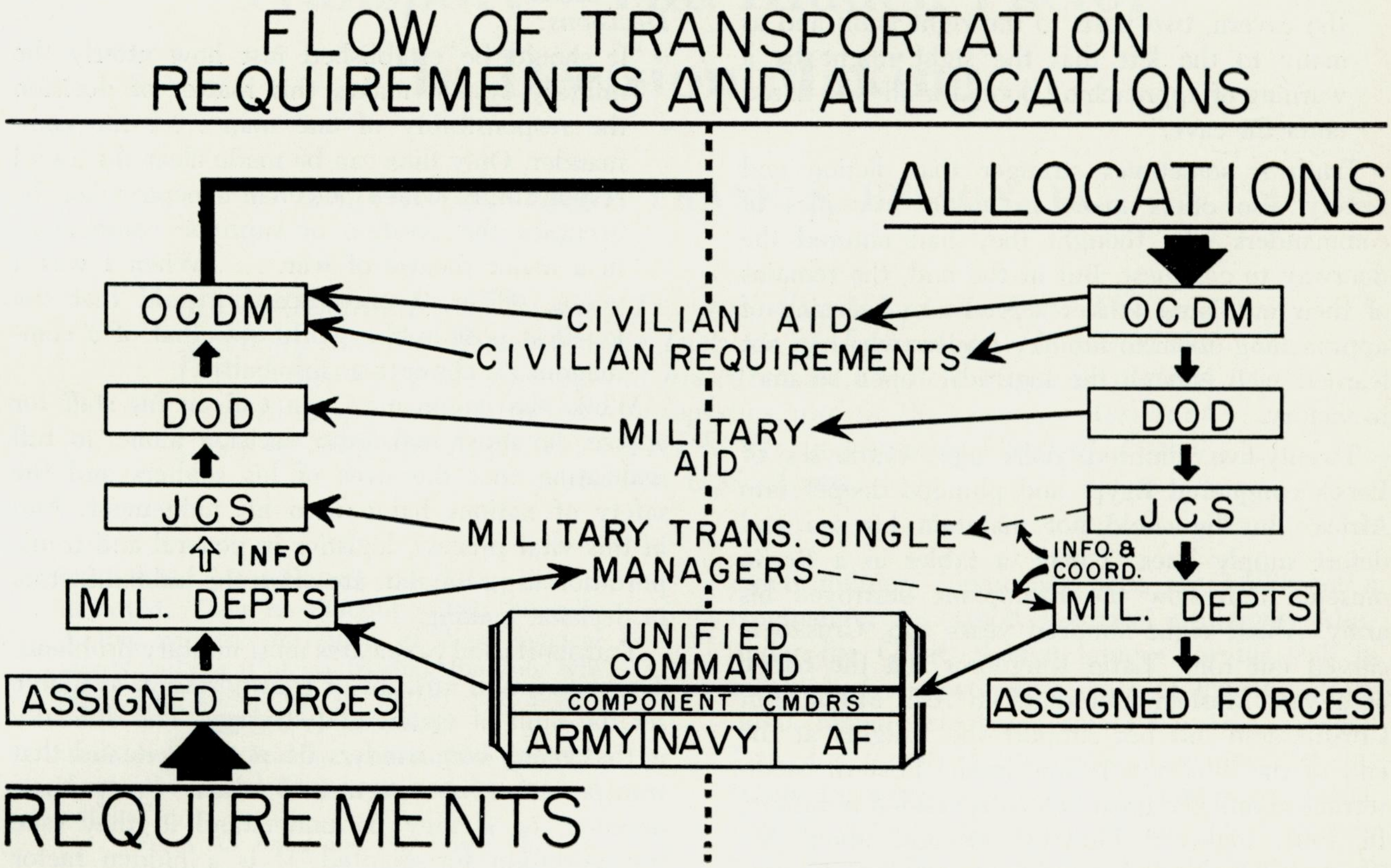
Transportation permeates most military problems. The means and amount of transportation available set the limit of tactics and strategy. The difficulty is that many commanders do not understand that transportation is woven into nearly every basic decision, or if they do understand it, they take transportation for granted. It is a hidden factor in decision making.

Because the significance of transportation is often overlooked, it is important to review fundamental principles. Probably the most important is that, in wartime, transportation is always in short supply. To put it to best use then, it must be controlled. Controls require procedures to establish requirements, to set priorities, and, finally, to provide allocations. Generally speaking, conflicts over requirements go up the organizational ladder, while allocations—which, in essence, are decisions—flow down.

For example, in the Armed Forces of the United States, (Figure 1), requirements flow from the unit that needs the transportation upward through the Army, Navy or Air Force. Then the Joint Chiefs of Staff, with the advice of the transportation single managers, send them on to the Department of Defense where the requirements for military aid are brought in. Finally, the Officer of Civil Defense Mobilization adds civilian and civil aid requirements and, under authority delegated by the President, makes allocations. The upward surge of requirements is reversed as allocations flow back down the organizational chain.

More detail on the relationships in the organizational chain is presented in Figure 2. The remainder of this article will be devoted to a dis-

FIGURE I



cussion of examples of how transportation has influenced decisions at certain of the levels on this chart.

The President

The President of the United States makes broad strategic decisions. One of the most important strategic decisions of World War II was whether the United States should concentrate its strength in the Pacific, or whether it should go "Europe first".

After World War I, United States military planners based their fundamental strategy on the "Pacific first". In 1931, the War Department officially designated colours for the areas in which fighting might occur as red for Europe, yellow for China, brown for the Philippines, and orange for Japan. These plans were based on war in a single area at a time, and much of the planning revolved around the orange for Japan.

With the rise of Hitler, the situation changed. Incident marched after incident with the majestic tragedy of the inevitable. Some isolationists began to call for a "chastity belt" of military and naval forces extending far into the Atlantic, so that peaceful virtues might be protected. But more practical war strategists, again looking into the colour spectrum, developed a series of "rainbow" plans involving more than one enemy at the same time. Even though the United States was brought into war by Japanese bombing of Pearl Harbor, it was RAINBOW V that went into effect, with the concept of a holding action in the Pacific and a concentration of force in Europe. The President selected RAINBOW V based on the decision, "Europe first".

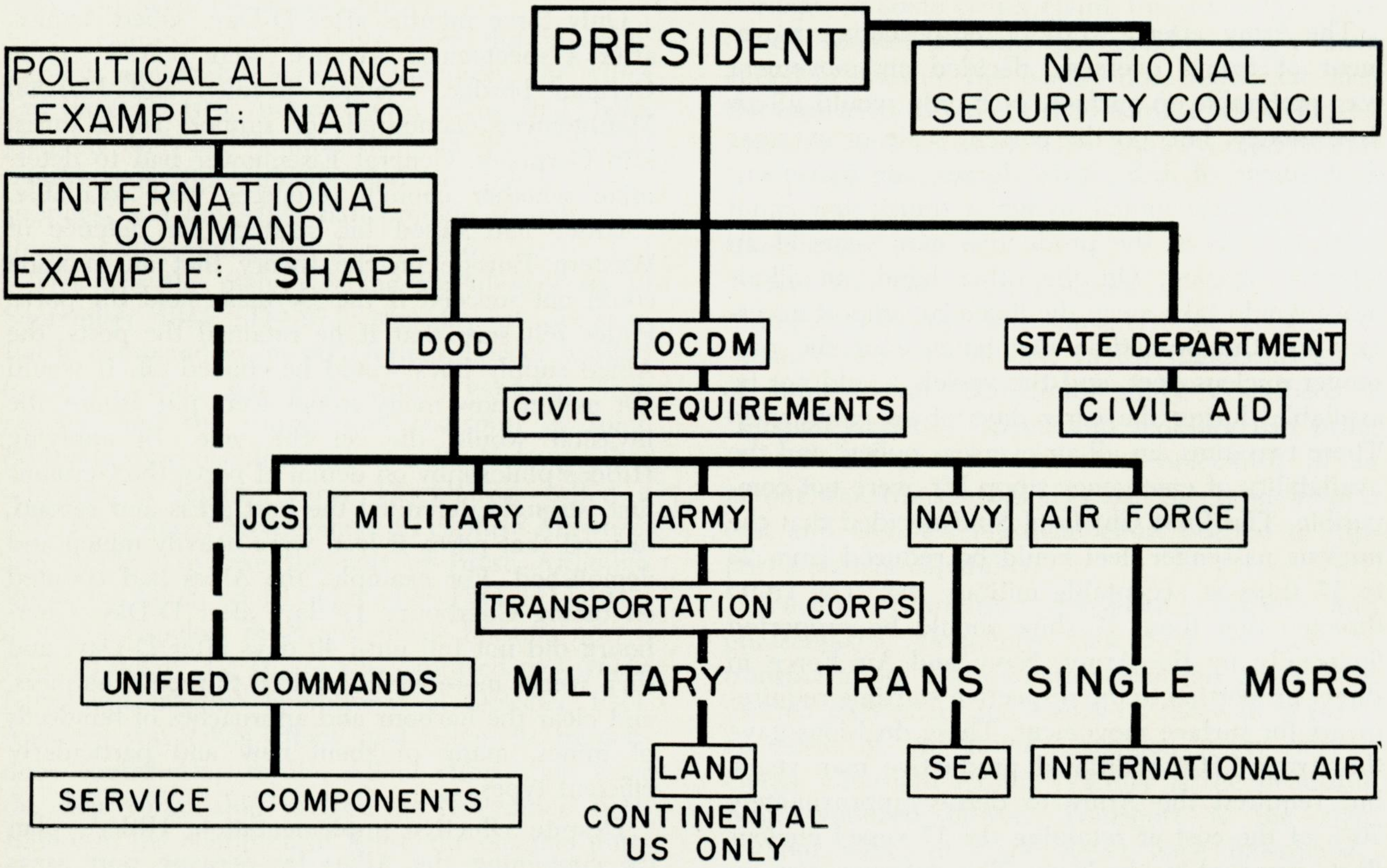
Although President Roosevelt probably thought primarily in political terms, his "Europe first" decision was really the only one that could be supported by the facts of transportation. The transportation aspects of the problem were relatively simple. In fact, it sometimes seems that the higher the level of the decision maker, the simpler the decision. Three thousand miles across the Atlantic, contrasted with six thousand miles over Pacific sea lanes, meant that the same limited amount of transportation could support far larger forces in Europe than in the Pacific.

Office of Civil and Defense Mobilization

The Office of Civil and Defense Mobilization (OCDM) is on the echelon just below the Presi-

FIGURE 2

KEY EMERGENCY TRANSPORTATION AGENCIES



dent, but on transportation requirements, it speaks for the President. OCDM has the job of determining the national capability and then balancing civilian requirements with those of the military. It also establishes necessary controls. In World War I and World War II, similar agencies faced very difficult problems, but today, the old problems of short supply of transportation are aggravated by the prospects of extensive damage from missile-born nuclear warheads.

OCDM explored the transportation problem incident to nuclear attack in a recent exercise—Snap Switch, the United States' part of a broad NATO exercise, Side Step. Side Step was designed to test the flow of men and materiel from the interior of NATO member nations into the European theatre. In Snap Switch, the basic assumption provided for more than two hundred nuclear strikes on the North American continent. OCDM assessed the devastation and assembled information on where things could be moved, and then issued instructions to the transportation industry and military departments on how they should route their cargo. OCDM had the job of finding channels for movements through the devastated areas. Though only a paper exercise, Snap Switch pinpointed deficiencies in procedures and provided raw material for planning and for intelligent decision making should the need arise.

DOD – JCS

The Department of Defense and the United States Joint Chiefs of Staff (JCS) are the military agents of the President. The JCS deals primarily with military problems, while DOD is concerned more with the economics of national defense requirements. With respect to transportation, the JCS consolidates military requirements, assigns priorities, apportions allocations, resolves conflicts, and makes decisions affecting more than one service. The DOD establishes transportation policy relative to the civilian economy and allocates responsibility for peacetime funding of transportation capability needed in wartime. Recently the Department of Defense and the Joint Chiefs had to decide on the size and use of the nucleus fleet of the Military Sea Transportation Service (MSTS). This is a fleet of nearly 100 cargo and passenger vessels with a gross of almost a million tons which is operated by MSTS. It is used in peacetime, but

its primary mission is to deploy United States forces in time of emergency.

The Army, after a study of the peacetime movement of troops overseas, decided air movement was preferable to surface. Not only would all-air save money, but, on the current scale of overseas deployment of U.S. Army forces, air movement would generate annual savings in transit time equal to two thirds of the productive man years of an infantry division. On the other hand, an all-air move would take away the financial support necessary for the peacetime maintenance of the passenger nucleus fleet, and the vessels would not be available during the early days of an emergency. These two aims, an all-air-overseas policy, and the availability of emergency troop lift, were not compatible. The Joint Chiefs of Staff decided that the nucleus passenger fleet could be reduced from 23 to 17 ships at acceptable military risk. The DOD directed that these 17 ships should be supported financially by the Army, Navy and Air Force in direct proportion to the respective wartime requirements for surface movement. These decisions gave the Army 1,000 additional productive man years, but required the Army to defray approximately 70% of the cost of retaining the 17 vessel nucleus fleet, operated by the Navy. This determination on air as opposed to sea lift in peacetime, is the type of decision in microcosm which may have to be made during war in macrocosm.

Unified/International Commands

Next are the Unified and International commands. U.S. Unified Commanders report directly to the JCS. U.S. Forces may also serve as components of International Commands. The left side of Fig. 2 illustrates command lines of U.S. Components operating under a NATO International Commander, Supreme Allied Commander, Europe (SACEUR). General Norstad as SACEUR, is also U.S. Commander-in-Chief, Europe (USCINCEUR).

A dramatic example of the influence of transportation on decision making in a wartime unified or international command was the dilemma confronting General Eisenhower as Commander-in-Chief, Supreme Headquarters Allied Expeditionary Forces (SHAEF) in September 1944. Faced with an acute shortage of transportation and supply, should he have tried to end the war with a bold knifelike thrust at the vitals of Germany? Or should he, as General Bradley expressed it, have yielded to the "tyranny of logistics?" Would transportation as usual be the obedient handmaiden of battle, or would she, in this instance, turn out to be a demanding mistress?

Only three months after D-Day, Allied Armies, after a spectacular advance, were poised on the German border. General Bradley and Marshal Montgomery clamoured for support for a thrust into Germany. General Eisenhower had to determine whether enough resources were available.

Hitler had based his strategy for defence of Western Europe on the theory that an invasion could not succeed if the Germans held the ports. Hitler felt sure that if he retained the ports, the Allied supply lines would be choked off. It would not matter how many troops were put ashore, the invasion would die on the vine. In applying Hitler's philosophy on denial of ports, the Germans first, strongly defended the port areas and second, insured that ports, if lost, were heavily mined and demolished. For example, the Allies had counted on taking Cherbourg 11 days after D-Day. Cherbourg did not fall until 40 days after D-Day, and then weeks more were required to repair the piers, and clear the harbour and approaches of hundreds of mines, many of them new and particularly efficient types.

Despite effective implementation, Hitler's plan for containing the Allies by denying port areas failed, primarily because the Allies were ingenious enough to operate without conventional ports. Artificial ports, landing craft and amphibians, supplemented by the meager port capacities available to the Allies, were the measures which broke the back of the German denial plan. The amphibious trucks or DUKW's were particularly effective, discharging some 40% of the cargo landed across Omaha and Utah beaches. The German High Command had so badly misjudged Allied logistic capabilities that a captured German General admitted, "We could not estimate your rate of supply."[3]

But the German concept of strangling Allied supply was not a total failure. It is easier to change tactics and send troops charging off in new directions, than to adjust supply to meet the altered situations. With the approach of winter, the improvised Allied resupply means became less effective, and Hitler still denied to the Allies the use of most ports. As supply lines lengthened, the support of fast-moving armies became more difficult. The French railroads, badly damaged as the result of Allied air attacks and German demolitions, could not carry the full load. Trucks, roaring around the clock down one-way routes across France, could not keep up with the demand. Air

supply helped in emergencies, but it was like giving water to a camel with an eye dropper. Resupply operations were becoming critical.

For example, ninety days after the invasion, through remarkable logistical ingenuity, the Allies had landed 10% more troops than had been planned and had landed 90% of their vehicle requirement. But vehicles and personnel eat up supplies, and the Allies had brought in only two-thirds of the supplies that they needed.

This was the picture facing Eisenhower on 10 September 1944 (D+97), the day of decision. Battle commanders on the German border wanted to drive ahead. But their armies were on "iron rations" and the supply and transport of some divisions were cannibalized in order to keep other divisions in fighting form. Eisenhower called a halt. He ordered Montgomery to capture Antwerp, and Bradley to take the port of Brest. Although Brest was taken on 18 September 1944 (D+104), it was a hopeless mess and never became operational. Luckily, Le Havre was captured two weeks later, and became operational in October 1944. Antwerp was taken intact, and began its tremendous contribution to the Allied effort soon after the first cargo ship arrived in November 1944. Based on the condition of Brest, the channel ports of Lorient, Quiberon and St. Nazaire, originally planned as the major supporting bases for operations inland, were left in German hands, and remained there until after the end of the war.

Eisenhower built up his transportation and supply along a broad front, and then smashed on to victory. No one knows for certain the consequences of a knifelike thrust in the winter of 1944. Perhaps, as some critics claim, the war might have ended sooner. Perhaps the gamble might have ended in disaster. But history does show that once the most critical part of the resupply was over, the Allies moved forward with boldness and vigour and pressed the attack to a successful conclusion.

Conclusion

Over the centuries, methods of warfare have changed radically. But transportation is still the "open sesame" to victory. In the dangerous game of limited war, sometimes aptly described as "Russian roulette," speed and mobility can bring victory and prevent a nuclear holocaust. In an all-out war, transportation is also the keystone of a vast and complex logistical effort needed to support a nuclear capability.

Winston Churchill, statesman, soldier, and phrasemaker, eloquently described the role of transportation. The quotation from his *River War*, written sixty years ago, hangs on the wall of many an office of the Royal Canadian Army Service Corps. Churchill wrote: "Victory is the beautiful, bright-coloured flower. Transport is the stem without which it could never have blossomed."

Notes

[1] Clausewitz, On War, pp. 18-19.

[2] Field Marshal Earl Wavell in lecture, "Generals and Generalship," quoted in Rupenthal II, 503.

[3] General Walter Bedell Smith, "Eisenhower's Six Great Decisions", pp. 48-49.

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Reflections on the Problem of Human Communication

ARTHUR PORTER

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CICERO is reputed to have said, "An engineer is, by his profession, mean, lowly, and no gentleman would be seen in a work-shop". And, unfortunately, this extremely bigoted and false doctrine persisted until the present century. Accordingly, the writer, an engineer, might be excused for displaying a measure of diffidence in approaching the task of communicating his views on one of the most formidable problems confronting mankind today—the problem of human communication. A problem which, as a result of the increasing proliferation of science and technology, is becoming ever more intractable. But I am unrepentant in accepting the assignment because scientists as a class are usually too modest to undertake tasks such as this, and yet their understanding of problems such as human communication usually transcends that of nonscientists.

Man has communicated with man for many centuries and he continues to do so reasonably effectively except in the languages of science and technology which remain mysteries to the vast majority of the human race. And if a satisfactory solution to the problem of communication between scientist and nonscientist is to be found, it will probably be initiated by the scientists and engineers, for the simple reason that there are few short-cuts to the understanding and translation of the languages of science. On the other hand, there is clearly an essential part to be played by journalists and writers in the extremely important task of ensuring that the public is accurately informed on scientific and technological matters. There is little doubt that Sir Winston Churchill[1] appreciated the difficulty of the problem when he wrote "This was a secret war, whose battles were lost or won unknown to the public; and only with difficulty is it comprehended, even now, by those outside the small high scientific circles concerned".

This paper will deal exclusively with those aspects of human communication which arise in technological contexts. The importance of effective communication of scientific information increases as time passes, and it is particularly significant in the evolution and organization of the Armed Services because, in general, these organizations are dealing with scientific developments at the frontiers of knowledge. The appellation "scientist" is used herein in a generic sense to cover the practice of science and the creative arts, applied science and technology, and it will be used to designate pure scientists, artists, engineers, architects, physicians, military scientists, social scientists, etc.

Consider initially, albeit much too briefly, the nature of human communication. The ability to communicate our ideas, instructions, thoughts, etc. to our fellow men must surely rank as the greatest achievement of the human race, and, without this ability, the evolution of man would have ceased before the dawn of civilization. For example, Ben Jonson has written "Speech is the only benefit man hath to express his excellency of mind above other creatures". And during the past century the spectacular developments which have taken place in the physical systems of communication have had a notable impact on man's affairs. But, for the purpose of this paper, the term communication will be interpreted, not as the transmission and reception of information by biological and physical systems, but rather as the coding and manipulation

of information to be communicated or translated. Human communication, as such, is being studied by specialists in such widely diverse fields as mathematics, linguistics, electronic engineering, psychology, physiology, etc. and the importance of an interdisciplinary attack on the problem has already been effectively demonstrated. In his collection of essays on human communication, Cherry[2] has outlined, for example, the nature of the problem and has laid the foundations for a still greater degree of collaboration between the scientific and the semantic disciplines.

But in so far as communication with the lay public is concerned the modern press and radio are by far the most potent influence. For instance, the reading habits of populations have changed considerably during the present century when book reading has been to a large extent superceded by newspapers and magazines and, recently, by television. And this writer believes that a strong liaison in the future between the scientist and the journalist may prove to play a most significant part in strengthening Western democracy. However, this topic is beyond the scope of this article which deals, for the most part, with the problem of communication between executives on the one hand and scientists on the other.

Stating the problem in its most general terms, it is required to develop a language, or languages, within an organization, which will optimize its effectiveness. In the 15th Century, a man of Leonardo da Vinci's outstanding ability could truthfully be said to understand a good proportion of the total knowledge available, and the communication problem between educated persons was not so complex as now. But today, specialization is essential and this inevitably results in language barriers. However, the very scientific and technological advances which have led to the new and highly complex languages, which can only be fully understood by the few, have also given birth to the large-scale electronic computers whose role, as systems for the translation of languages (both mathematical and literary),[3] is only in its infancy; and these may have a profound influence in facilitating human communication in the future.

Apart from the organization of government itself there are perhaps no institutions more sensitive and more dependent on effective human communication than the Services. This is correlated with the fact that the Services use the most advanced tools and equipment which modern science can provide. Indeed, many serving officers are applied scientists.[4] In consequence we find increasingly that military leaders, in addition to their military training, are frequently trained in one or another of the scientific and technological disciplines.

Biological Evolution and History

Human communication is the basis of our society and a review of its history would inevitably involve the history of mankind and all his works. Further, the ability of man to communicate information and ideas may well be the most fundamental phenomenon involved in his biological evolution. And a brief study of some of the factors inherent in the evolutionary process may not be out of place, and it may even be helpful in ascertaining patterns of behaviour which may suggest methods of attacking present-day communication problems.

As a biological process, evolution necessarily involves fundamental motivations which have as a goal the continued survival of the human race. These are, first, the necessity of obtaining food, and second, the necessity of defence against a multiplicity of potential enemies (ranging from the elemental virus to the nuclear warhead of an ICBM). And essential adjuncts to these two fundamental requirements are the law and religion. In order to survive, both physically and spiritually, man has, since the Paleolithic period, invented and manufactured vast numbers of tools and implements which have been utilized to provide food, defence systems, shelter, and religious, civic, and national, buildings and structures. Moreover, these tools have evolved with man essentially because our environment is never static, and consequently the most dynamic feature of man is the continued evolution of his brain in which the richness of the neutral patterns and pathways continually increases. Our environment is in fact necessarily stochastic, i.e., it is describable, at least partially, in terms of probability laws which are time-dependent, and it should be noted that life would be impossible if our environment was completely predictable on the one hand, or absolutely unpredictable on the other. The proliferation of science and technology is essentially nature's way of ensuring, albeit ideally, that the human race will survive and continue to evolve biologically by ensuring increasingly adequate food supplies and increasingly complex systems (medical and other) in spite of a rapidly increasing world population, and a rapidly diminishing store of the earth's riches. And it is not surprising that to cope with a more and more complex environment, more and more complex tools and machines are required. Further, the increasing complexity of tools and machines inevitably in-

volves an increasingly difficult problem of human communication.

Man's destiny began to take shape with the advent of the first primitive tools because he rapidly learned how to render usable nature's resources of material and energy. Moreover, the creation of tools and machinery has always, except perhaps at the dawn of civilization, depended on the development of adequate communication systems. One of the major reasons is that man has a very limited capacity to perform manual tasks, and indeed certain mental tasks also, such as high-speed arithmetical operations. Thus, in order to achieve certain objectives, it has always been necessary for men to operate in groups and hence to communicate with each other. For example, in order to manufacture a new tool or new engine or new building, the first requirement after the initial concept and design had been completed was to enlist a group of people to carry out the work. And the establishment of adequate communication channels between the inventor (i.e., architect, engineer, etc.) and the group carrying out the actual physical work must, in the early days of history, have constituted the first real example of the inherent ability of the scientist to direct the activities of his fellow-men.

The fact that man's evolution has been oriented around his tools suggests that, throughout history, the scientists have been great humanists (almost by definition) because they have taught humanity to work and to build, and this applies today. Were it not so the human race would not survive. It must surely be regarded as a sign of an inferiority complex on the part of a minority of the practitioners of the so-called humanities (fortunately, excluding the creative arts) to assert that the engineers of today must be humanized when, in fact, the engineering profession actually epitomizes humanity.

Since the urge to survive is uppermost, at any rate biologically, in human motivations, and hence the urge to defend, it is obvious why, at all stages of our civilization, the tools and instruments designed for military operations have been the most advanced examples of science and technology in existence at a particular time. And this applies to all branches of applied science. For example, major advances in the theory and practice of medicine have frequently occurred during military operations, and certainly the science and art of surgery owes a great debt to the naval surgeons of the Elizabethan era and to subsequent eras.

Scientists have rarely had difficulty in communicating "downwards" and "sideways". For example, in the latter respect, engineers have been successfully applying the principles of pure science and the new materials developed by pure science for centuries. An outstanding recent example arises in the field of "solid-state physics". The transistor, which is likely to revolutionize electronics and as a result technology as a whole, was a laboratory specimen less than twenty years ago and today it is in widespread production and its applications are multitudinous.

But the major difficulty of human communication in the technological sphere is communication "upwards" between, for example, scientists and government and indeed in all situations where the ultimate executive authority is in the hands of nonscientific personnel who neither understand the language of science nor the motivations of the scientist. Throughout history, it is indisputable that the major brake on the evolution of man has been due to the inability of many of those in authority to base decisions on logic and scientific facts rather than on extreme conservatism, superstition and the emotions. The martyrdom of Leonardo and Galileo, the early struggles of the pioneer engineers of the first industrial revolution, and there are many such examples, surely provide an adequate warning to modern society that major decisions and policies must be made by people who fully understand the problems involved. And in many cases, certainly in defence matters, these are essentially technological in character. It must also be recalled that in time of war, when all man's primeval instincts are aroused, the scientist has usually been uninhibited by the politician and the nonscientific executive and the results have often been extremely spectacular—a catalogue of the technological advances resulting from World War II would be impressive indeed. And there is surely no fundamental reason why such uninhibited progress, especially in matters related to defence, cannot be achieved in peace-time.

Recent history suggests that communication between scientists, government and the population at large can be made effective. Indeed it can be argued that the two major scientific achievements of the U.S.S.R. during the past twenty years have not been the launching of the Sputniks, nor the extensive utilization of automation; but rather, first, the creation of an organization whereby scientific and technological resources are not inhibited by the executives of government departments who may have no knowledge of science and second, by the effective recruiting of the press,

radio and television to "sell science and technology to the public". Even in 1936 Ruhemann, describing conditions in the Soviet Union, wrote "Every Soviet newspaper prints leading articles on scientific and technical subjects and the results of science and engineering are front page news. . . . Well-stocked scientific technical book-shops are as frequent in Soviet towns as tobacconists are in London". On the other hand, it took nuclear energy and the Sputniks to produce "front-page" news in the Western democracies where the news coverage of sporting events must be at least ten times that of science and technology.

In concluding this brief and inadequate glance at history, it may not be out of place to quote Sir Maurice Bowra, Warden of Wadham College, Oxford, the eminent classical scholar and sometime Professor of Poetry at Oxford. In the second of the Graham Clark Lectures,[5] Bowra stated that, without engineering, civilization is impossible and further that China and Greece and Rome in turn, paid the price for treating engineering as of secondary importance and lost their leadership in the world of their days.

Human Communication and Education

Education is perhaps the supreme form of human communication. Previously we considered how science and the creative arts have played a massive and essential part in the evolution of human civilization. And no doubt one reason why the sciences attract to their ranks the most highly intelligent groups is the fact that science is playing such a fundamental role in ensuring the future survival of the race, and evidence is readily available that men with scientific, technological and creative aspirations are, as a group, more highly intelligent than others. The results of scholastic aptitude tests in U.S.A. and in United Kingdom show very conclusively that is in fact the case.[6] A scientific education must therefore be geared to deal with men and women who are endowed by nature with more intelligence than their fellows. In the light of this conclusion, it is highly incongruous, and indeed almost tragic, that science and technology were not recognized as true university disciplines until comparatively recently. The entrenchment of lesser mortals in the ancient universities in positions of authority was responsible largely for the boycotting of the sciences for centuries.

Such arrogance and bigotry must have retarded not only human communication between scientist and nonscientist but also man's evolution as a whole. This fact was recognized almost a century ago by Thomas Huxley who challenged the whole concept of university education as it then was. He said "The universities make literature and grammar the basis of education; . . . Now that in my apprehension is not real culture nor is it what I understand by a liberal education. The thing you really have to do is, in my opinion, to invert the whole edifice and to make the foundation science . . ." And more recently Sir Eric Ashby[7] with his concept of "technological humanism" has set out to do just this. It would indeed be pleasant and instructive to develop here the educational merit of the sciences and technology as basic academic disciplines but unfortunately time and space limitations preclude such an undertaking. Nevertheless, the idea is by no means new and Ben Jonson once wrote "If words are the daughters of earth, then things are the sons of heaven", and Leonardo da Vinci in extolling the merits of the engineer wrote "Mechanics is the paradise of the mathematical sciences, because by means of it one comes to the fruit of mathematics".

For the present purpose, it is convenient to consider the major objectives of education as essentially, first, the conditioning of the brain and central nervous system through learning processes to perform the function of thought, and second, the fitting of people into modern society. These objectives are clearly closely correlated and both have a psychological origin. As our formal education proceeds, we become conditioned at higher and higher levels and, in the case of scientists, the ability to think in terms of the sophisticated languages of science and mathematics depends appreciably on the degree of conditioning. In this context, conditioning is used to describe the process of associate learning and parallels the physiological mechanism described as the conditioned reflex". Much of a scientist's formal education is concerned with conditioning processes and these are continued throughout his life, and constitute the severe disciplining without which the scientist's creative ability would be strictly limited.

But learning through association is perhaps the most fundamental biological learning process and it is not surprising that the scientist takes a leaf out of the book of nature in his approach to scientific technological problems by utilizing models, (physical, mathematical and biological) to study the behaviour of complex systems. And generally, and this fact is probably little understood by the layman, a considerable proportion of scientific language is a highly specialized form of "model"

language. For example, to a scientist the circulation of blood in human body, the distribution of electrical energy, the design of irrigation systems, are all analogous problems and similar models can be used in the study of each. But perhaps the most powerful model of all is the modern high-speed electronic computer, which can be programmed to simulate the behaviour of physical and biological processes when their behaviour can be formulated in mathematical language. Undoubtedly, the electronic computer in the role of a simulator is having a profound influence on interdisciplinary research and as a result the gaps between various hitherto apparently independent scientific disciplines are being effectively bridged. And it is not too much to hope that this same concept and approach to problems will, in the future, facilitate communication between scientists and laymen.

Another interesting speculation is that the educational process as such may lend itself to the model approach. For example, in education, ideas and information are imparted to the student and it is necessary to observe through a "feedback" process, the extent to which the student is stimulated and learns. But we understand comparatively well the mechanism of feedback because it arises in many physical and biological situations and this knowledge may be of some value to the educationalists. However, it is important to recognize the dual nature of the problem of human communication as being made up of the communication of information on the one hand and the communication of ideas on the other. And any theorizing concerning the communication of ideas is a psychological problem of considerable magnitude.

It was pointed out previously that military organizations are very dependent upon human communication, frequently at a highly technological level. This has been recognized for several centuries and many of the military academies established throughout the world have a technological bias. For example, the science of ballistics, the forerunner of the science of rocketry and space exploration, has been taught in military institutions for centuries. This recognition of science and the part science and technology play in military operations has resulted in the foundation of such first-class educational institutions as the Royal Naval College, Greenwich; the Royal Military College of Science, Shrivenham; the Royal Military College, Kingston; the Royal Air Force College, Cranfield; etc., and these institutions have contributed appreciably to knowledge in many fields.

The controversial problem of "humanizing the scientists" is beyond the scope of this paper and reference should be made to Ashby's recent book for an impartial discussion.[8] However, for the sake of the future of the human race, it is to be hoped that the "rear-guard action" at present being "fought" by the humanities, and their pompous exhortations to the effect that scientists should, in their formal education, receive more instruction in the humanities, while at the same time gloating over their own ignorance of the sciences, will not be prolonged. Doubtless, the process of biological evolution of the human species will, as time passes, bring about a transformation and perhaps future generations will be governed by persons who are not completely unfamiliar with the language of science—"*omnia mutantur, nos et mutamur in illis*".

Language and Logic

A major difficulty in the communication of scientific information and concepts arises because of the non-static nature of evolution, which necessitates the continual expansion of the languages of science, and, it should be noted, that the rate of expansion of these languages must increase. On the other hand, the normal languages of human communication (i.e., English, French, etc.) are, in contrast, comparatively static and "machine translation" of these languages is already showing promise and this is only possible because language translation can be programmed.[9] The machine translation of scientific language, except in very limited respects, is clearly not possible. This does not imply, however, that scientific language is non-logical but rather that it is to a certain degree empirical. And this is due essentially to the fact that scientific investigation is based on measurement and observation. We recall the famous Kelvin dictum "When you can measure what you are speaking of and express it in numbers you know that on which you are discoursing. But if you cannot measure it and express it in numbers, your knowledge is of a very meagre and unsatisfactory kind."

But measurement involves numbers and it is scarcely surprising that the common denominator of all scientific languages is mathematics, and it can be argued that, accordingly, the foundations of science are based on the laws of logic many of which were formulated by Aristotle. However, the rigour and sheer deterministic nature of Aristotelian logic frequently cannot provide an adequate model for scientific thought and evolution. And increasingly, especially during the present century, scientists have become more aware of the theories of

probability, and their fundamental role in nature, and we find that all the major scientific advances in such fields as thermodynamics, nuclear physics, quantum theory, information theory, etc. can only be formulated in the language of probability. This is consistent with our view that evolution is essentially stochastic in nature. If, for example, the whole of knowledge can be represented by a given "space", the surface of this "space" will have a labile fringe which is continually "probing into the unknown"—such a model applies also to the process of evolution.

Unfortunately, probabilistic concepts are by no means easy to comprehend and herein lies, perhaps, one of the major barriers to the establishment of effective communication channels between scientists and non-scientists. An additional problem which is not unrelated to the understanding of the scientific method is that of "decision-taking". And today "decision theory" is a well-recognized and documented branch of statistics. It is a logical development since the process of taking decisions must necessarily be guided by probability considerations on account of the stochastic nature of our environment.

Decision-taking must always involve, to some extent, the prediction of the future, and the process therefore involves the application of probability laws which have been formulated as a result of analyzing past experience. Many decisions today should be predicated on the technological advances of tomorrow and the groups best equipped to assess such future developments are the scientists and creative thinkers. The decision-taking problem is particularly difficult in the field of defence where national safety is involved and policies inevitably require the expenditure of a significant proportion of the national income. In order to utilize the scientific and technological power of the West in an optimum way, it is clear that policies involving highly technological matters must be based on the considered advice of the top scientists and applied scientists in the country. Unfortunately, defence policies are frequently predicated on emotional and political considerations instead of on sound technological premises. Science and technology have unfortunately already waged much too long and exhausting a battle against superstition, ignorance, prejudice and vested interest.

Note on Operational Research

There is at least one branch of scientific methodology which has a direct bearing on human communication – I refer to operational research. The subject has, during the past few years, achieved the stature of a scientific discipline having the main object of optimizing systems and processes through the analysis and interpretation of information.

Historically, operational research methods were first introduced a few years prior to World War II in connection with the siting and operation of the coastal chain radar stations in Britain; an important, and, as it proved later, an indispensible factor in the allied victory in the Battle of Britain. Subsequently, operational research became increasingly important during the war as new scientific equipment was brought into service. Equipment which, like radar, brought about a complete reorientation of military planning in such areas as anti-aircraft defence. Few serving officers during this period could be expected to understand the scientific and technological background, or indeed the military potential of such revolutionary systems, and it was always a major objective of the operational research teams to ensure that the new scientific equipment was fitted into the existing operational procedures as effectively as possible. The operational research team was most effective as a channel of communication between the research groups who conceived and designed the new equipment on the one hand, and the military commanders on the other.

Nor is it coincidental that operational research became a recognized scientific technique during World War II. The introduction of complex weapons, coupled with the enormous problems of supplying modern armies, fleets and air forces, resulted in organizational problems the magnitude of which had never been encountered previously. And operational research methods were helpful in the analysis of such problems; while today similar situations in industry and commerce are being successfully handled by the same techniques backed by high-speed computers. For example, operational research groups are active in a wide spectrum of human activities and their ability to translate complex technological problems into simplified models provide admirable communications channels between management on the one hand and research and development on the other. Similarly, in the optimization of defence policies it is already clear that electronic computers can be used to simulate "war games" and here again, the operational research team will be the main communications channel. However, this does not imply that the non-scientific executive will be provided with "short-cuts" to an understanding of profound scientific principles.

The problem of training and selecting executives in all branches of human activity is of considerable complexity. A major difficulty is that the accepted criteria for leadership such as intelligence, character, drive, and initiative are not easy to measure and frequently other less noble characteristics provide the basis for selection. In this technological era it must be obvious that some scientists are eminently suitable to undertake high executive posts in spite of the fact that, until comparatively recently, a commonly held view has been that scientists and engineers cannot, *ipso facto*, by their training, become good politicians or good industrialists. In the past, for example, the scientist-industrialist has sometimes been referred to as "that rare hybrid". It is to be noted, however, that this misconception appears to be more common in the United Kingdom than in North America. That it is a misconception will be clear since the survival of the West is certainly in the hands of the scientists today. Indeed, in view of their contributions to humanity in the past it is almost unbelievable that so few scientists have aspired to high rank in politics and government. The only conclusion which must be drawn is that since the basis of a scientist's motivation is "the search for truth" and since truth is not always palatable to the politician, who must always be conscious of the effect of his utterances on the population at large, the present position is perhaps understandable. However, it is very necessary that means must be found by the Western Powers to bring some scientists into government at the highest levels.

It may be argued convincingly that the failure of scientists to participate in political life in the West is the fault of the scientists themselves. And there is much truth in this. On the other hand the nature of the scientist's employment, and indeed of his work, mitigate against participation in politics, and this constitutes the major difficulty. Perhaps some mechanism will be found in the future to ensure that the personnel of democratic governments will include a rational cross-section of the professions and that science, the creative arts and applied science will not be overlooked.

It is not suggested that all senior managers, commanders and government leaders should have a scientific background or even more than an elementary understanding of scientific principles. But it is contended that, in view of the increasing impact of technological advance on all affairs of state, at least ten percent of our leaders should be first-class scientists. Be it noted that appreciably more than this proportion of leaders in the West are lawyers whose knowledge of technology and science is usually not extensive.[10]

However, it is gratifying to note that in the fields of defence and industry there is an increasing tendency for technologically qualified men to achieve high rank. For example, a survey of the leading industrial executives in U.S.A. was carried out a few years ago by Fortune magazine and it was ascertained that somewhat more than one third were trained as scientists.[11] And this is not surprising because executive decisions must involve an understanding of the appropriate language, and in industry this is usually scientific in nature. Similarly, the increasing numbers of graduates of the military (including Naval and Air Force) colleges of science who achieve the highest ranks in the Services is a most encouraging tendency. And herein lies the key to enhanced human communication with the Service organizations.

It should be noted, also, that communications between military commanders, scientists, and government leaders were highly effective during World War II. The outstanding example was the collaboration between Sir Winston Churchill and the first-class scientist, Lord Cherwell; and there is little doubt that the great wartime leader was considerably influenced in taking major policy decisions, involving technological considerations, by the advice of his scientific friend.

Moreover, the dependence of victory in World War II on technological achievements was fully appreciated by governments. And the methods used to ensure effective communication between government, military and scientific personnel were not only effective but no doubt were responsible for the shortening of the period of hostilities. An outstanding example of such a communication channel was the so-called "Sunday Soviets", a notable feature of the activities of the Telecommunications Research Establishment (TRE) at Malvern, England.[12] Senior Air Force officers and senior civil servants met on "equal terms" each Sunday during the period 1941-45, with scientists at Malvern, and frank discussions of problems and possible solutions were carried out in an informal and friendly atmosphere, which was particularly conducive to the merging of military and scientific minds. The outstanding success of such comparatively unorthodox techniques in the field of human communication have not, unfortunately, been continued during the post-war period. Nevertheless, there has been an increasing reliance by the Services and by peace-time industry on the scientific

tool, forged in war-time, which has been described as operational research, and in some respects this is playing an equivalent role to the "Sunday Soviets". Further, the advent of management consulting services, which are essentially based on operational research methodology, is proving more and more important in the optimizing of industrial and commercial operations.

Accordingly, in the choice of commanders and executives where drive, courage, intelligence and experience all play a significant part, it is highly undesirable to preclude the technologist from high executive rank perhaps because his training in the humanities may have been slight. It is not inappropriate in this connection to recall the words of Leonardo, the engineer, the artist, the scientist, the physician, and the philosopher—"I am fully aware of the fact of my not being a man of letters may cause certain arrogant persons to think that they may with reason censure me, alleging that I am a man ignorant of book-learning".

Conclusions

The ever-increasing gap in knowledge between the scientist and non-scientist constitutes today perhaps the most profound of the many problems of human communication. In no field of human endeavour is the problem more acute than in all matters appertaining to defence on account of the highly technological nature of modern weapons and modern military logistics. It is urged, first, that the scientist should tackle this and allied problems with the same vigour and energy with which problems of pure science are normally handled, and second, that the regrettable lack of interest of scientists, in the past, in the fields of politics and national affairs, should be rectified. The fact that the problem is recognized fairly universally throughout the Western world is a good omen for future accomplishments in this direction. We must ensure that human communication, even in the most abstruse technological matters, is facilitated at government levels. It is also clear that the journalist, in all his modern guises (radio, TV, etc.), will prove to be a still more important link between government administrator and scientist, and between scientist and public, than in the past. And indeed "press coverage" of scientific matters is improving almost daily and this is another excellent omen.

To view the problem in a correct perspective it may not be out of place to quote the views of the classicist Sir Maurice Bowra and the scientist, Professor C. H. Waddington. Bowra[13] has said, "As the Greeks said 'Even the gods do not fight against necessity', and for us engineering has become a necessity. It has brought untold benefits to the world, and if it has often enough been held responsible for our catastrophies, it is we and not it, who are to blame. I even cherish the hope that it may help to solve some of our political troubles. . . . Man's unique position in the theme of things lies in his ability to turn nature to his own ends, and if he really knows what these ends are, he should be able to do on an ever-extended scale what he has already begun to do with such imagination and devotion and skill." And Waddington[14] has written, "Science by itself is able to provide mankind with a way of life which is, firstly, self-consistent and harmonious, and secondly, free for the exercise of that objective reason on which our material progress depends. So far as I can see the scientific attitude of mind is the only one which is, at the present day, adequate in both these respects. There are many other worthy ideals which might supplement it; but I cannot see that any of them could take its place as the basis of a progressing and rich society."

There seems little doubt in the minds of Bowra and Waddington, and indeed of most intelligent people, that science and technology must play an increasingly active part in the future of national affairs. Nor should it be forgotten, in these days of turmoil in international affairs, that the only groups at present maintaining comparatively cordial relations between West and East are the scientists, creative artists and the technologists. And these relationships should be encouraged.

Operational research, industrial engineering, and management consulting appear to be three fields which are well suited to bridging the gap between the executive and the scientists and already they have achieved considerable successes in this respect. In the problem of communicating scientific information and ideas a major requirement is frequently to remove redundant information, and to ascertain the basic relationships which exist between key variables in a process or situation. It is in these respects that operational research and allied research methods are of particular value because one of the main objectives is usually to optimize the utilization of information, and this frequently calls for a scientific sifting and sieving of the data. Further, these comparatively new scientific disciplines depend increasingly for their effectiveness upon the application of large-scale electronic computers and data-processing systems. Thus the application of "games theory" to military

or industrial problems usually necessitates the use of computers on account of the large volume of computation normally required. The great advantage of these techniques to management or command lies in the possibility of examining a wide range of system variables and parameters, and observing their effects on the behaviour of the system or plan under consideration. It is, in fact, the scientist's model approach which has considerable merit in handling these problems, and the computer merely provides a means of simulating or setting-up the model.

We may expect in the future to see an appreciable increase in the utilization of operational research methods, and perhaps their most important contribution will be in establishing effective communication channels between the scientist and nonscientist. The use of "model language" will certainly expedite the communication of ideas and information in all fields of human endeavour involving technological considerations.

But in spite of the success of operational research groups in various fields the major problem of obtaining effective human communications channels between government and the Services, and between government and the sciences remains unsolved in the majority of the democratic countries. For example, in a recent article in this Journal, Dr. Preston wrote:[15]

> ". . . the Ministers who have the real responsibility for making decisions are also lacking in technical knowledge though, it is true, they are in a better position than the public to seek and obtain the best advice. Furthermore, a great many scientists and others outside government circles, while without access to secret information, possess the technical knowledge equal to, or greater than, that of many of the officers and officials responsible for national security policy."

I share this view with Dr. Preston and I suggest that the recent history of defence policy of the West, involving fantastic expenditures, exemplifies the serious nature of the problem which confronts us. Consider, for example, the Bomarc controversy;[16] it is surely highly incongruous that a defence system, involving extremely sophisticated and complex scientific and technological principles and concepts, should be the subject of long and acrimonious debate between participants who do not understand the scientific principles involved even in their most elementary aspects. And it is not unlikely that many scientists in the universities and industry do understand such problems, and they are in a position to advise the government, and, no doubt they are willing to do so.

I would suggest, therefore, that the possibility of scientific and technological policy committees being established, at least one of which should be at the highest level, consisting of scientists from government departments, Boards and Councils, from the Services, from the universities and from industry, should be explored. The main objective of these committees would be to advise the government and the individual Services. In the early stages of establishing such machinery in Canada it is highly probable that the work of the committees would be on a full-time basis, but surely this would be a small cost to pay for ensuring that the best scientific advice is available to the government. It would be hoped that the activities of such committees would be free from the stranglehold of Treasury Departments which have not always been helpful in matters appertaining to scientific research.

The recent establishment of a Ministry of Science in the United Kingdom, together with the well-established Advisory Council on Scientific Policy are steps in the right direction. But it must be noted that the first Minister of Science in Britain is a nonscientist – fortunately, an exceptionally capable one—and, in a country with such a wealth of scientific talent, it is surprising that a scientist was not appointed. This appears to me to be at the root of the whole problem of human communication at the "summit" of affairs. So long as scientists and applied scientists are referred to as "Scientific and Engineering Manpower", so, most certainly, will human communication at high level become increasingly difficult. If the scientific and technological potential of the West is not nourished through education, and is not used efficiently, especially at policy-taking levels, then the probability that we will follow ancient China and ancient Greece and ancient Rome and lose our world leadership, will increase.

[1] Churchill, Sir Winston. "The Second World War, Volume II", p. 377, Cassell & Co. Ltd., 1949.

[2] Cherry, Colin. "On Human Communication". John Wiley & Sons, Inc., 1957.

[3] Richens, R. H. "Preprogramming for Mechanical Translation". Mechanical Translation, 1956, Vol. 3, p. 20.

[4] Military engineers were probably the first engineers to be recognized as professional men.

[5] Bowra, Sir Maurice. "The Impact of Engineering on Society". Second Graham Clark Lecture, Journal Institution of Electrical Engineers, April 1956.

[6] Chauncey, Henry. "The Use of the Selective Service College Qualification Test in the Deferment of College Students", Science, Vol. CXVI, July 1952, pp. 73-79.

[7] Ashby, Sir Eric. "Technology and the Academics". St. Martin's Press (London), 1959.

[8] Ashby, Sir Eric. loc. cit.

[9] Richens, R. H. loc. cit.

[10] This situation should be compared with that in the Soviet Union. In articles on "Soviet Science and Ourselves", published in the Sunday Times of London (17 January, 1960), the Right. Hon. Aubrey Jones, a former Minister of Supply in the British Government, wrote "An astonishingly large proportion of Soviet leaders—thirty-nine out of the sixty-seven members of the Soviet Presidium—have had a scientific or technological training; and those who have not cannot escape the influence of the prevailing form of education. As a result, scientific and technological projects command a readier passage through the higher echelons of government than in the West".

[11] Booker, E. E., Antioch Notes, March 1956.

[12] Rowe, A. P. "One Story of Radar". Cambridge University Press, 1948.

[13] Bowra, Sir Maurice. loc. cit.

[14] Waddington, C. H. "The Scientific Attitude". Pelican Books, Vol. A84, 1948.

[15] Preston, R. A. "The Discussion and Formulation of National Security Policy". R.C.A.F. Staff College Journal, 1959, p. 83.

[16] This is perhaps an inappropriate example because there is some evidence that the fault, if such there be, for pursuing the Bomarc/SAGE project to such extreme limits of technological complexity, does not rest with governments or indeed with the Services, but rather with a "starry-eyed" group of scientists, at a famous educational institution, who "blinded the authorities with science". Such is the difficulty of human communication at these levels.

The fact is that the soldier has an inborn horror of science. Mentally living in an intellectual age at least a generation gone, science antagonizes him directly he is confronted with it professionally.

—J. F. C. Fuller

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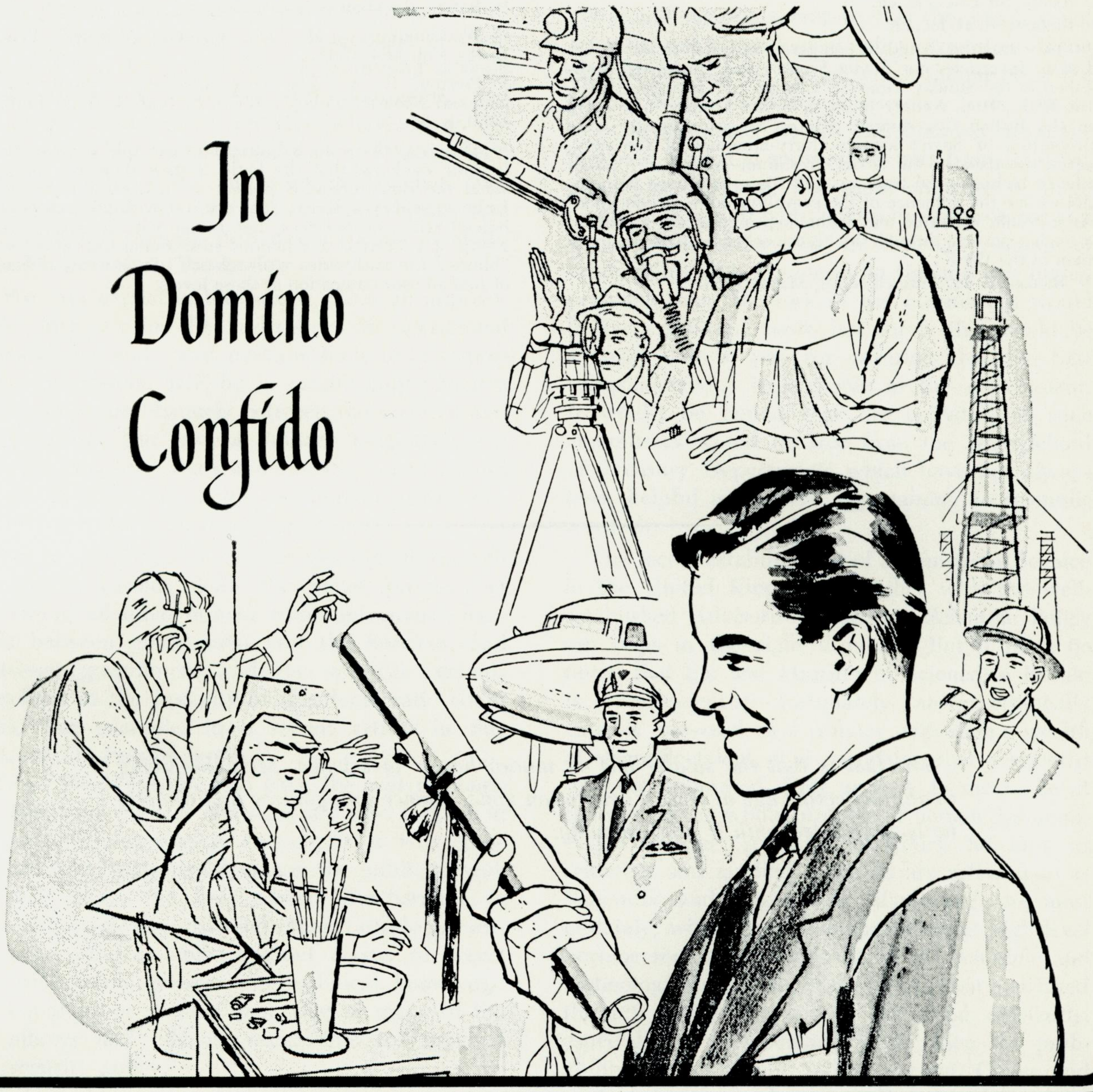

In the days to come, this Journal will serve as a reminder of the many friends you have made, of work accomplished, of good times spent during your ten privileged months at R.C.A.F. Staff College.

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Canada, NATO, and Nuclear Weapons

JAMES EAYRS

Born in London, England, in 1926, Professor James Eayrs attended the University of Toronto, the London School of Economics, and Columbia University where he obtained his Ph.D. He served briefly in the R.C.N.V.R. in 1944-45. Since 1951 he has been a member of the Department of Political Economy, University of Toronto, where he teaches International Relations. In 1959-60 he was Managing Editor of the Canadian Journal of Economics and Political Science, and is presently co-editor of the International Journal. Author of "Canada in World Affairs, 1955-57", and a contributor to "As Others See Us: The United States Through Foreign Eyes" and "The Growth of Canadian Policies in External Affairs", Professor Eayrs has completed "Government and External Affairs in Canada", a book-length study of the foreign policy process, which is to be published shortly.

MOST discussion of strategy for the non-communist West assumes the consequences of membership in the North Atlantic Treaty Organization to be much the same for each of its smaller members, and accordingly the strategic requirements of Canada are lumped together with those of other junior partners in the Alliance (just as theirs are with ours) with little or no regard for the circumstances of our special situation. Thus of three volumes of essays on NATO published in the last few years, none singles out Canada for distinctive treatment;[1] and even Alastair Buchan, in his recent *NATO in the 1960's*, while urging that NORAD become a NATO command and the Canadian brigade be withdrawn from Western Europe to form a NATO mobile reserve,[2] has less to say about Canada's problems than might be expected from the son of a former Governor General and a veteran of Dieppe and the 14th Canadian Hussars. But not only is our position in the Atlantic Alliance different from that of such other junior members as Belgium, Italy, Greece or Turkey; it is different from that of the twelve other members presently sharing our status as a non-atomic power allied in NATO to the nuclear triumvirate of the United States, the United Kingdom and France. A sound nuclear policy for Canada – whether a policy of atomic abnegation or a policy of atomic armament—can be developed only by carefully considering the special requirements of Canadian geography, tradition, and national interest.

I

The proposal has been put forward, first by Lieutenant-General G. G. Simonds and more recently by an American defence critic,[3] that Canada should acquire an apparatus for massive retaliation under its own control, thus providing Canadians

with "a renewed assurance that they possessed for themselves some means for rendering costly any attack upon or over its territory and for assisting the nation to meet 'blackmail' nuclear threats".[4] Such a remedy is wholly unsuited to our peculiar predicament, for of all the distinctive aspects of Canada's strategic position none is more crucially important than the fact that, alone among the members of the Alliance, we can present no rationally grounded case for an independent deterrent to atomic attack. The main reason why the government of the United Kingdom embarked at such enormous effort and expense upon development of its own nuclear weapons and delivery systems was through fear that the bombers and missiles of the United States might not deter the Soviet Union from assaulting or bullying the British Isles. Would a United States President be ready to risk the certain incineration of his country for the sake of preserving the integrity of Britain as a nation? Or, amounting to much the same thing, would a Russian leader believe him ready to take such a risk? The doubting and anxiety to which such questions have given rise have proven costly beyond belief to the British taxpayer, saddled with the three sets of V-bombers, the Woomera ranges and the abortive Blue Streak missile. They may prove even more costly to the French, who seem prepared to alienate even more than they have already the opinion of the Afro-Asian world by making immense budgetary preparation for converting a pair of experimental atomic explosions into a fully-fledged nuclear weapons system.[5]

Determined negotiations might well produce for Canada its own deterrent of this kind, drawn from the arsenals and technologies of the United States or the United Kingdom; and even if it failed, the construction of our own nuclear weapons system, costly and difficult as it would be, is not beyond our financial and technological capacity, as it is clearly beyond the capacity of any other presently non-nuclear NATO member excepting West Germany. But, altogether fortunately, our occupancy of the northern half of the North American continent makes such expense and effort wholly unnecessary. Any atomic attack upon North America would bring about United States retaliation. The Soviet Union, therefore, cannot under imaginable circumstances contemplate a nuclear strike directed specifically against Canada. The American apparatus for massive retaliation serves to deter attack on Canada precisely to the same extent that it serves to deter attack on the United States itself. *We are the sole ally of the United States of which this can be said.* It follows that the only eventuality for which the acquisition of a Canadian deterrent against thermonuclear attack could be soundly conceived is the altogether improbable one of the United States adopting a policy of unilateral atomic disarmament.

There are, however, reasons other than reasons of strategy why states seek entry to the nuclear club. They do so for reasons of prestige. Prestige played some part in the British decision, and a larger part in the French decision, to become an atomic power. For newly independent and underdeveloped nations prestige will offer the only inducement to nuclear status, but it will be a potent inducement nonetheless. The poorest of nations, offered assistance by the wealthy, are notoriously reluctant to put philanthropy to work where it is most urgently needed; in the name of severing strings they insist on building steel mills and nuclear reactors, just as they lavish foreign exchange on paved roads and national airlines, seeking to impress the foreigner.[6] The atom, used for peace or war, offers a tempting short-cut to great powerdom. Nuclear weapons have become the most impressive of all international status symbols, or will do so shortly; and nothing seems more likely to cause the spread of such weapons throughout the world.

But while Canada has some reason to be regarded as both newly independent and under-developed, Canadian kudos would remain peculiarly unaugmented by the acquisition of atomic weapons. In the first place, any strategic advantage conferred by a nuclear arsenal controlled by Ottawa must be weighed against the hostility its possession may be expected to arouse in a world still disposed to place nuclear weapons and their owners in a special category of iniquity. To no small extent our status as confidant to certain of the Afro-Asian nations, notably India, rests upon their conception of Canada as a Western nation uniquely free from the characteristic blemishes of Western nations: free from what the Bandung powers understand by "colonialism", free from weapons depending for their destructiveness upon the fission or fusion of parts of the atom. As the Afro-Asian powers themselves develop atomic aspirations, this consideration will rapidly diminish in importance; for the time being it ought to play a part in the calculus of net advantage, and so long as the present Canadian image persists there may be no point in exchanging the kind of power resting on influence for the kind of power resting on force.

Britain and France, knowing perfectly well that their nuclear status would cost them dearly in Afro-

Asian goodwill, counted on greater influence at Washington to redress the balance. To some extent this expectation has been fulfilled. But again the special circumstances of Canada's situation make it folly for us to develop nuclear weapons in order to blast our way into the inner councils of the Pentagon. Our wartime contribution to the Manhattan Project, the great (if diminishing) worth of Canadian geography to North American defence, the sympathetic hearing usually assured for Canadian representatives in Washington, have given Canadian governments influence in nuclear affairs out of all proportion to what our military power would normally warrant. And while it is true that non-nuclear status precludes Canada, under the U.S. Atomic Energy Act and its amendments, from sharing quite as intimately as the United Kingdom in some of the facts of nuclear life, much, probably most, of its substance is conveyed to us, for, as provided in the U.S.-Canada agreement of May 22, 1959, we are already entitled to receive "information necessary to the development of defence plans; the training of personnel in the employment of and defence against atomic weapons and other military applications of atomic energy; the evaluation of the capabilities of potential enemies in the employment of atomic weapons; the development of delivery systems compatible with the atomic weapons which they carry; research, development, and design of military reactors to the extent and by such means as may be agreed."[7]

It therefore follows that the acquisition by Canada of nuclear weapons cannot rationally be justified by considerations of prestige, any more than its justification may be sought in the need to prepare a distinctive deterrent to nuclear blackmail and aggression.

The matter appears in a different light, however, when one considers the ways in which Canada might usefully strengthen the American deterrent as opposed to duplicating it. Allowing the emplacement of missile sites in northern Canada has certain strategic advantages. It would exploit the greater operational reliability of IRBM's over ICBM's at the present stage of American rocketry. It would provide greater accuracy by shortening the range. It would remove the apparatus of massive retaliation to points far distant from the centres of population and industry to which the present ICBM sites are dangerously adjacent.[8] It is true that far northerly location of IRBM's places them within closer range of Soviet attack as well as beyond the reach of warning by radar of such attack. But there is the compensating advantage of unambiguous warning to the heartland that an attack is definitely underway, a warning inherently beyond the ability of any radar to signal with absolute certainty. The United States may decide to reject the proposal, on the grounds of the vulnerability and expense of hardened missile bases, but it should be given the opportunity to consider it on its merits. Similarly, we could contribute to the strengthening of the deterrent by granting access to our territorial waters, particularly in the Arctic Ocean and in Hudson's Bay, for United States Polaris-carrying atomic submarines, and to our highway and railway systems for its land-based mobile missiles.

A further way by which Canada could contribute to making the American deterrent more effective is by opening our territory to United States anti-missile and anti-aircraft defences. It will be up to the United States government, having taken counsel with its operational researchers, to determine their most effective location, but in our own interest we should place no obstacle in the way of locating these on Canadian territory if a more forward location than the border appears desirable. (It appears to a layman, as distinct from an operational researcher, that the more forward their location, the more desirable for everyone concerned except would-be aggressors.) United States interceptor aircraft should be based, if necessary, on Canadian airfields; there is no merit whatsoever in the proposal to restrict them to refuelling and rearming following sorties launched from American bases.[9] Since anti-missile and anti-aircraft defences against surprise attack are effective only when armed with nuclear weapons, they should be provided with such weapons. If the pattern of anti-aircraft and anti-missile defence created in this way seems to offer inadequate protection to Canadian centres of population and industry, it may be necessary to supplement it by our own. Determined negotiation must then attempt to modify United States atomic energy law so that the nuclear components of these weapons may be placed in Canadian hands along with their means of delivery. Canadian control is desirable not for reasons of national prestige but because divided control weakens the capacity to deter. For this reason it may be preferable, should such negotiations fail, to request the United States to assume full operational control over anti-missile and anti-aircraft defences installed on Canada's initiative and at Canada's expense. Alternatively, the nuclear components might be acquired from the United Kingdom under conditions allowing for full Canadian control.

II

Canada's present contribution to the NATO Shield in Western Europe consists of an army brigade and an air division. A consistent policy of atomic abnegation would necessarily deprive these forces of all types of atomic weapons. If they were deprived of them, and if NATO strategy continues on its present course, our forces would thus become one of the few non-nuclear contingents in a Western defensive coalition facing an enemy armed with atomic weapons and ready to use them. Merely to state this position conveys a sense of unreality, and Canadian policy in this respect is very different. The Prime Minister's statement of February 20, 1959, referred to examination then in progress by the Canadian and United States Governments of "problems connected with the arming of the Canadian brigade in Europe with short-range nuclear weapons for NATO's defence task."

It is true that NATO strategy has been criticized for relying on tactical nuclear weapons to redress the balance the Soviet Union's 140 operational divisions have so heavily tipped against the West's 21-and-a-bit, and it is now fashionable to look to the conventionally armed infantryman to provide in his unspectacular way a solution to NATO's strategic difficulties. Such doctrine makes sense only on the assumption that Soviet forces are themselves unequipped with tactical nuclear weapons; or, if they are so equipped, that Soviet military doctrine rejects their use except in self-defence; or, if it accepts their use in offence, that a greatly augmented NATO conventional force will deter or blunt a Soviet atomic assault. The first and second of these assumptions are no longer valid; Soviet forces are equipped with tactical nuclear weapons on a scale at least equal to our own, and expressions of misgiving at the consequences of their use have in recent military discussion given way to expressions of gratification at the decisive advantage conferred upon forces trained in the tactics of the atomic battlefield. Whether the third assumption is valid it will take an atomic battle to determine. But it is hard to see how any government, especially a democratic government traditionally concerned with the safety of its soldiers, can set its seal of approval upon a strategy requiring its conventionally armed forces to risk combat against numerically superior atomically armed forces when the means of nuclear retaliation are close at hand. "Any country which renounces for itself the development of nuclear weapons, without certain knowledge that its adversaries have done the same, is likely to find itself in the position of the Polish Army in 1939, fighting tanks with horses."[10] The answer to Soviet superiority in atomically armed troops is not more NATO conventional forces but more NATO forces capable of responding with either conventional or nuclear weapons as circumstances dictate.

It seems likely that any rational NATO reappraisal of its future needs would look askance at Canada's brigade, costing as it does the equivalent of two European divisions, and that the imperatives of the fashionable notion of interdependence (which may be defined succinctly if inappropriately by the Marxian formula "from each according to his abilities, to each according to his need") will demand that Canadian troops be withdrawn from Western Europe and a better method of contribution to the common cause devised. Should this happen, there would arise even more insistently than now the question of what part if any a Canadian government should have in the decision to use whatever nuclear forces a Soviet strike might make necessary.

The present policy governing the use of nuclear weapons by NATO forces in Europe is more than a little obscure. There appears to be general agreement that the decision to fire an atomic weapon of whatever magnitude is no ordinary operational decision left to the whims and impetuosities of a field commander, but is to be resorted to by SACEUR only after political consultation with the members of the Atlantic Alliance. But with which of them does consultation take place, and how? The President of the United States and the British Prime Minister with as many of his colleagues as could within minutes be assembled would almost certainly have to be consulted. So, perhaps, would two or three governments in Western Europe, probably the French and the West German. But if the Soviet Union were to launch a formidable military assault, with or without nuclear weapons, there would be no opportunity to consult effectively with all the fifteen governments concerned, for by the time the round had taken place the Red Army would be at the channel ports.

Two competing considerations have jostled for priority. On the one hand there is the need to insure that the decision to pull the nuclear trigger, risking as it does the danger of thermonuclear war, is taken only after the collective wisdom of the Alliance has been brought to bear upon the situation. On the other hand there is the need to establish in the mind of the would-be aggressor that the basic NATO commitment to regard an attack upon any member as an attack upon all members

is not a bluff to be called by the strategy of ambiguous aggression. The result has been that the decision-making process for the most fateful of all decisions is shrouded in uncertainty. By leaving the Russians in doubt as to whether the Supreme Commander can and will at his own discretion give the order to open nuclear fire, we have hoped to exploit the deterrent aspect of the NATO shield and so to postpone indefinitely the need to make the dread decision at all. But in order to leave the Russians in doubt we have also left ourselves in doubt. The price of perplexity on the other side has been a growing uneasiness on our own, especially on the part of NATO's smaller members of which Canada is one—having no voice in the decision if it needed to be made. Increasingly the demand is heard that the use of NATO's nuclear forces in Western Europe be governed by a more systematic procedure in which the smaller members of the Alliance would be allowed, even better, be required, to participate.

Three of various proposals are worth attention. The earliest, originating with the foreign minister of Belgium, would have vested the decision to use the nuclear components of the Shield in the NATO Council.[11] Such a procedure, while offering the smaller members a significant, indeed a dominant, role in NATO strategy—for in the Council their veto would prevail—would reduce NATO's powers of decision to those of its most craven and timid signatory; it would mean (to take an extreme case) allowing, say, Iceland, having no armed forces of its own let alone nuclear forces, to dictate the nuclear strategy of the entire Alliance. So unrealistic a proposal has slight chance of adoption, nor is its adoption desirable.

A second suggestion, recently put forward by Alastair Buchan,[12] is that a new NATO command should be created, in which would be vested all of Western Europe's nuclear decisions, including any decisions related to a proposed NATO deterrent in the shape of mobile land-based Polaris missiles. This arrangement no more than the present arrangement provides an answer to the problem of consultation; there is something singularly unconvincing about Mr. Buchan's argument that the Supreme Commander Deterrent, having less to preoccupy him than the Supreme Commander Europe, would be able to carry out the process of consultation with more energy and despatch.

A more promising approach to the problem is to be found in the conception of an inner grouping of NATO members collectively responsible for political aspects of the nuclear command. Such a concept is ill-regarded by the smaller members of the Alliance as tending to create an inner circle of key decision-makers from which they would be excluded. To this it may be replied that a peace-saving procedure in which some members have not participated is preferable to a peace-losing procedure in which all have had a say; those nations attaching more importance to status than to tranquillity have a scale of values which the nuclear age has rendered altogether perverse, and the Alliance is better off without them. Moreover, the credibility of the NATO deterrent has already been lessened as the result of a large and unwieldy membership and will become increasingly dangerous unless power and responsibility are brought into closer consonance. Finally, the grievances of the smaller members may be overcome by allowing them partial representation on any inner Council that develops. There is perhaps a place here for the ancient device of the panel system employed to give the Dominions representation on the British Empire delegation at the Paris Peace Conference in 1919: in modern NATO dress this would involve vesting the decision to use nuclear weapons in response to Soviet attack in Western Europe in the Supreme Commander-in-Council, the Council to consist of the United States, the United Kingdom, France and West Germany, together with one or two other non-permanent members taking their turn on the panel. The chances of prompt and wise decision would in such a reduced gathering be improved, without weakening either the sense of NATO community or destroying the credibility of the deterrent. Such machinery as this might help to solve the problem, but it should not be mistaken for a solution. There are few more dangerous occupational diseases besetting the military theorist than what might be called "strategist's cramp", of which the principal symptom is the delusion that difficult problems may be disposed of by the contrivance of institutions, however ingenious.

III

Most Canadians presently appear to favour a policy of atomic abnegation, in preference even to a limited nuclear strategy for continental defence and the defence of Western Europe. What follows is an attempt to consider critically some of the arguments used in support of the policy of defending the realm without nuclear weapons of any kind.

Perhaps the most convincing rests on moral rather than expediential ground. It has been stated eloquently, if without total conviction, by Mr. George Kennan: "Let us divest ourselves of this weapon

altogether; let us stake our safety on God's grace and our own good consciences and on that measure of common sense and humanity which even our adversaries possess; but then, let us at least walk like men, with our heads up, so long as we are permitted to walk at all."[13] This is a pacifist argument, and the pacifist case has certainly lost none of its relevance since the Sermon on the Mount. But notice what the pacifist argument is: it calls on us to stake our safety not on conventional weapons but on God's grace; to forego not merely atomic weapons but all weapons; to regard the taking of human life as a supreme moral outrage. This is a noble creed, but not a creed consistent with a defence policy of any kind, and certainly not with a defence policy countenancing the use of firebombs, napalm and other "conventional" explosives of greater destructive power than the revolutionary new types of sub-kilotonic weapons presently under development.[14]

A second argument for atomic abnegation for Canada rests on the ground of alleged operational inefficiency of the weapons to be used. The most common version is that as there is no possible defence against the ballistic missile, any strategy other than a counterforce strategy, by which the aggressor is prevented from striking solely for fear of being struck himself, is worthless. Such an argument seriously underrates our scientists, who have begun to make a habit of doing the impossible. The interception of a ballistic missile has been compared to hitting a bullet with a bullet, but there is perhaps nothing so very remarkable in such an achievement by a society which mass-produces colour television fifty years after the magic lantern, and indeed the Nike-Zeus anti-missile gives every promise of successful development. What is practically impossible is the certain interception of every nuclear device deployed in all-out attack, from those installed in the nose-cones of Soviet ICBM's to those clandestinely lodged by Soviet agents in the lockers of railway stations and downtown hotels. But to adduce this sombre possibility as an argument against using nuclear weapons in defending the continent is to overlook the crucial if troublesome point that such weapons, no less than the weapons of massive retaliation, are useful only if they are not used. It is their value as a deterrent which makes their development worth its immense cost, and if fired against an attacker they have failed in their only purpose. Though there may be an intimate relationship between operational efficiency and deterrent effectiveness, the two are not identical. Unless a weapon appears reasonably efficient in the estimation of the enemy it may fail to deter him, and it might therefore be folly to practice a Potemkin strategy of creating a deterrent force out of the contemporary equivalents of cardboard and *papier mâché;* but if his intelligence was known to be as unobservant as Catherine II it would be very sound strategy indeed.

Then there is the fear of "escalation", that the use of any nuclear weapon of whatever size and in whatever circumstances would lead irresistably to the use of larger ones in all circumstances and so plunge the world into the all-out atomic war it is the very purpose of nuclear weapons to deter. Argument as to whether or not such a calamity will occur is singularly pointless, for in this the future is bound to be inscrutable. Those who adduce the inevitability of escalation as an argument for dispensing with nuclear weapons tend, however, to rest their case on a technological assumption rapidly becoming obsolete and on a political assumption which, if valid, precludes the possibility of limited warfare of any description. The technological assumption is that the explosion of a tactical atomic weapon however small is so indiscriminate in its effects that the other side, being bound to mistake tactical for strategic assault, will retaliate on a greater scale. But owing to the development of nuclear weapons on a sub-kilotonic scale there is no technical reason why an atomic anti-aircraft burst or anti-tank missile of five or ten ton TNT equivalent[15] need be mistaken for the kind of weapon dropped on Hiroshima. The political assumption is that neither side struck by nuclear weapons in whatever form will be able to refrain from retaliation on a massive scale. But this is a throwback to an older and outmoded era of conflict in which war and peace were regarded as mutually exclusive categories. Today each side has arrayed against the other an armoury of weapons capable of applying force along an infinitely graduated scale, weapons ranging from radio transmitters to cobalt bombs, and survival depends precisely on the capacity of each to respond with the appropriate proportion of force to the pressure of the other. Soviet leaders appear to have grasped this conception much more clearly than, say, the authors of the British White Paper of 1958; here, for once, the Marxist-Leninist tradition has not led them astray.

Finally, the employment by Canada of nuclear weapons for the defence of North America and Western Europe against surprise attack is objected to on the ground that their acquisition will significantly diminish the chances of solving what is

sometimes called "the Nth power problem", making it very much more difficult to keep to four the number of independent centres of nuclear decision-making throughout the world. This consideration has determined our present policy of accepting nuclear weapons from the United States only under conditions of American custodianship as yet undisclosed. When the Prime Minister first announced on February 20, 1959, that "the government is . . . examining with the United States government questions connected with the acquisition of nuclear warheads for Bomarc and other defensive weapons for use by the Canadian forces in Canada", he made it clear that "ownership and custody of the nuclear warheads should remain with the United States", giving as the reason for this the government's belief that "the spread of nuclear weapons at the independent disposal of individual nations should be limited."[16]

However desirable the objective of this policy may be, there is some reason to think it unattainable. Reference has already been made to the potency of nuclear weapons as international status symbols. There is, to be sure, a faint possibility that other societies now on the threshold of nuclear statehood, Sweden and Switzerland for example, might be willing to forego their atomic ambitions given some effective system of international control. Such a system is a great deal to hope for. Can anyone familiar with the fate of the modest proposals for international control of nuclear weapons testing really expect agreement on the infinitely more complex and intrusive scheme needed for protection against atomic arms smuggling and clandestine production? But even the unlikely event of some such agreement may not abate the desires of Afro-Asian governments to acquire nuclear weapons of their own when the opportunity to do so presents itself, as it surely will. It is unrealistic to forego national control over a nuclear weapons system in the expectation of thereby warding off the coming era of nuclear plenty.

Although the overwhelming concensus of Canadian opinion regards the objective of limiting the nuclear club to its present restricted membership, as manifestly desirable, it must be firmly pointed out that its desirability should not be taken for granted. It is of course beyond dispute that a world where fifteen or twenty governments are capable of exploding nuclear weapons will be a frightening place to live in. Yet the risks of accidental war, while terrifying enough, may be better run than the risks of nuclear aggression in a world where calculated assaults are encouraged by states lacking the means of nuclear deterrence. Nor should it be forgotten that the attempt to hold the line at the present number of nuclear powers is likely to result in a situation of far greater volatility when fifteen or twenty countries, having been deprived of nuclear weapons for a decade, suddenly discover, as no doubt they will, a cheap and simplified process of manufacture. Rather than confronting a host of nations unexpectedly arriving at what might be called a stage of nuclear puberty without any knowledge of the bees and the flowers, might it not be better to anticipate such a stage by conducting, over the next few years, a supervised programme of nuclear aid for defence and economic development, accompanied by institutional arrangements and codes of behaviour intended to lessen the risks of war by accident or design? It is at least arguable that this course is preferable to being suddenly overwhelmed by a group of irresponsible and undisciplined atomic adolescents.[17]

Policy is always a choice among evils, and the policy maker cannot hope to do more than to choose the least of these evils. In defence policy the choice is especially excruciating, just as the penalty for error is especially severe. The alternatives presented above are harsh, but they are not false. And we must see the world as it is, if we are to have a world at all.

1 See W. W. Kaufmann (ed.), *Military Policy and National Security* (Princeton, N.J., 1956); Arnold Wolfers (ed.), *Alliance Policy in the Cold War* (Baltimore, Md., 1959); Klaus Knorr (ed.), *NATO and American Security* (Princeton, N.J., 1960). Ben. T. Moore, *NATO and the Future of Europe* (New York, 1958), and Gardner Patterson and Edgar S. Furniss, Jr., *NATO: A Critical Appraisal* (Princeton, N.J., 1957), are similarly devoid of any special treatment of the Canadian position.

2 (London, 1960), pp. 79-80, 93, 109.

3 Lt. Gen. G. G. Simonds, "Critical Stage in Defence", *The Times* (London), November 24, 1958; Melvin Conant, "Canada and Continental Defence: An American View", *International Journal,* XV, 3, Summer, 1960.

4 Conant, *op. cit.*, p. 227.

5 The cost of the French nuclear programme immediately after the first Reggan detonation already amounted to 105 billion francs (old currency). See *France's First Atomic Explosion* (French Embassy press release, February 13, 1960), p. 37.

6 The Ghanaian Minister of Transport and Communications, Mr. Krobo Edusei, recently informed a press conference that the newly created Ghana Airways would be equipped to "uphold and carry to foreign fields not only Ghana's national flag but also the Ghanaian and African personality". *The New York Times*, February 18, 1960.

7 Canada, House of Commons Debates, May 25, 1959, p. 3966.

8 Most notably that of the ICBM site at Plattsburg, N.Y. It must be added that the residents of at least one such community seem cheerfully unconcerned: "Far from de-

ploring the presence of Atlas ICBM's in their backyards, the townsmen [of Cheyenne, Wyoming] are making a determined effort to increase the missile stockpile in the area.

[9] Canada, House of Commons, Special Committee on Defence Expenditures, *Minutes of Proceedings and Evidence*, No. 16, June 28, 1960.

[10] Freeman J. Dyson, "The Future Development of Nuclear Weapons", Foreign Affairs, 38, 3, April, 1960, p. 460.

[11] Paul-Henri Spaak, "The Atomic Bomb and NATO", *Foreign Affairs*, 33, 3, April, 1955, pp. 353-9.

[12] *NATO in the 1960's*, p. 76.

[13] George F. Kennan, *Russia, the Atom, and the West* (London, 1958), p. 55.

[14] Dyson, *op. cit.*, pp. 457-64.

[15] Since nuclear explosions no greater than those of conventional weapons used in the Second World War are now possible it may be asked why such conventional weapons should not be used instead of atomic weapons for tactical purposes. The answer lies in the ease and economy of nuclear delivery systems, two men and a bazooka now having the fire power of an artillery regiment or a heavy bomber.

[16] Canada, House of Commons Debates, February 20, 1959, p. 1224.

[17] This point is made by Roger Hilsman, "On NATO Strategy", in Wolfers (ed.), *op. cit.*, p. 170.

R.C.A.F. STAFF COLLEGE JOURNAL
ESSAY CONTEST FOR 1961

The R.C.A.F. Staff College Journal Essay Contest will be held again in 1961. The contest is open to all members or former members of the Canadian Armed Forces and the Civil Service, and the prize of $250.00 is awarded for an unsolicited essay, not exceeding 5,000 words in length, likely to stimulate thought on military, and particularly air force, matters. The field thus includes strategy, operations, training, logistics, personnel administration, technical services, research and production, and any other related field. In addition to the prize money, the writer of the winning essay will be paid at the usual rate of three cents per word if his work is published in the Journal. If possible, a representative group of these essays considered to be worthy of honourable mention will also be printed in the Journal. Authors of these essays will be reimbursed at the same rate.

The Board of Directors of the Journal will appoint the judges, whose decision will be final. If no essay meets the standard of excellence set by the judges, the right to make no award will be reserved by them. Essays are not to contain classified information. Manuscripts must reach the Editor of the Journal by 1 June, 1961.

Honourable Mention

Lieutenant Commander Clayards' article, "Hydrofoil Craft—A New Hope for NATO's ASW Problems," was considered worthy of an "Honourable Mention" by the judges of the Journal Essay Contest.

Hydrofoil Craft – A New Hope For NATO's ASW Problems

LIEUTENANT COMMANDER W. E. CLAYARDS

Lieutenant Commander W. E. Clayards, 36, graduated from Royal Roads in 1943, and joined the RCN as a midshipman the same year. His many tours of sea duty, including tours in the Pacific and Korean waters, have given him a broad background in anti-submarine warfare. Prior to his present appointment, Lieutenant Commander Clayards was Naval Liaison Officer at the Defence Research Establishment, Dartmouth, N.S. He is now Commanding Officer of the Frigate, H.M.C.S. Swansea, based at Halifax.

TODAY'S international struggle is being fought in the debating halls and the field of economics, where nations will be won over not so much by the military might of a prospective ally but by the degree of economic and technical assistance given. It is therefore not surprising that some NATO leaders advise a military retrenchment to a more compact system of defence and a diversion of NATO's main efforts to an economic effensive in the underdeveloped parts of the world. However this does not remove the menace of 500 Russian submarines on our doorstep; these shall for some years to come be a major threat to the continued freedom of the seas. One cannot overlook the importance of unrestricted access to the principal trade routes of the world in the event of a major Western economic offensive. Nor can the fact that submarines nearly won two wars be lightly disregarded. Whether or not NATO re-deploys to more economically tenable positions in the next few years, the Atlantic Naval Force must be prepared to meet and counter the Red submarine threat. Present anti-submarine methods and systems could be much more effective, but only at the penalties of increasing complexity and costs; both of these threaten to overwhelm our resources before any semblance of anti-submarine coverage of the required density is achieved. Therefore any defence measure that possesses both increased effectiveness *and* economy must be considered. Here is where vehicles such as hydrofoil craft may give new hope in the solution of NATO's naval problems.

FACTORS AFFECTING NATO'S ASW SITUATION

Current ASW vehicles must be used in varying tactical combinations to produce a successful result. A Hunter-Killer Force may be made up of the whole range of naval vehicles, submarines, destroyer escorts, carriers, fixed wing carrier aircraft, helicopters, blimps, and shore-based long-range aircraft. Each one of these groups of vehicles has its experts and proponents. It is noted however that the combination usage in a proper balance is a proven requirement rather than a

preponderance of one vehicle over another, notwithstanding, of course, specific tactical situations.

This ASW combination must possess the requirements of speed, be highly manoeuvrable, and be able to detect and track submarines with a kill capability as demanded by the international climate. Unfortunately the whole combination is very expensive in money and manpower and therefore is not available for deployment in the numbers needed. Nor does it have the ability to meet satisfactorily all of the requirements, either with single vehicles or with various combinations.

Fortunately the hydrofoil craft shows great promise of meeting the above requirements while at the same time complementing ships, submarines, and aircraft, by filling in some of their deficiencies. It is a craft that might assist greatly in solving our problems, first on grounds of ASW efficiency and secondly on grounds of cost efficiency. Let us take a closer look at its background, attributes, and the feasibility of NATO naval usage for anti-submarine warfare.

THE ASW HYDROFOIL CRAFT

Definition

Hydrofoils and aerofoils are basically identical in principle—both support craft by lift-developing foils. The medium of water, however, is used in the case of hydrofoil craft. Thus a vehicle is called a hydrofoil craft when the hull is raised entirely above the water by means of lift generated in its underwater wings or hydrofoils. This action eliminates the hydrodynamic hull drag and also greatly reduces all movements caused by wave action.

Just as these two air and water foils parallel one another in principle, so their historical background is closely aligned, although the main interest and development has been in the aerofoil. Accumulated theoretical and technical experience with the aerofoil over the past sixty years is readily adaptable to the hydrofoil.

Background

A French nobleman, the Comte de Lamberte, took out the first patents for a hydrofoil craft in 1891. He in turn was followed by an Italian, Forlanini, in 1905, who produced a successful ladder type foil that allowed speeds in the vicinity of 40 knots. Other Italians followed: Crocco, Recaldoni and Guidoni, but these men were interested in the application of hydrofoils to seaplanes (strangely enough their quest was answered some fifty years later by research work on the U.S. Sea Dart). Even the Wright brothers had an unsuccessful try at a hydrofoil craft. Eventually Casey Baldwin and Alexander Graham Bell bought out the Forlanini patent and commenced experimentation and finally developed the HD4. This craft obtained the world's water speed record of 61.5 knots in the Bras d'Or Lakes in 1919. At that time these two men sought to use their vehicle for anti-submarine warfare. Operating in groups of three they would respond to air sightings of surfaced sumbarines at high speed, stop near the submerge datum and by means of hydrophone cross bearings, locate the submarine for a depth charge attack. An investigating committee from the Admiralty were most favourably impressed at the time—but the 1923 military retrenchment closed off a promising development. Baldwin continued his developments through the years and in World War II built the successful invasion smoke screen vehicle called the "Comox Boat". His influence can be seen in the more recently successful Canadian Defence Research Board's "Massawippi", which has done 55 knots in rough seas. To date the main Canadian development continues to use ladder-type foils.

Many other nations (all to be future NATO members) contributed to the development of the hydrofoil—U.S., U.K., France, Holland and Germany. From 1936 onwards, the German designer-builder combination of Schertel-Saschenberg produced many successful hydrofoil craft, and only the efficiency and accuracy of Allied bombing prevented a fully seagoing and fighting hydrofoil from out of Germany during World War II. Even at that, an 80-ton craft was built to operate as a blockade runner between Sicily and North Africa and it performed at 40 knots, before it was lost through stranding off the Dutch Coast.

Post-war hydrofoil activity has seen a whole series of successful commercial ferry ventures, operating in the Messina Straits, Aegean Seas, Swiss Lakes, Lake Maracaibo. Needless to say, the Russians are using them also on the Volga River.

Naval application of hydrofoils has been restricted; firstly, in that size was too small for a useful payload, and secondly, they were too small to function in the open seas. However, recent studies in Canada and the U.S. based on actual experience in the field with test vehicles from 5 to 20 tons, show that it is feasible to build all-weather, high speed, operational hydrofoil craft, even up to 3,000 tons. At this stage of development, an adequate answer to our problems can probably be found in the 100 to 500 ton range. At the time of writing, an 80-ton commercial prototype is being built by the Maritime Administration

of the U.S. Department of Commerce and should be operating by the latter half of 1961. Announcements have also been made that a U.S. Navy craft of over 100 tons will be built in the near future. Thus, hydrofoil craft, straining at the leash for nearly sixty years, are at last in the running because they are feasible and they do meet a need in today's anti-submarine warfare vehicle requirements.

Requirements and Capabilities

When we examine the requirements and capabilities of an anti-submarine warfare vehicle, we should look into four main considerations. They are seakeeping, speed, endurance and fighting equipment. There are also certain other general advantages when we use the hydrofoil craft for this specific task of anti-submarine warfare. Let us review them.

Minimum size of displacement vessels for efficient all-weather operations in the Atlantic during the Second World War was found to be about 1600 to 2000 tons or frigate size. Heavy rolling and pitching along with rapid accelerations made life unbearable and operational efficiency low in the smaller ships during the winter gales of 1940 to 1945.

Seakeeping and weather capabilities of hydrofoil craft must be experienced to be believed, although naval architects can calculate the movement effects without undue difficulty and show seakeeping motions of hydrofoil craft to be much less at either high speed or in displacement condition than a conventional vessel of a similar size. Experienced mariners are highly sceptical at the likelihood of any small craft being able to survive the North Atlantic.

Notwithstanding the sceptic's opinions, many studies and actual commercial experience over the past ten years show that acceptable working conditions can be achieved with a 100-500 ton hydrofoil craft. In normal displacement operation, a hydrofoil craft should compare with those of a conventional ship twice its dimensions (i.e., 1600 to 2000 tons) because of the damping and inertia provided by the immersed foils. On the other hand, at full foilborne speed, with certain safety equipment (harnesses and seat belts) the hull would either *platform* or be supported above the wave tops at a designed wave clearance height (10-15 feet in this case) or the craft would contour and follow the undulating surface with a fixed hull clearance independent of wave height. A combination of both platforming and contouring would likely be used combining the best features of both and with a hull clearance of about 10-12 feet.

It is of interest to note some of the commercial and experimental experience to date, although most of these hydrofoil craft have been less than 30 tons. The 28-ton PT20, for example, has been making scheduled passenger runs at 35 to 40 knots in the Adriatic, Aegean and Caribbean Seas. And although designed for inshore 6-foot maximum wave conditions, it has operated foilborne in 16-foot Caribbean waves. Another 15-ton craft called the "Aquastroll" with a 3-foot clearance has operated successfully in 8-10 foot waves of the Baltic Sea. Canada's Defence Research Board's "Massawippi" of eight tons has operated successfully at 55 knots in 6-8 foot waves. Even when these craft must drop back on the hull because of heavy seas, they maintain extremely good speeds and stability because of their foils; the PT20 has done 15 knots in 12-foot Aegean Seas without undue passenger discomfort. Canada's Defence Research Board's 20-ton experimental craft "Bras d'Or" showed at maximum a roll of only six degrees in a 10 to 12 foot seaway.

The foregoing does not lay claim to an overwhelming all-weather capability at foilborne speeds; like any other vehicle the hydrofoil will have its limitations imposed by weather. These, however, will be considerably less than those felt by displacement craft of similar size at high speed. The displacement condition, as has been seen, is a very stable one under nearly all sea states, and comparatively speaking, under a high sea condition hydrofoil craft are superior to displacement vessels in speed and stability. Furthermore, they possess the seakeeping ability of vessels several times their size. As it seems that naval hydrofoil craft would spend most of their life in the displacement state, these seakeeping factors are vitally important. Thus is is heartening to note that the theoretical argument has been fully supported by practical experience.

A ship's endurance requirement for ASW Atlantic operations, as indicated from past experience, is a minimum of 8 to 10 days at an economical speed of about 12 knots. This would give a range in the vicinitiy of 2,500 to 3,000 miles before refuelling. Indications are that much greater ranges are possible with hydrofoil craft of the 100-500 ton range in the displacement mode. Such ranges would be useful for operations which commence large distances off shore. Endurance at maximum foilborne speeds would vary under weather conditions, but would be between 12-24 hours at

either 60 to 45 knots, and at ranges between 600-1,000 miles. Naturally foilborne operation consumes fuel very rapidly, but it is thought that the ratio of high speed usage to slow speed usage in actual operations is likely to be quite low. The amount of replenishment fuel required for distant operations is small enough for any merchantman, tanker, convoy, escort or submarine to supply. It may be seen, then, that hydrofoil craft would have the necessary endurance to carry out Atlantic ASW operations effectively.

Anti-submarine vehicles must of necessity possess superior speed and manoeuvrability over the submarine. It was better than a two to one advantage in the past for ships over submarine. With submarine speeds well in excess of 25 knots, we now need speeds of 50 to 60 knots or more. Ships use helicopters to make up the differences; however in the case of the hydrofoil craft this speed is an inherent capability. Hydrofoil craft by their very design have a power/speed ratio similar to aircraft. Hence, they will be superior to ships and submarines. Very broadly, every unit increase of speed for a ship requires a power increase of only two. This means, all things being equal (they never are) the hydrofoil craft will always outperform the others in speed. Theory and experience indicate that performance of a hydrofoil craft, in acceleration and retardation rates, along with speed and manoeuvrability, should exceed that of a modern high speed submarine by a wide margin.

The effective ASW vehicle should carry fighting equipment that allows the best sonar search and the most accurate direction of attack possible, along with high probability anti-submarine kill weapons. It should also be outfitted with navigation and communication equipments. Anti-personnel weapons would always be necessary and in some cases an anti-aircraft weapon might be fitted.

The ASW hydrofoil would be able to carry a very effective warload that might consist as follows: a searcher type variable depth sonar, a short range attack type sonar, magnetic anomaly detection gear, homing torpedo weapons, radar and navigational equipment, tracking and plotting computors, and anti-personnel weapons. All this ship equipment would be re-engineered to aircraft standards, for the actual warload of hydrofoil craft would have to be kept to between 10 and 15 percent of the overall weight of the craft because of inherent design limitations.

Weight limitations of the warload should not unduly hamper the anti-submarine effectiveness of the craft, for it is assumed that variable depth sonar ranges of a hydrofoil craft would equal that of a destroyer escort (operated only in the displacement condition). However, it would have a slightly smaller weapon outfit that could curtain a sustained kill capability; but even so, this would be greatly superior to that carried by some of today's anti-submarine aircraft.

The future weapon potential of a hydrofoil craft is even more intriguing. If manoeuvrability of the craft is such that it is able to station itself over the submarine at will, then it can literally hold the submarine in its sights and dispense with the homing weapons. Development of a high speed straight trajectory underwater missile does not seem difficult in the light of today's engineering advances. All in all then, it would appear feasible that a 100-500 ton hydrofoil craft would not only match and complement the fighting capabilities of a modern destroyer escort, but would also completely revitalize the use of surface craft in ASW.

General Advantages

There are also certain other general advantages gained from using the hydrofoil as an ASW vehicle. These are cheaper costs and superior capabilities of detection and classification, along with those of localization, tracking and kill.

The main feature of the ASW argument that is likely to have the greatest impact on our NATO leaders is the low costs of hydrofoil craft, relative to conventional vehicles of comparable ASW effectiveness for a given defence expenditure. Considerable experience gained in building commercial hydrofoils enables us to make realistic estimates for the hull and engine costs of the basic operational craft. The cost of equipment and warload can be readily estimated from available sources. This would bring the basic hull costs between two to four millions whilst the equipment would be about another million. The ASW hydrofoil therefore would cost between 3 and 5 millions, as compared with costs of other vehicles. This is indeed modest. An ASW submarine costs about 50 millions and an ASW carrier about 60 millions. A destroyer escort costs 30 millions and a long range maritime aircraft 5 millions. Both ASW helicopters and fixed wing carrier aircraft are about a million dollars each. As can be seen from these figures, then, we can get between six to ten similarly effective ASW vehicles for the cost of one destroyer escort.

Actual operational usage takes between five to eight aircraft; either maritime, carrier borne, or helicopters; to keep one continuously on station. It is apparent that hydrofoil economy will be

vastly superior in similar operations and will be enhanced by refuelling and recrewing at sea. Further operational usage comparison with submarines and destroyer escorts show no great differences, except in use of manpower. The crew of a hydrofoil craft should not number any more than 25, about 1/10 of a destroyer escort. All these cost attributes cannot fail to interest NATO naval planners whose needs are more and cheaper ASW vehicles at no increase in manpower.

Nearly every NATO member has its naval forces committed to saturation in its own areas, yet there is a requirement for some mobile and some standing patrols in other strategic spots. This additional coverage must be met at present by current ASW vehicles whose detection equipment is of comparatively short-range capability as limited by the underwater sound medium. Some of these vast areas requiring coverage might readily use all of the present NATO naval force. It is apparent then there is a need for many more detection platforms of all types.

A hydrofoil craft employing conventional sonar would compare very favourably with the current detection capabilities of a destroyer escort, but up to ten can be built for the cost of one destroyer escort; therefore, up to a tenfold increase in detection capability is possible, notwithstanding likely new gains in area sweep rates over the destroyer escort. This "small and many" concept allows the detection platform relative invulnerability from submarine attacks. On the other hand, it offers swift reprisal to an enemy submarine carrying out an anti-escort policy. It is quite clear, then, an anti-submarine force of many small vehicles of all-round capability is a most desirable addition to the current threat of 500 Russian submarines.

The problem of classification is a very difficult one, and longer sonar ranges will actually increase the difficulties. Speed and detection capabilities of hydrofoil craft allow a swift localization of the target, for a better signal to noise ratio or visual confirmation, and so the "small and many" concept would considerably ease today's classification dilemma.

Interception of a high speed submarine is one of the more difficult tasks ASW forces must face. The destroyer escorts are unsatisfactory because of their slower speeds and the use of helicopters relieves their problem only to a degree for the weather is an unfortunate limiting factor. Because of the general expense of a destroyer escort fitted with helicopters, and the resultant wide deployment, there is often an unsatisfactory time late element. When submarines show their hand by attempting anti-submarine interceptions, they lose their advantage of stealth and silence. Both of these vehicles are attractive and vulnerable targets in material and trained manpower. The destruction of such an expensive vehicle would leave a wide gap, not easily filled on an escort screen or distant barrier patrol.

It would appear that hydrofoil craft have marked advantages over certain other vehicles for interception because of their speed potential and deployment in large numbers. These two factors mean a rapid build-up of point concentration with a relatively small time late factor. The actual process of interception could either be one of self-direction using sonobuoys or by vector from a consort hydrofoil craft.

Tracking a submarine for extended periods is a very hard thing to do either with single anti-submarine vehicles or the full tactical combination of ships, submarines and aircraft. They can be restricted by weather, lack of endurance or limited by insufficient numbers. If we are to retain the upper hand in anti-submarine warfare during this cold war period, we must have the ability to track (or escort) a high speed submarine, at high speeds in all weather for prolonged periods. Furthermore, there must also be the possibility of a high kill probability as required by changes of international climate.

Slow and medium speed submarines can be tracked by an anti-submarine ship and aircraft combination. The hydrofoil craft outfitted with proper sonars can do the same at displacement speeds of below 20 knots and with a reasonably equivalent endurance dependent on weather and tactics. High speed submarines could also be tracked by using either one or two hydrofoil craft. The single craft technique would vary sonar listening periods with maximum speed runs while the team of two would use vector methods.

The value of this "unique" capability as a psychological deterrent is inestimable. If we are to carry out surveillance of certain strategic ocean areas by ship, aircraft and submarine barriers, then a back-up tracking system is essential. Hydrofoil craft give promise of doing this using their speed and deployment in large numbers.

Killing a modern submarine manoeuvring at high speeds is just as difficult as trying to catch a greased pig in an open field. Both problems would be simplified by using area weapons such as nuclear weapons or shot guns. But both are likely

to be outlawed as was use of poison gas. More conventional methods such as ahead-thrown depth charges and homing torpedoes must be used but they both have inherent "time late" inaccuracies. The closer the ASW vehicle gets to the submarine, therefore, the better the chances of kill—for both hunter and hunted! Therefore, effectiveness of kill depends on the ability to (a) gain and hold an effective attack position and (b) carry and use the weapon effectively. Killer submarines cannot very well compete with the hydrofoil craft in the attack role, because of low speeds (minimum noise) and a serious weapon problem, not to mention likely countermeasures. Who would be hunting who, at cavitation speeds or even moderate speeds? Modern destroyer escorts are likely to have just as much difficulty as the submarine and be even more vulnerable. Ship-borne helicopters will help but they are endurance and weather limited. Fixed wing aircraft would rely almost completely on the effectiveness of the weapon's homing abilities as it would have difficulty in maintaining close contact with a submarine.

As seen from the previous discourse, hydrofoil craft promise to surpass ships, submarines and aircraft in maintaining close contact in the most favourable attack position because of their high speed and manoeuvrability. Furthermore, their size and elusiveness presents a difficult and unattractive target for an aggressive submarine. Finally, as mentioned before in the "Fighting equipment" requirement, the hydrofoil craft has a very great potention in being able to "lock on" to a submarine for despatch of armed short range underwater missiles.

Now that the characteristics and capabilities of a hydrofoil craft have been reviewed in reasonable detail, a brief examination of operational roles is in order. Possibly these actual requirements will serve to demonstrate even more clearly the unique capabilities of the craft.

Ocean area defence systems are likely to be resolved into two broad categories; forward area surveillance networks or barriers, and off-shore systems. Both systems would consist of some kind of detection barrier backed up by a vehicle system able to classify, track, or kill. Current vehicles would very much limit the extent of these operations because of poor density, but as hydrofoil craft costs are much less, more extensive and effective barriers could be specified. Better detection, tracking, and kill would also be obtained by the injection of a few hydrofoil squadrons into the systems. It is likely, too, that improved usage in the matter of aircraft area coverage would make the tactical combinations of all four vehicles a much more effective anti-submarine force. We would then have several more barrier combinations in addition to the present stand-bys: submarines and aircraft, destroyers and helicopters. Hydrofoil craft and destroyers or hydrofoil craft and submarines with an air search would be ideal. Obviously successful forward systems greatly reduce the effort in the rear off-shore areas and effectively add time to our side. So we should consider them accordingly.

Off-shore areas present a problem of identification of innumerable targets of both surface and otherwise. There is, of course, long range aircraft coverage, but it is an impossibility for aircraft to keep track of a fishing fleet or identify the traffic, in focal areas of the Atlantic. Fog conditions only add to the misery of the airborne watch dog. Conventional ships with helicopters could be very useful but they are not available in numbers nor do they have the specific abilities of all-weather localization and kill without a large time late penalty. This is another obvious place for hydrofoil craft, in surveillance, where it could be used as a slow speed, stable platform in rough seas and yet become a high speed localizer as required. Once interception had been achieved, the submarine could be attacked at any time in the tracking period.

Local defence of small areas of tactical importance may be required and, consequently, by use of hydrofoil craft, a much greater area could be swept at no greater cost and with all the advantages of a "small and many" concept.

Convoy operations have been radically affected by high speed submarines that can attack directly or fire a stand-off weapon (possibly nuclear). So readjustments in escort screens have had to be made to cater for all round submarine attacks and expanded convoy ship spacing. Thus extremely high escort force requirements have been necessary in the face of the generally accepted fact that present-day escort vessels will not be available in sufficient numbers. Hydrofoil craft seem very promising for the convoy escort role because of their availability in numbers at low cost and other previously mentioned advantages in detection, localization, kill and invulnerability. Replenishment from the convoy would be a simple matter and there would be no need of economy in the high speed usage. Submarine commanders would think twice if they knew how quickly a gap in the convoy screen might be filled or yet how

quickly and forcefully retribution might be accorded them if they closed to attack. Fleet screening problems although much more exacting than convoys, are basically of the same character. The necessary precision anti-submarine coverage could more than be fulfilled by hydrofoil craft and for much less expense.

Beyond these main roles, many sub-roles present themselves, all utilizing the three main attributes of hydrofoil craft, manoeuvrability, high detection-kill probability and low cost. Barriers could be rapidly reinforced in the face of a mass penetration of submarines. A coast guard role in the face of international stress would be easily and effectively filled. The craft could do most things a destroyer-plus a helicopter could do and many tasks that several aircraft would be needed for. It seems then perhaps the main role of hydrofoil craft is one of complementing our present forces by extending the capabilities of our current vehicles in all directions and dimensions.

It is obvious there are many other specialized naval roles in which hydrofoil craft might effectively be used. However, this is another chapter that will follow our more immediate requirements of anti-submarine warfare.

FEASIBILITY

The question arises that if the hydrofoil craft is such a low cost effective anti-submarine vehicle, why do NATO powers not have it in full production now? Is it feasible?

The means exists for estimating costs quite accurately and also NATO basic research and development resources, along with those of the aeronautical industry, stand ready for orders. Engineering and design studies leading to final operational production are certainly within our scientific knowledge and technological capabilities. Power plants suitable for this operation are now "shelf items". The tremendous hull stresses that would be encountered can be adequately designed for, and new high stress metals make the problem of a routine nature. The reluctance to produce this craft is certainly not due to inadequate technology in the field, it is an entirely feasible proposition in this respect.

Perhaps other developments have overshadowed the hydrofoil craft. One might ask, "What about this 'Hovercraft' vehicle?" Presumably it can move at high speeds over water and float when required. There are three reasons why there is no redundancy or competition from this craft at present. Firstly, it is still in the early experimental stage. Secondly, its designers envisage large sizes of 1,000 tons or more and thus they are unlikely to obtain the wave clearance for "all-weather" operations. Lastly, and probably most important, the high cost of this craft will likely place it outside the "small and many" concept. No doubt as time progresses, however, the "Hovercraft" too will take its place as a "complementary" vehicle in the anti-submarine warfare requirement but this appears to be some years away.

CONCLUSIONS

It is therefore concluded that the new priority being placed on the economic struggle in the world's underdeveloped areas has re-emphasized the exigency of Freedom of the Seas. NATO must be fully prepared to control these seas should they be threatened by the Red submarine fleets.

Hydrofoil craft of all-weather and long-endurance capability would be highly effective in detection, localization, tracking and kill of high speed submarines. Furthermore their relatively low cost in material and manpower would allow a high density anti-submarine deployment in strategic areas heretofore not thought possible. Finally, hydrofoil craft can offer more anti-submarine capability per defence dollar than any other vehicle. Thus, these craft are economically desirable, technically feasible, and operationally necessary. Can NATO afford to ignore them?

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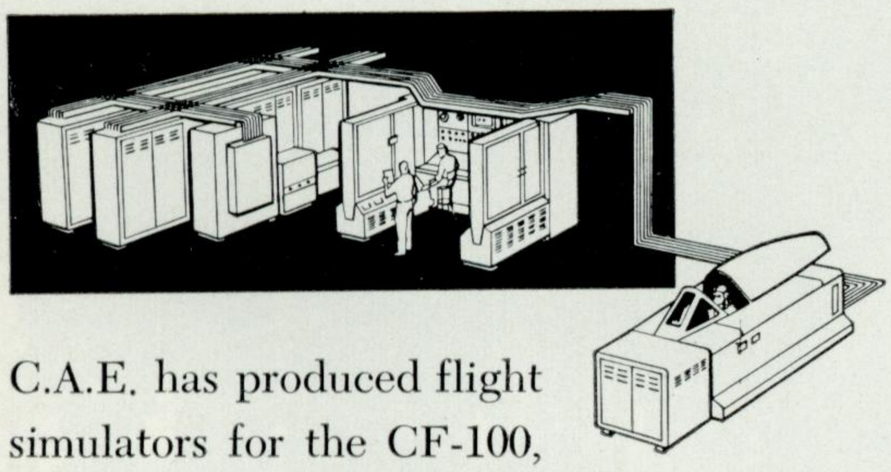

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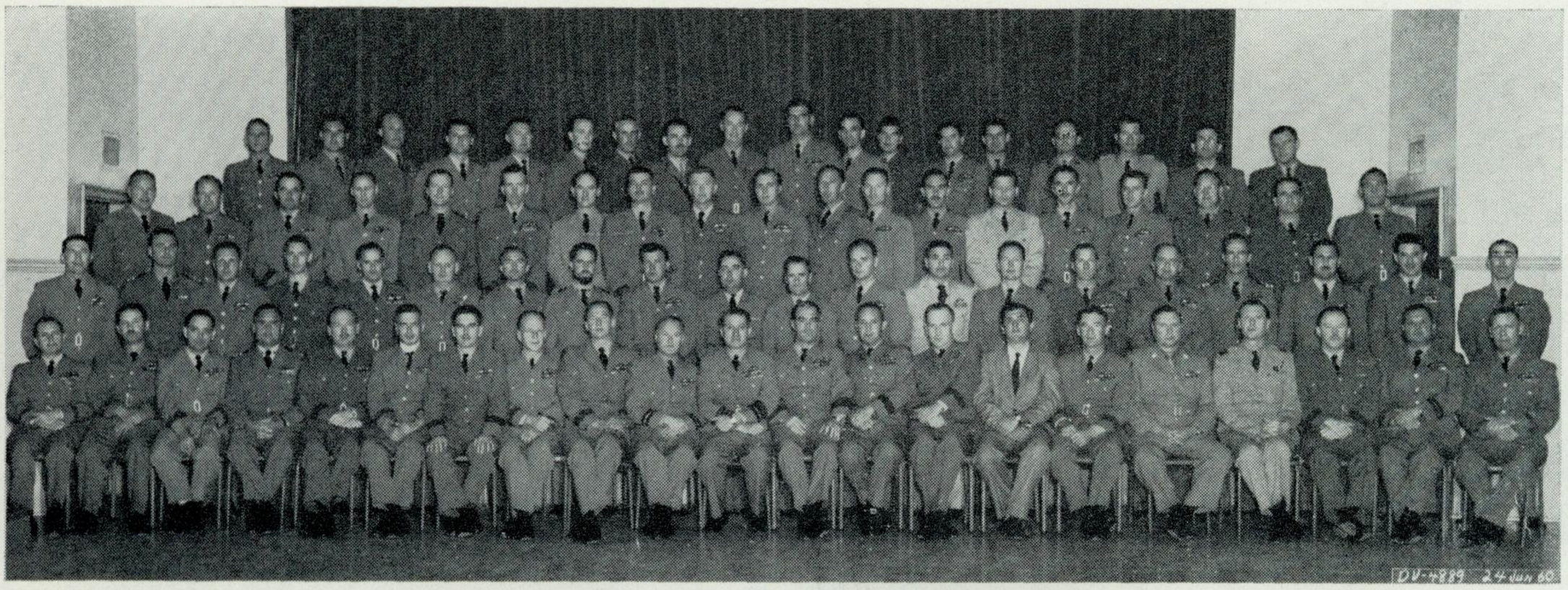

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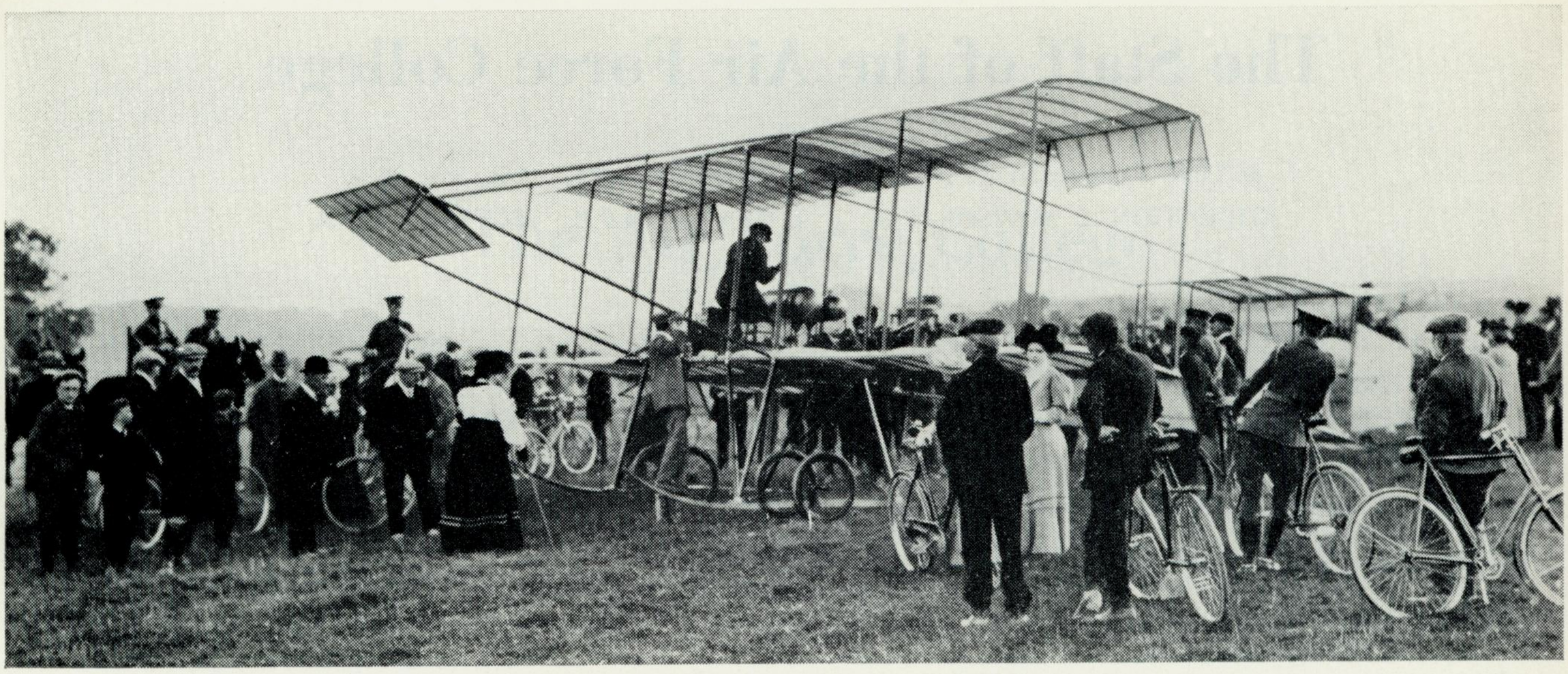

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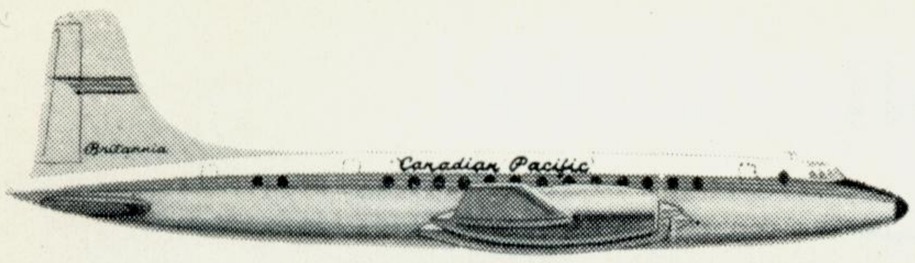

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Book Reviews

STRATEGY IN THE MISSILE AGE

By Bernard Brodie (423p., Princeton University Press, Princeton, N.J., $8.50)

Reviewed by the late AIR VICE-MARSHAL K. L. B. HODSON

IT used to be said repeatedly at the R.C.A.F. Staff College that the more that could be written and argued about the day's politico-military problems, the more chance there would be for the development of rational solutions to the seemingly hopeless dilemmas posed by the advent of fusion weapons and advanced means of delivery. In similar vein, Dr. Brodie begins his "Strategy in the Missile Age" by deploring the lack of intellectual concern in the U.S. for the interrelationship of political and military problems. Civilian officials and politicians don't know enough about the highly specialized military profession. Security denies them necessary information. On the other hand, the senior officer has been traditionally more concerned with tactics than with strategy. These shortcomings have prevented an informed team approach to these all important problems.

While such an unfortunate situation has undoubtedly existed in the past, at least three trends are working towards an improvement. Staff colleges have liberalized their teachings since World War II. Purely service colleges have widened their perspectives to include broad strategic subjects, relationships of the services to their governments, as well as a good deal of attention to scientific and technical developments. At the higher National Defence College level, senior government officials as well as outstanding executives from the business world join with service students in studying economic and political trends and their effects on military problems in the broad sense. In the departments of defence, the last few years have seen the scientists and operational analysts making a much broader contribution to decisions governing the choice of weapons systems by bringing an objective common-sense approach to military problems. This is helping to coordinate the military and civilian viewpoints. Equally important is the contribution to understanding made by eminent authors writing in this field. In this capacity, Dr. Brodie has served well. His latest book, "Strategy in the Missile Age" is a masterful clarification of the political and military issues that confront today's world.

The book is divided into two parts. The first prepares the ground for the arguments to be developed in the second half. At the same time, these opening chapters give an excellent dissertation on some subjects of more immediate interest to staff colleges.

The principles of war have emerged as an essential part of military education. But how valid are they today, what does one do with them, and how does one teach them? The R.C.A.F. Staff College has settled for the lecture approach to enumerate and cite examples of the principles in order to stimulate the usual discussion as to where such principles fit in the military scheme of things. Dr. Brodie's expressed dissatisfaction with the traditional treatment of these principles probably crystallizes the unexplained uneasiness staff college instructors have often felt during this phase of the course. The principles have become bare slogans. They have succumbed to the modern trend to put knowledge in capsule form; to explain past failures or successes in terms of poorly understood catch-phrases. In effect, to be of value, this is a subject which should be exhaustively explored, the original meanings carefully studied and the application of these principles analyzed in relation to the detailed action of military campaigns. Only in this way will it finally be appreciated that while the principles themselves may be immutable, their application depends entirely on the circumstances which pertain. Since these are different for each situation, action cannot be guided by stereotyped rules but must depend, if success is to be gained, on the careful weighing of these circumstances of factors and on the ultimate exercising of judgment. Since staff colleges do not have sufficient time to afford

this kind of treatment, the teaching of principles of war must perforce remain somewhat sterile and unsatisfactory.

Another chapter which will be of intense interest to staff colleges is the author's assessment of the effects of strategic bombing in the Second World War. In spite of efforts to encourage free thinking, service staff colleges have never really succeeded in being objective. Each has probed deeply into the histories of past wars to collect and put together evidence to support the hobby-horse of that particular Service. It is useful therefore to have this objective analysis of the results of bombing both Germany and Japan, based on the reports of the U.S. and British survey teams and interpreted with no more ulterior motive in mind than to provide understanding. Such objectivity will perhaps be more palatable to the Services now that the advent of nuclear weapons virtually eliminates World War II bombing experience as a basis for present needs. It is with a description of the magnified destructive powers of nuclear weapons that part two of this important book is introduced.

Attractive features of this book are the well-turned expressions and the touches of whimsical humour that alleviate the dead seriousness of the subject matter. His clear style makes Dr. Brodie eminently easy to follow as in this second half he unfolds methodically his analysis of East-West power relations and of strategy as seen by the West.

Deterrence has been the keynote of Western strategy for the past decade. While deterrence is a relative term, it is normally used to denote a capability somewhat less than that required to win a war. Deterrence is the manifest ability to inflict sufficient damage on the enemy to make him believe that to launch an attack would not be worth the price. If the attack were made, the deterrent capability would not necessarily be adequate to insure survival. And in an all-out nuclear war, survival of one side or the other would appear to be about all that could be looked for by way of so-called winning.

The fact that both sides have a deterrent and consequently neither side will rationally commit itself to a nuclear war is a well-known situation often pictured by such analogies as the two scorpions in the now-famous bottle. But Dr. Brodie points out that this situation is much too easily accepted without a proper understanding of the real danger to the West. Nuclear weapons confer what could be an overwhelming advantage to the side which is willing to strike first. The difficulties which befall the strike-second or retaliating nation

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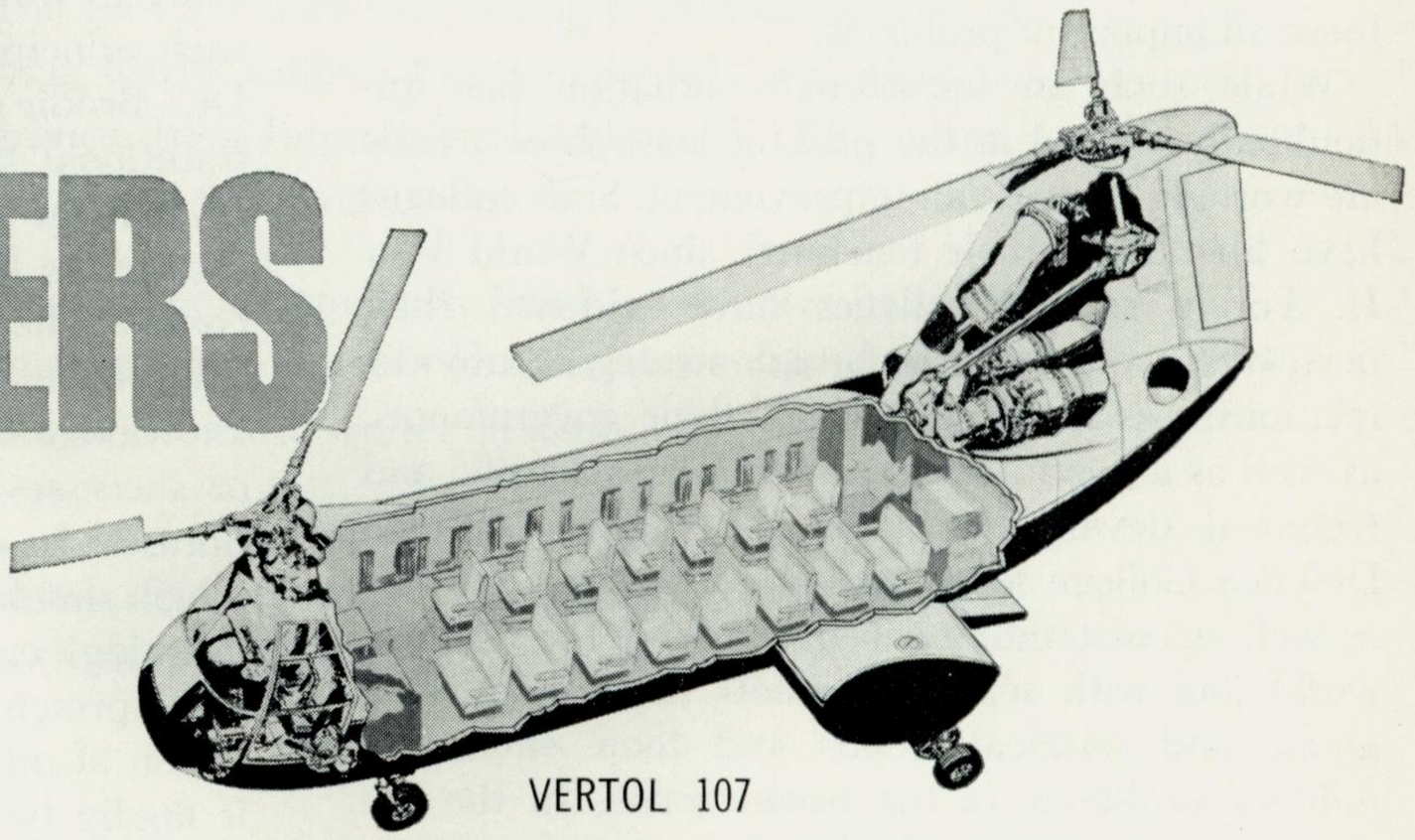

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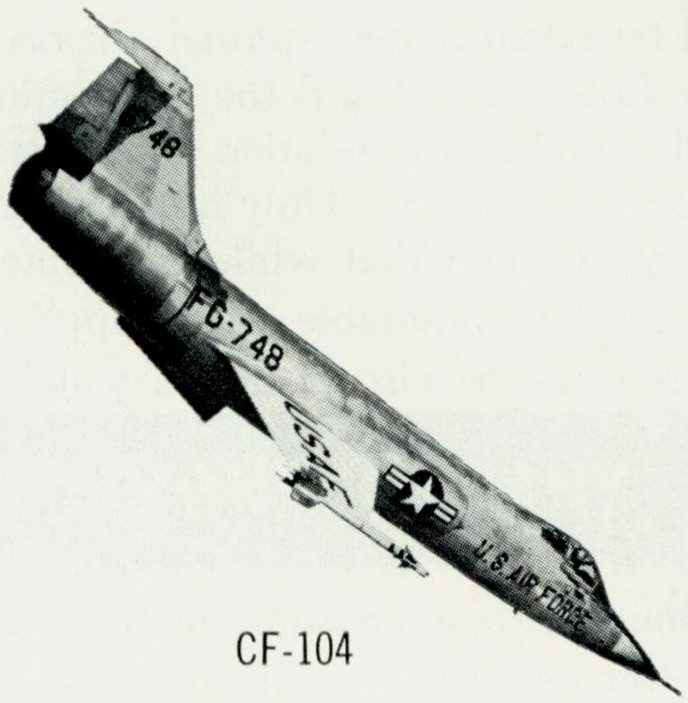

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are apparent in terms of the need for unequivocal warning, a rapid decision-making process and, most important, a high degree of security for the retaliatory force. Since the U.S. is not likely to strike first, then there is a clear requirement to develop and protect a deterrent capacity against a nation which holds the initiative. The difficulties of this situation are manifold and must be overcome.

There inevitably exists the doubt as to whether a nation whose deterrent capacity is not of such magnitude as to be capable of fighting a war is really geared mentally and physically to use the deterrent. If the doubt persists in the enemy's mind, then the power of the deterrent decreases. Whether or not the deterrent is subsequently used is not the point, since to be called into use is, by definition, to fail. Therefore, it is extremely important for the U.S. to give creditability to its deterrent. Strong civil defence measures would add a degree of such creditability.

The case for civil defence appears to be gaining strength. There was a period when such measures were thought to be of no use. The results of an all-out nuclear war would be so devastating, so far-reaching, so horrible as to give no hope of survival. If a slim chance of escaping obliteration could be discerned, the usual comeback was that no one would want to live in those conditions anyway. Dr. Brodie argues that the problem is not hopeless, that civil defence shelters offer a good return for the monies expended. In other than areas which are close to the impact point of nuclear weapons, the all-pervading danger is from fall-out. Shelters can effectively combat this threat. Shelters make sense in rural areas where a substantial portion of the U.S. population lives. Survival of a part of this rural population might be synonymous with national survival. Even those who claim that shelters in the cities would be of no use are prejudging the issue. There are a number of varieties that the opening moves in a nuclear conflict might take. Striking at the U.S. retaliatory force with no effort against cities might be one such opening gambit, in which case there would be time to occupy city shelters. In fact, strong civil defence measures would permit advantage to be taken of any unexpected course that the war might follow, either because an enemy seeks an advantage in using blackmail threats or because his luck has been perverse. In any event, strong passive defence measures show a firm resolution to stand fast, to fight if necessary and thus to strengthen the effectiveness of the deterrent.

While allowing that the enemy must never be given a free ride, Dr. Brodie does not seem to feel that active defences are a practicality. He indicates that contrary to public belief, the problem of defence against the manned bomber has not been completely solved. The advent of the ICBM has added immeasurably to the difficulties of the defence. Moreover, an attempt to provide a defence against the missile would draw attention to the need to improve defences against the bomber. The author goes no farther with this, leaving the reader to wonder whether the technical problems are indeed beyond solution or whether Dr. Brodie feels that in view of his realistic assessment of the present budgetary restrictions, sufficient funds cannot be brought to bear at this particular time to force results.

However that may be, the facts of the stalemate suggest to this reviewer that one way of upsetting the equilibrium is for one side to develop a defence. A defence possessed by the U.S. even though far from complete would inject another element of doubt into the present equation, and thus strengthen the deterrent. An effective defence would break up the stalemate completely. If such a defence were developed first by the Soviet, the results would be catastrophic for the West. The stakes are so high as to compel major efforts to be directed to the rediscovery of defensive means. It could be argued further that a defence having even a small degree of effectiveness against ballistic missiles should be implemented in order to keep the problem clearly in sight, and to maintain the defense organization and the trained personnel so that better systems could be introduced quickly and without hiatus.

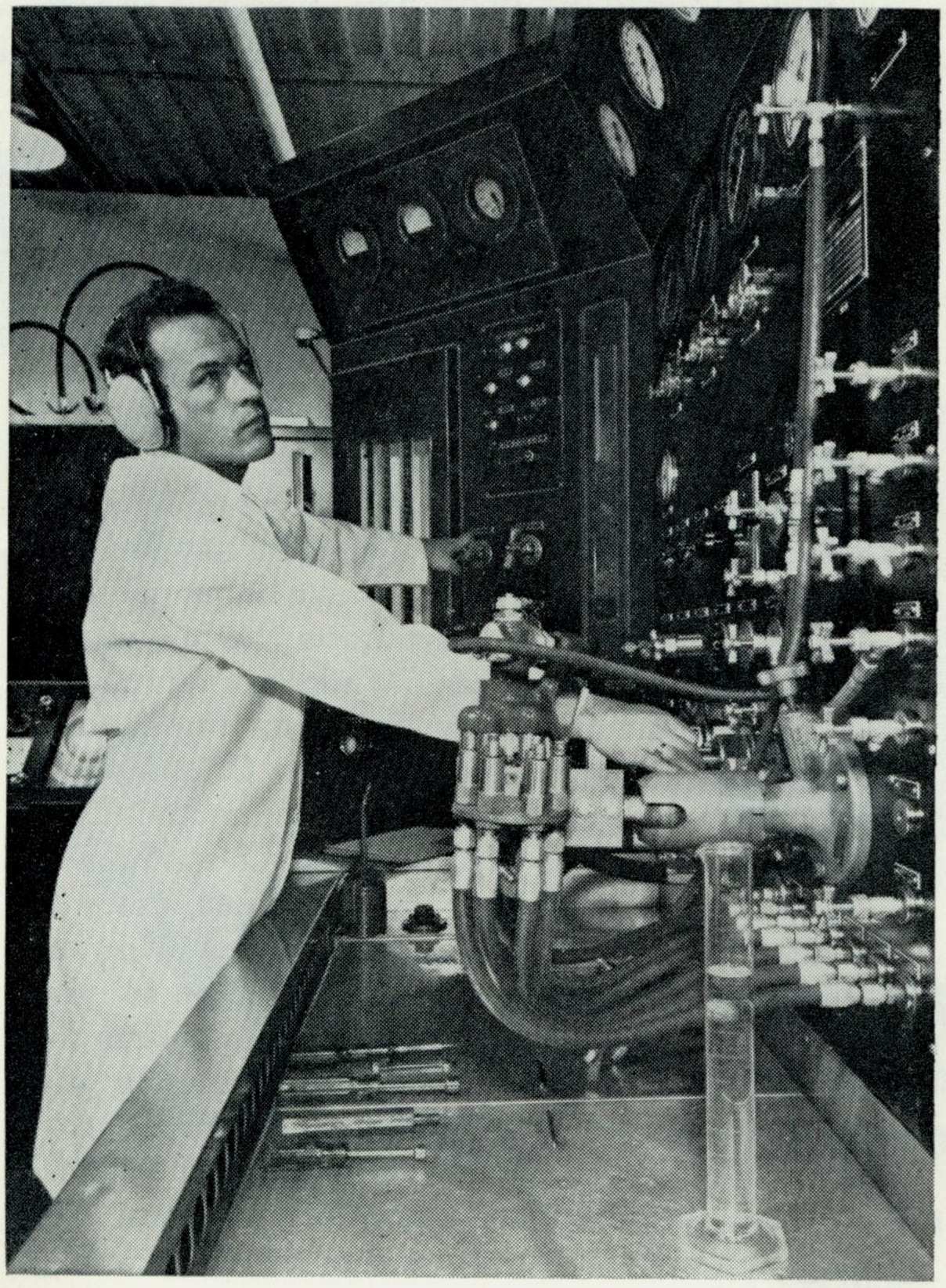
The inexorable manner in which Dr. Brodie's logical outline reveals the magnitude of the West's problems and the precariousness of the West's position might lead the reader to argue that the West should strike first or at least be prepared to attack if there is solid indication that an enemy has aggressive intentions. While not dismissing completely the possibility that some quite extraordinary situation might cause the U.S. to strike first, Dr. Brodie examines the difficulties and hence the unlikelihood of such a course of events. We know enough about the ways of a democracy to realize that the moral issues can never really be dismissed. Furthermore, those who argue for preventive or pre-emptive war are overlooking the difference between an academic discussion and being in the very real position of the chief executive who must accept the full weight of national criticism, world opinion and future judgment. The arguments offered by the author should go a long

way towards squelching irresponsible talk on this subject.

Again, the difficulties of keeping up with the stalemate situation and the horror inherent in total war, lead to another means of exerting pressure—the limited war. Here, Dr. Brodie takes to task some prevailing opinions which he feels have been arrived at with insufficient study. Are nuclear weapons used in a limited war really capable of offsetting a numerical advantage? Can a limited war in which nuclear weapons are used be kept limited? To be equipped to fight a nuclear war even on a small scale, requires forces to be organized in a manner which would handicap them unacceptably if they were to be ordered to fight without nuclear weapons. While the concept of relying on the Strategic Air Command to handle a local fight anywhere in the world is attractive because it is relatively cheap, nevertheless, it is not necessarily sound. The difficulties of maintaining the deterrent are such as to suggest that SAC should be permitted to keep full attention devoted to the primary mission. The author concludes that separate forces should be provided to cope with limited wars and that these forces should be prepared to fight without nuclear weapons. In this way, some of the restraints on legitimate U.S. intervention in peripheral wars would be removed.

Thus, at least three deficiencies in the present U.S. posture are brought forth; protection of the retaliatory force, civil passive defence measures and specialized forces to fight limited wars. While the author leads us to believe that a reasonable effort along the three lines mentioned would go a long way towards improving the degree of security, he hastens to point out that complete security for the U.S. is a thing of the past. It then becomes a matter of judgment as to what degree of security the nation is able and willing to afford. His chapter entitled "Strategy Wears a Dollar Sign" underlines just how difficult is the exercise of that judgment.

"Strategy in the Missile Age" deserves to be widely read. The subject is timely. The issues are of paramount importance. The clarity and objectivity of Dr. Brodie's treatment will promote understanding of these issues. Understanding on a broad scale is a prerequisite to improving our position.



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DETERRENT OR DEFENSE

By B. H. Liddell Hart (257p., Frederick A. Praeger, New York, 1960, $4.95)

Reviewed by PROFESSOR J. I. JACKSON

THE WRITINGS of Captain Liddell Hart have earned an important place in the catalogue of military thinking. This wise and durable authority has now published, in *Deterrent or Defense*, a collection of his ideas on the contemporary situation which have for the most part appeared previously as separate studies.

Deterrent or Defense, which carries the subtitle "A Fresh Look at the West's Military Position", seeks a military posture for the West which will deter aggression without posing the danger of suicide by nuclear strike and nuclear retaliation. Now that Russia possesses powerful nuclear forces, in Liddel Hart's view, the Great Deterrent is a protection only against total-war nuclear attack. He doubts that the West's strategic nuclear power can deter lesser forms of aggression, or even a sizeable onslaught with conventionally-armed forces, because its use would precipitate retaliation on a scale the West could hardly survive. Any Western superiority in number of nuclear weapons is not necessarily significant, because the Western countries as compared to Russia are more densely populated and more vulnerable. "Now that New York and Chicago are within range of bombardment by Russian rockets," he writes, ". . . would not the Americans hesitate to unleash their strategic air forces in reply to Russian aggression in Europe or Asia?" His conclusion is that there is a need for "a better kind of deterrent", which can deter by being able to defend against attacks of less than all-out proportions.

All this is of course not particularly new. The inadequacy of the Great Deterrent has been the subject of much discussion ever since it came into being. However Liddell Hart's solution to the strategic dilemma of "Suicide or Surrender" is worth careful study. He bases his solution on two interesting postulates; the effectiveness of amphibious forces, and the ability of conventionally armed land forces to withstand superior numbers in attack. Disciples of the newer schools of strategy may recoil from such apparently antedeluvian ideas with a horror concealed only imperfectly by the deference due their eminent source. But Liddell Hart is a realist, and unlike some of his contemporaries he does not wish nuclear weapons out of existence as a prelude to reinvoking a conventionally armed Utopia.

He accepts the existence of nuclear weapons, and sees the maintenance of the strategic nuclear deterrent as the prime military task. However he believes the West's recourse to this strategic deterrent and to tactical nuclear weapons as the only answer to Russian numerical superiority to be a misguided result of obsolete strategic and tactical thinking. Thus the idea of *fighting* a third world total war becomes nonsensical, and thus also preparations and stockpiling for such a war are completely wasteful. The idea of *winning* a war is no less fallacious, because an extension of aims beyond purely limited objectives can only lead to suicidal total war. Thus the building of armaments to win a long war, which must call for far more weapons than those required simply to deter war, is also hopelessly wasteful.

Nor are tactical nuclear weapons either a necessity or an unequivocal boon to NATO's outnumbered armies. Atomic weapons give a greater killing and destructive effect for less guns, ammunition, and logistics tail; the precision of small-yield atomic weapons makes possible their use without laying waste to a defender's homeland. However atomic guns or missiles are fairly easy to locate and destroy, and if only a few exist the loss of a small number will have a proportionately great effect. Larger yield atomic weapons are of little use once an enemy has penetrated a defended area and mingled with defending forces; in this situation small-yield devices could be used against targets as small as a platoon, except that the wholesale use of small-yield devices poses an

economic problem because they use fissile material in the most inefficient way. Furthermore, the advantages of atomic weapons would only be realized if armies discarded their bulk of conventional weapons, which would leave them incapable of producing effective firepower in any situation that did not call for atomic action.

Apart from these rather specific objections, the general view that tactical atomic weapons favour the defence is also open to question. The presence of atomic weapons makes concentration for attack impossible, but it also makes imperative the dispersal of the defence, and with this dispersal, offensive concentration is not necessary. Liddell Hart concludes provocatively that the presence of atomic weapons reduces the importance of quantitative superiority but increases the importance of the qualitative advantage of superior tactical skill. This advantage, which may enable an attacker to break through without numerical advantage, is a strong argument for professional armies. His final objection to tactical atomic weapons is that the atomic battlefield will almost inevitably ignite total nuclear war.

Having by his logic demolished the present NATO concept of shield and sword forces, the value of conscript armies, and the worth of the NATO nuclear posture, Liddell Hart offers his own defensive deterrent to the kind of limited aggression which nuclear forces are likely to find so perplexing.

His solution is based on an analysis first of the effectiveness of thoroughly trained and self-contained amphibious forces. He attributes to a non-specialized approach the difficulties encountered in the World War I landings at Antwerp and Gallipoli and in the World War II landings in Africa, Sicily, Salerno, and Anzio. Contrasting these marginal successes with the highly successful landings carried out throughout the Pacific campaign, he concludes that landings can succeed if executed by "a strong amphibious force embodying all the different arms and elements required for effective attacking power, and capable of carrying out a large scale landing operation." The model for such a force already exists in the United States Marine Corps, and upon this model amphibious "fire-extinguisher" forces should be built which could move quickly and powerfully into action around the periphery of continental Europe or the Erasian land mass.

Such amphibious forces, in Liddell Hart's view, would be preferable to airborne forces because the speed of strategic movement and effect on arrival of the latter may be severely restricted by the scarcity of suitable or usable en route and terminal airfields, and by air transport's inability to carry heavy equipment.

Captain Liddell Hart's second analysis is of the ratio of forces to space required for offensive and defensive land operations. This is a study of historical trends, and from it emerges the conclusion that a basic trend in land warfare over the past century is a growing material ascendency of defence over offence, and a diminishing ratio of force to space needed to hold a front. Applying this conclusion to the problem of defending central Europe, Liddell Hart reaches the somewhat unorthodox figure of thirteen divisions as sufficient to hold — with conventional weapons — a sudden Soviet attack by the twenty divisions now in Eastern Germany. The forty divisions which the Soviets might deploy in ten days would be held by twenty-six divisions, which could be reduced to twenty divisions if there were a German militia of ten divisions organized for static or locally mobile defence. Even if after a month of logistics preparation the Soviet force were built to the estimated possible sixty divisions, a NATO force of forty divisions should be able to hold, and hold using only conventional weapons.

Such defensive success could be achieved only by using highly trained and fully mobile forces deployed so that a high proportion of reserves were held back to be launched only when the enemy's main thrusts were revealed, and using tactics thoroughly suited to the modern battlefield.

Arguments of this kind from an authority of Liddell Hart's stature are not to be taken lightly. If valid, his analysis of the consequences of nuclear weapons on the battlefield casts grave doubt on some of the basic assumptions of Western strategy. However it is difficult to pass over the fact that in his argument the implications of air power are almost completely ignored. This produces a narrowness to the argument which damages the final conclusions. The idea of operating amphibious task forces on the European flanks, or for that matter around the whole periphery of Soviet influence, cannot be accepted without a very thorough enquiry into the vulnerability of such forces to air attack — even non-nuclear air attack. The idea of fighting with non-nuclear weapons in Europe is also difficult to accept without recognition of air power. Distances in Europe

are short, modern aircraft speeds are high, and radar cannot identify the kind of bomb-load an aircraft is carrying. The side which hesitated to launch nuclear weapons when its radar screens showed intense air activity — even random activity or that apparently associated with only the battle-field — might find within minutes that the enemy had got in the first nuclear blow. And the first blow is the one that counts.

These qualifications aside, *Deterrent or Defence* is a stimulating and informative book. It illustrates an analytical approach to military activity which is seen too seldom. It deserves to be studied.

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AN APPROACH TO SANITY

By Field Marshal The Viscount Montgomery of Alamein, K.G.

(94p., Nelson, Foster & Scott Ltd., Toronto, $2.00)

Reviewed by DR. MARCUS LONG

MONTGOMERY of Alamein was a master of the art of war. It does not follow that he is also a master of the art of peace, of the techniques needed to settle political differences on an international scale. The key to success in the one field may well block success in the other.

In battle the commander must cut through the complex to the simple for swift decision and action. In the field of human affairs, including the political, it may be taken as a truism that simple answers to complicated problems are nearly always wrong. The Field Marshal, it must be pointed out to his credit, has noted this difference[1] and, to his discredit, completely ignored it. If the issues were as simple and the solutions as easy as this treatise suggests we could start almost immediately on the preparations for banquets celebrating the end of our major troubles.

"My training as a soldier has taught me that when you are confronted with a very difficult and very complicated situation, which is bedevilled by a vast number of inter-related factors, very clear thinking is needed—and you must aim at simplicity, and cut out all the unimportant trivialities.

"You must seek for the *one factor* on which ultimate success or failure will depend . . .

"In the conflict between East and West, *that one factor is Germany.*"[2]

This is simplicity indeed. No one doubts the importance of the German question and its inherent dangers, nor the importance of trying to reach some adequate settlement. But surely no one conversant with the international situation and aware of the motives of our contemporary communist dictators seriously considers that "ultimate success or failure" depends on this single question. If the German question were settled tomorrow new occasions for trouble would be found elsewhere. Germany is the symptom of a disorder and not its root. That is why we are not too surprised to find Montgomery, who has located the one single important factor in Germany, advising us in another place that "NATO Europe is now the area where the military danger is least. The real dangers now lie elsewhere—notably in Asia and Africa."[3]

No one can question the motives of the Field Marshal. He wants an end to war, particularly the sort of war now possible. He has taken part in the two major wars of our century, wars which he suggests could have been prevented by political action, and cannot rid his mind of the terrible fact that these two wars brought death to 60 million people. He wants to secure peace for our children.

Many of his prescriptions, increased contact between the peoples of the two blocs, increased trade, attempts at partial agreements etc. deserve serious consideration. Largely, I suspect, because they were the creation of others. It is when Montgomery tries to be original that trouble begins.

"We now come to the 64,000 dollar question;" (*I must interpret this as another example of the 'one factor' about which thinking is most important.*)

"Is it possible, given time, that the Russians can become part of Christendom?"[4]

He argues that this is, indeed, highly possible which, if accomplished, would enable us to "hand over a peaceful world to our children's children."[5]

This statement is so absurd it merits little attention. I am not quite sure what is meant by "Christendom". In at least one sense of the word the Russians are a part of Christendom, for instance if we agree with Toynbee and others that Marxism is but a Christian heresy. Even if they are outside and can be brought back in I fail to see how this can guarantee anything in particular to our grandchildren. The assumption that if men believe in God they will act like gentlemen in international affairs has little warrant in fact, it seems to me that Italy and Germany were part of Christendom in the heyday of Mussolini and Hitler and that Spain and Cuba are today. But even if it did

make all the difference suggested by the author it still leaves China outside the fold and I, for one, will feel uneasy about future peace so long as China continues its present policies. If the peace of the world depends on bringing China within Christendom I tremble for the future, for "our children's children".

This same simple approach to basic problems appears in the account of his interview with Khruschev. Here, reverting to the view that Berlin is crucial, he suggested that we "get the United Nations Organisation 'in' on the Berlin problem. The aim would be to produce a sound United Nations plan for West Berlin, with definite United Nations guarantees, acceptable to both sides."[6] The proposal is so stunningly simple it is little wonder Khruschev agreed;[7] it has enough loopholes to win ready assent from anyone. Precisely what is meant by a "sound" U.N. plan and what meaning can be attached to United Nations guarantees in an area where the Soviet Union believes its own interests to be involved. I cannot envisage a moment in the foreseeable future when a power that has steadfastly refused U.N. intervention in any of its problems, for instance Hungary, will agree to leave the interests of the West in Berlin unchallenged in order to support the United Nations. Such co-operation would indeed introduce a new day of hope; it would also be in striking contrast with the forms of co-operation the Soviet Union has given to the United Nations in the Congo. I think in particular of the tongue-lashing given the Secretary-General by the Soviet representative for implementing a plan of action for which this same representative had voted only a few days earlier.

This same simple approach to problems dogs his interviews with Khruschev, Mao Tse-tung and others. He appears to read into their characters and motives precisely what he wants to find there and makes this reading a basis for many of his proposals. In all cases he was favourably impressed by the personal abilities of the dictators and thoroughly convinced that they are so engrossed with their domestic problems they have no desire for war. (That, incidentally, would seem to throw the blame for international tension on our side, a point Montgomery comes close to making when he urges us to stop publicizing our weapons.[8])

Dictators are not a new species; they have been with us since the beginning of organized society. Even the Athenians, a compact, illustrious and independent people, had their share of them. Many of these men had high ability and a genuine desire to promote the interests of their own people. None of these qualities conflict with the classic formulas for dictators of Machiavelli or Hobbes. Nor is there any clash between these personal qualities and interests and what could be considered highly immoral actions towards their enemies. In the league of dictators, if we may borrow a phrase from baseball, the aim is to win and nice guys seldom do. But if posing as a nice guy will help, that is all to the good.

Surely Montgomery has not forgotten Stalin so soon nor the kindly estimates of his intelligence and motives made by eminent politicians, particularly Roosevelt. Indeed I know he has not, since he attributes the fatal political decisions, which have since made Germany such a crucial factor, to the naive belief that the settlement of political boundaries could be postponed until the end of the war. Stalin smiled and smiled as he proceeded doggedly to his goal of ensuring the Soviet Union of a firm control of all of Eastern Europe.

It is never safe to take a dictator at his face-value, particularly if that dictator is the prisoner of an ideology and an ideological machine. Under those circumstances it is better to err, if error is necessary, on the side of seasoned reporters like Frederick Nossal who began his estimate of the Chinese situation for the *Globe and Mail* with the chilling words: "The fanatics who rule China today have embarked on a crusade to convert the world to communism *even if it means global war.*"[9] So long as they adopt that sort of attitude we must make sure that our guard is always up and that we are alert to treachery while doing everything possible to find some means of establishing more workable relations and averting war; we must pay more attention to their actions than their words, a lesson India learned painfully.

Dogmatists, whether philosophic, religious or political, are usually single-minded about goals and morally indifferent to means. That is one clear lesson of history. There is no reason to assume that they have changed. After Montgomery wrote his kindly views of Khruschev (in this book) and of Mao Tse-tung (in the popular press) the Chinese leaders strangled Tibet and Khruschev sabotaged the Summit Conference.

It may seem strange, at the end of a critical review, to suggest that I agree with many of the proposals offered by Field Marshal Montgomery. It seems like good sense to recognize the Communist government of China as the only adequate representative of the Chinese people in the United Nations, to avoid as far as possible and by any means that do not involve a retreat from funda-

mental principles by the West any actions that might produce a war, to negotiate in good faith, accept minor agreements where major ones are not possible and to seek every desirable means of increasing understanding and removing causes for fear and suspicion. These seem to be expressions of common sense and do not, I believe, conflict in any way with my attack on Montgomery's simplified estimates of the personnel involved, the problems confronting us and the prospects for the future. It would be dangerous, I feel, for us to take such estimates seriously as a basis from which to work for whatever sort of co-existence we can obtain. If taken seriously they would affect, for the worse, the nature of our policy.

Montgomery of Alamein was a master of war; it does not follow that he is a master of the art of peace. This might have been gathered from the familiar logical fallacy, *Ad Vericundiam;* it is amply demonstrated by his writings. After reading this book I am more than ever sold on the idea of leaving the conduct of war to the generals and the treatment of political questions to the politicians and the political experts.

[1] p.81 ff.
[2] p.85 (Italics mine).
[3] p.75.
[4] p.39.
[5] p.41.
[6] p.30.
[7] p.31.
[8] p.39. "We cease to hurl threats of destruction at the Eastern bloc. We must cease to be boastful of our nuclear strength and what we can do with it."
[9] *Challenge From the East* by Frederick Nossal. (Reprinted in booklet form by the *Globe and Mail*, Toronto.) (Italics mine.)

NATO IN THE 1960's

By Alastair Buchan (131p., Wedenfeld & Nicolson, London, 12s6d)

Reviewed by JOHN GELLNER

NOT many people on this side of the Iron Curtain would quarrel with the basic concept of NATO. Probably just as few are satisfied with the actual performance of the alliance in the eleven years of its existence. On the political plane, a serious attempt has at least been made to improve the organization and to streamline procedures: the "Three Wise Men" (Lange of Norway, De Martino of Italy, Pearson of Canada) produced a remarkable report which, if it did not lead to a common NATO policy, at least resulted in better non-military co-operation among the treaty members. On the military side the situation is different. Here, many "wise men" at the Lisbon Conference of 1952 agreed on a sound long-range plan. The trouble is that it was never implemented, so that today, after eight years of whittling away and of reneging on accepted obligations, there is hardly any similarity between what NATO should have by now in military force and what it actually has.

NATO has another nine years to go (it was established in 1949 under a 20-year agreement), and all indications are that, whether or not it is made to work properly, it will have its life span extended beyond 1969. It is thus not too late for another attempt at making NATO into a really effective instrument of military power. To do this is, indeed, a matter of desperate urgency.

Last year, the (*British*) Institute for Strategic Studies set itself the task of pin-pointing the deficiencies in the military setup of NATO, of defining the needs, and of finding remedies which could be applied during the second decade of the life of the alliance. A study paper was produced and was debated at a conference in Oxford, in October, 1959. That paper was the work of the Director of the Institute, Mr. Alastair Buchan (incidentally, a son of the late Lord Tweedsmuir. Governor-General of Canada, and himself for six years an officer in the Canadian Army), who then put it into book form under the title, *"NATO in the 1960's"*.

As this reviewer intends to deal in somewhat more detail only with the two themes developed in the book, the background against which NATO

must build its military posture and the principal recommendations for improving the latter, he might be permitted to reverse the usual procedure and to give his summation right here, at the beginning. Be it said, then, that Mr. Buchan's is a most valuable contribution not only to thought on the usefulness, and potential usefulness of NATO, but to military thought in general. In fact, in the opinion of this reviewer, "*NATO in the 1960's*" is the most trenchant examination of the subject yet published, a work which has to be studied rather than read, because every sentence has its significance and every judgment is meticulously developed from carefully sifted and evaluated evidence. It is really a staff paper on a very general plane. The book is thus of great value to the professional military man to whom it presents the problem of NATO as a whole instead of in the bits and pieces with which he normally has to deal.

It is inevitable in works of this kind that some of the conclusions must be based on circumstances which are subject to change. This is particularly so when these circumstances are political in nature. In the present case, the study group and the author must have worked against the background of a possible Soviet-American *rapprochement*, a development which in the second half of 1959, after the Nixon visit to Moscow and the Khrushchov visit to the United States was just designing itself on the political horizon—and which, incidentally, impressed Western Europeans deeply (and most unfavourably). As this has since proved to be a mirage, one of the premises, albeit the least important, on which the author bases his appreciation of the situation facing NATO, is somewhat weakened. Mr. Buchan, of course, freely admits the possibility that "some of *(his)* judgments may not stand the test of time".

Broadly speaking, the author sees the problem of NATO in the Sixties in the "coincidence" of an increasing Soviet threat, of rising doubts about the credibility of the American nuclear deterrent, and of the continuing reluctance of all NATO powers to provide the conventional military forces which would make the Alliance less dependent on the nuclear deterrent. In other words: The Soviets will be pressing harder as their stock of nuclear weapons and their ability to deliver them rises. Correspondingly, the European members of the Alliance will become more and more doubtful that the United States will use its nuclear might except to save its own neck. Yet they do little to raise the conventional armed forces which, if they were available in sufficient strength, would make it unnecessary to decide in every case between all or nothing, and would thus act as the most credible of the deterrents to war.

It is important to realize that it is not so much what the United States would actually do to protect a European member of NATO that poses a problem, but what the European members *think* the United States would do (the author himself is inclined to discount these European doubts which, at any rate, must have diminished since last May). To create a supplement to, if not an alternative for, the American deterrent is thus highly desirable, at the very least to ensure the continuing coherence of the Alliance. There are clearly two roads which can be taken, the national and the supra-national. The former is that presently advocated by the French, not because they consider it the better but because, with Gallic logic, they believe it to be the only practicable. Thus General Gallois has stated that France must build its own nuclear striking force because only a deterrent under full national control will have credibility. He would, of course, be the first to admit that national deterrent forces in what should be a closely knit 15-nation alliance are both divisive and wasteful.

On the other hand, NATO would already have the collective means to deter war in its conventional armed forces if these were only strong enough to achieve their aim of "enforcing the pause" in case of massive Soviet aggression, and, equally important, preventing the creation of a *fait accompli* by a lightning Soviet strike in a limited area. As things stand now, the forces which are available, a fragment only of those envisaged in the Lisbon plan, are not only deficient in numerical strength and modern equipment but also largely static because they depend on national logistic organizations and national lines of communication. This weakness can not be made good by the infusion of American tactical nuclear weapons—this reviewer can only agree heartily with the author when the latter speaks of "the delusion of the value of the tactical nuclear weapon as a weapon of defence". What it really does is to make it likely that a limited war situation—the author calls it an "ambiguous" situation—will speedily develop into the dreaded all-out nuclear war.

Although he strongly advocates the speedy creation of a conventional force which will be capable of accomplishing the NATO mission, Mr. Buchan also envisages the possibility that "the West as a pleasure-loving society seeking protection through technical gimmicks however grisly" may not have the inner strength to make the material and per-

sonal sacrifices which such a policy would demand. In that case, as an alternative, he proposes that the existing conventional NATO forces be welded together into a truly integrated, mobile force to back up national territorial (militia) units which would take over the task of holding up the "shield" along the Iron Curtain.

There remains the problem of creating a credible, supra-nationally (and thus presumably not selfishly) controlled nuclear deterrent. Here, Mr. Buchan climbs rather far out on the limb when he advocates the speedy organization, in NATO and under a Supreme Allied Commander Deterrent (SACDET), of an IRBM system "designed and allocated by the most energetic NATO committee or *ad hoc* authority that has as yet been assembled, and subject to the most rigorous central operational control that can be devised". In this system the United States would be a partner on the same level as all the others, while retaining in S.A.C. its own, nationally controlled nuclear deterrent. The IRBM chain, armed possibly with "Polaris" or "Pershing" missiles produced by all those NATO countries which have the technical means for it, would extend from the North Cape to Alexandretta. On the trigger would be the finger of SACDET, of whatever nationality he might be, who would be guided by strict rules of engagement determined beforehand by the NATO Council.

The reader must pass his own judgment on the feasibility of this plan. Even if one discounts the purely statutory difficulties—the United States, for instance, would have to scrap the MacMahon Act—there remains the fact that two all-important prerequisites are not given now: a common, world-wide NATO policy which would do away with the present inner divisions in the Alliance, and real inter-dependence among the treaty members. To expect either would, in the light of the experience of the first 11 years of NATO, seem tantamount to expecting the millenium.

Again and again in his book, the author stresses the need for a common policy and for interdependence if NATO is to achieve its military aim. If anybody ever doubted that this is indeed the key to success for the Western alliance, he will doubt no more after he has worked his way through Alastair Buchan's remarkable book.

THE EDGE OF THE SWORD

By Charles De Gaulle (128p., Nelson, Foster & Scott, Toronto, 1960, $4.95)

Reviewed by SQUADRON LEADER W. J. HYNDS

PROBABLY the first point that should be made about this short and extremely readable book is that it was written, not as one might suspect in 1960 by General de Gaulle, world statesman and President of France, but rather, in 1932 by Captain de Gaulle, a young and relatively unknown soldier in the French Army. When originally published the book was titled *The Point of the Sword;* translated into English and republished in 1960 the point has now become *The Edge of the Sword.* In the hands of a personality as dynamic and direct as Charles de Gaulle the sword is applied with authority and precision to cut away the sometimes hazy trappings of military and political doctrine and penetrate to the heart of the problem.

Briefly, *The Edge of the Sword* is de Gaulle's personal credo of what it means to lead both in the military and political arena. In five essays entitled, *The Conduct of War, Of Character, Of Prestige, Of Doctrine,* and *Politics and the Soldier,* he sets forth his personal philosophy on authority and leadership and pleads for a realistic assessment of French military needs and potential. In addition, in an enlightening foreward to the book he defines with clarity the relationship between the public and the military in times of peace and war and makes an eloquent appeal for understanding of, and pride in, the military arts.

In the opening essay, *The Conduct of War,* the central theme that is to be developed later becomes apparent. De Gaulle begins by generalizing on the part that personal intelligence and instinct have

to play in the make-up of all great leaders. While not underestimating the importance of intelligence he makes it quite clear that intelligence by itself will not produce great leaders. Then, almost mystically, he develops the role that instinct must play. He speaks of "withdrawal into oneself"; "meditative thought"; "the feel of what exists". Having laid the ground work de Gaulle then defines the problem in these words: "Training for war is, first and foremost, training in leadership, and it is literally true, for armies as well as for nations, that where leadership is good, the rest shall be added unto them."

In the essays that follow de Gaulle goes to some length to explain the problems that have to be faced in developing character and establishing prestige for the soldier in time of peace and war. At first glance this might appear to be just another treatise to an age old problem; but de Gaulle is careful not to treat the abstract elements of leadership in isolation; he examines them in concert with doctrine and tests his theories in a fascinating, almost storybook style, against French military philosophy since the time of Napoleon.

As one might suspect de Gaulle's thoughts on authority and leadership are often controversial and seldom follow the usual pattern as laid down in standard text books on the subject. For example, he warns of the danger in peacetime of the easy-going, mediocre officer coming to the forefront and getting ahead, while the real leader, the "difficult, rebellious type," is held back, if not eliminated completely. But according to de Gaulle, in times of crises it is usually this same difficult and rebellious officer who comes to the top and who is most needed by the nation.

Captain de Gaulle's personal testament is a book well worth reading. As a publisher rightly claims, *The Edge of the Sword* "is a provocative and revealing book by one of the most important leaders of the Western Alliance". It is that and more. For the casual reader who seeks to understand the enigma that is General de Gaulle it helps to explain many of his controversial actions of the past. For the military student the book is especially valuable. It is, in effect, a case study of a dedicated and inspiring leader who has something to say about the complex subject of leadership and who says it very well.

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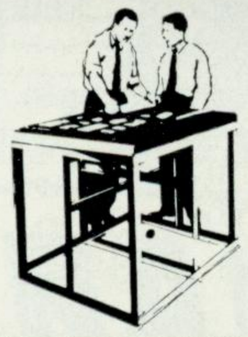
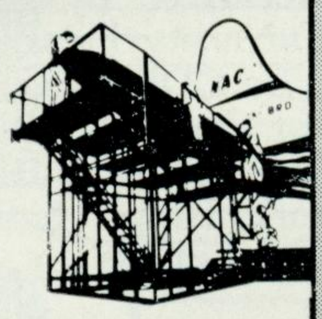

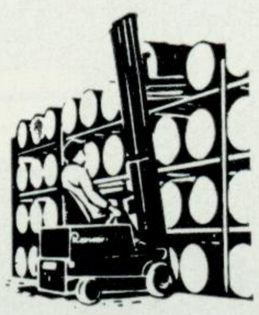

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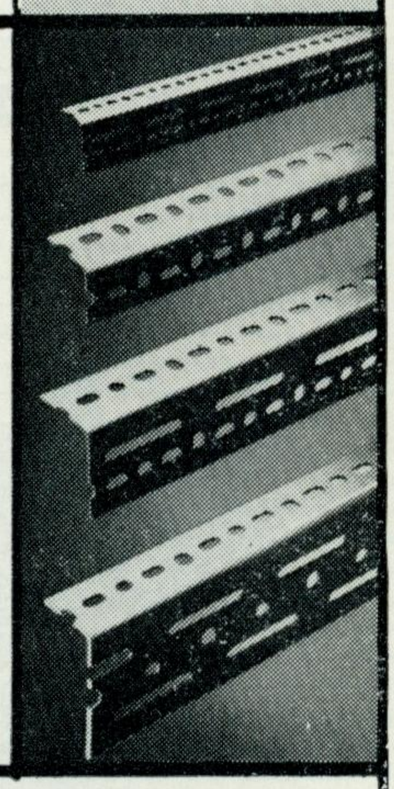

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OTHER BOOKS RECEIVED

The limitation of space prevented the inclusion of a review on the books received from publishers:

Science and Liberal Education. By Bentley Glass. Louisinana State University Press, 1960. 112p., $3.00. (Published in Canada by Burns & MacEachern, Toronto.)

The Professional Soldier, by Morris Janowitz. Free Press of Glencoe. (Published in Canada by Burns & MacEachern, Toronto.)

The Soviet Design for A World State. By Elliott R. Goodman. New York, Columbia University Press, 1960, 584p., $6.75.

What Makes an Executive? By Eli Ginzberg. New York, Columbia University Press, 179p., $3.50.

Surface at The Pole. By CDR. James Calvert. Toronto, McGraw-Hill Co. of Canada, 1960, 220p., $5.50.

Education in The Perspective of History. By Edward D. Myers, New York, Harper & Bros., 1960, 388p., $6.00. (Published in Canada by Musson Book Co. Ltd., Toronto.)

The Uncertain Trumpet. By Gen. Maxwell D. Taylor. New York, Harper & Bros., 1960, 203p., $4.95. (Published in Canada by Musson Book Co. Ltd., Toronto.)

The Strategy of Peace. By Senator John F. Kennedy. New York, Harper & Bros., 1960, $4.25. (Published in Canada by Musson Book Co. Ltd., Toronto.)

Nuclear Policy for War and Peace. By Thos. E. Murray. Cleveland, World Publishing Co., 1960, 241p., $4.75. (Published in Canada by Nelson, Foster & Scott Ltd., Toronto.)

One Chinese Moon. By J. Tuzo Wilson. New York, Hill & Wang Co., 1960, 274p., $4.95.

Tank. By Arch Whitehouse. Toronto, Double Canada Ltd., 1960, 383p., $5.75.

Strange World of The Moon. By V. A. Firsoff. New York, Basic Book Inc., 1960, 226p., $6.00.

Fallout: A Study of Superbombs, Strontium 90 and Survival. Edited by John M. Fowler. New York, Basic Books Inc., 1960, 235p., $5.50.

Fighter Command. By Peter Wykeham. Toronto, McClelland & Stewart Ltd., 1960, $6.00.

British Civil Aircraft, Vol. II. By A. J. Jackson. London, Putnam & Co. Ltd., 1960, 595p., 63s., (Published in Canada by McClelland & Stewart Ltd. Toronto, $12.50.)

Official Secret. By Clayton Hutton. Toronto, Clarke, Irwin & Co. Ltd., 1960, 195p., $4.00.

The Tragedy of Apartheid. By Phillips. Toronto, Longmans, Green & Co., 1960, $4.50.

Let's Go Flying. By Martin Caidin. New York, E. P. Dutton & Co., 1960, 214p., $4.75 (Published in Canada by Clarke, Irwin & Co. Ltd.)

The Beauty of Gliding. Toronto, Clarke, Irwin & Co. Ltd., 1960, $7.75.

Admiral Togo. By George Blond. Galt, Brett-Macmillan Ltd., 1960, 252p., $4.50.

Airborne from Edmonton. By Eugenie Louise Myles. Toronto, Ryerson Press, 1960, $5.00.

A Sky of My Own. By Molly Bernheim. New York and Toronto, Rinehart & Co., 1959, $4.50.

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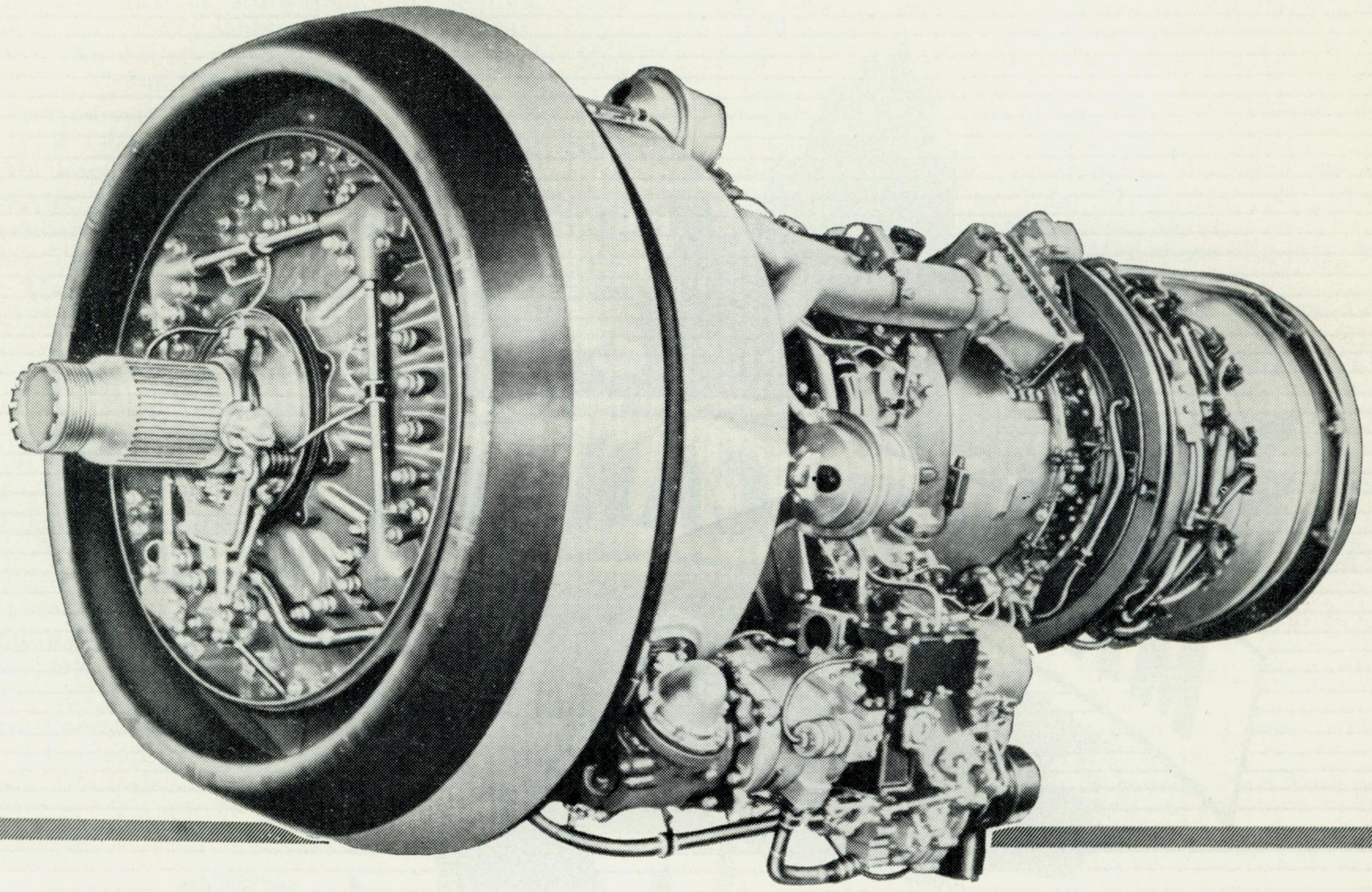

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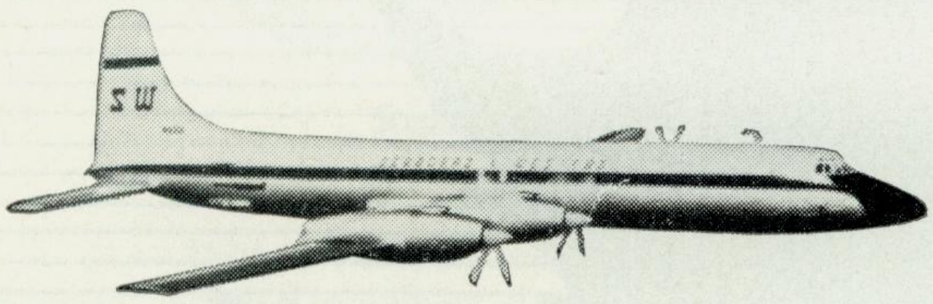

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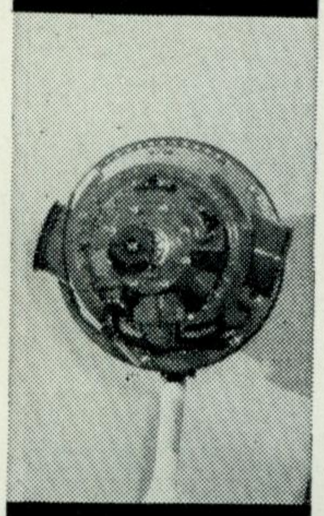

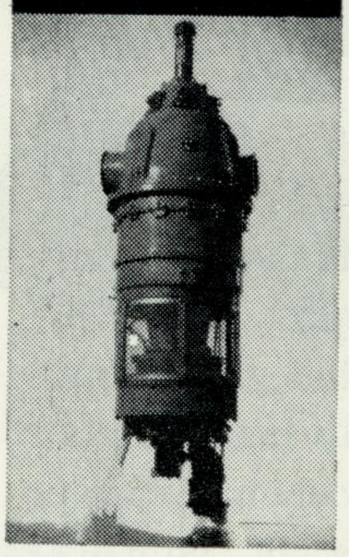

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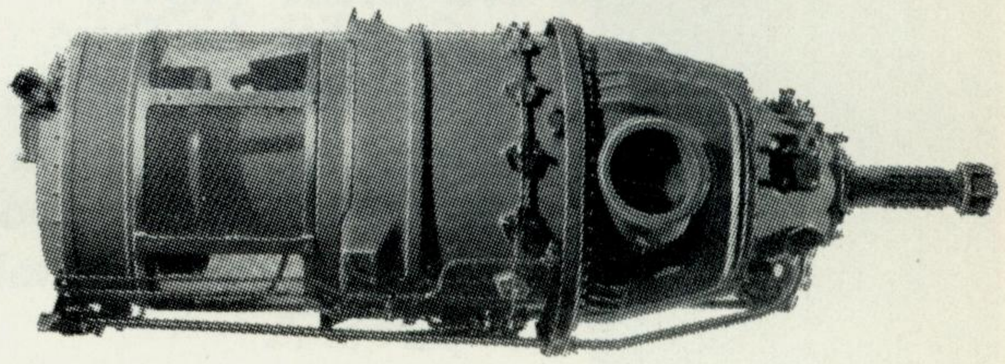

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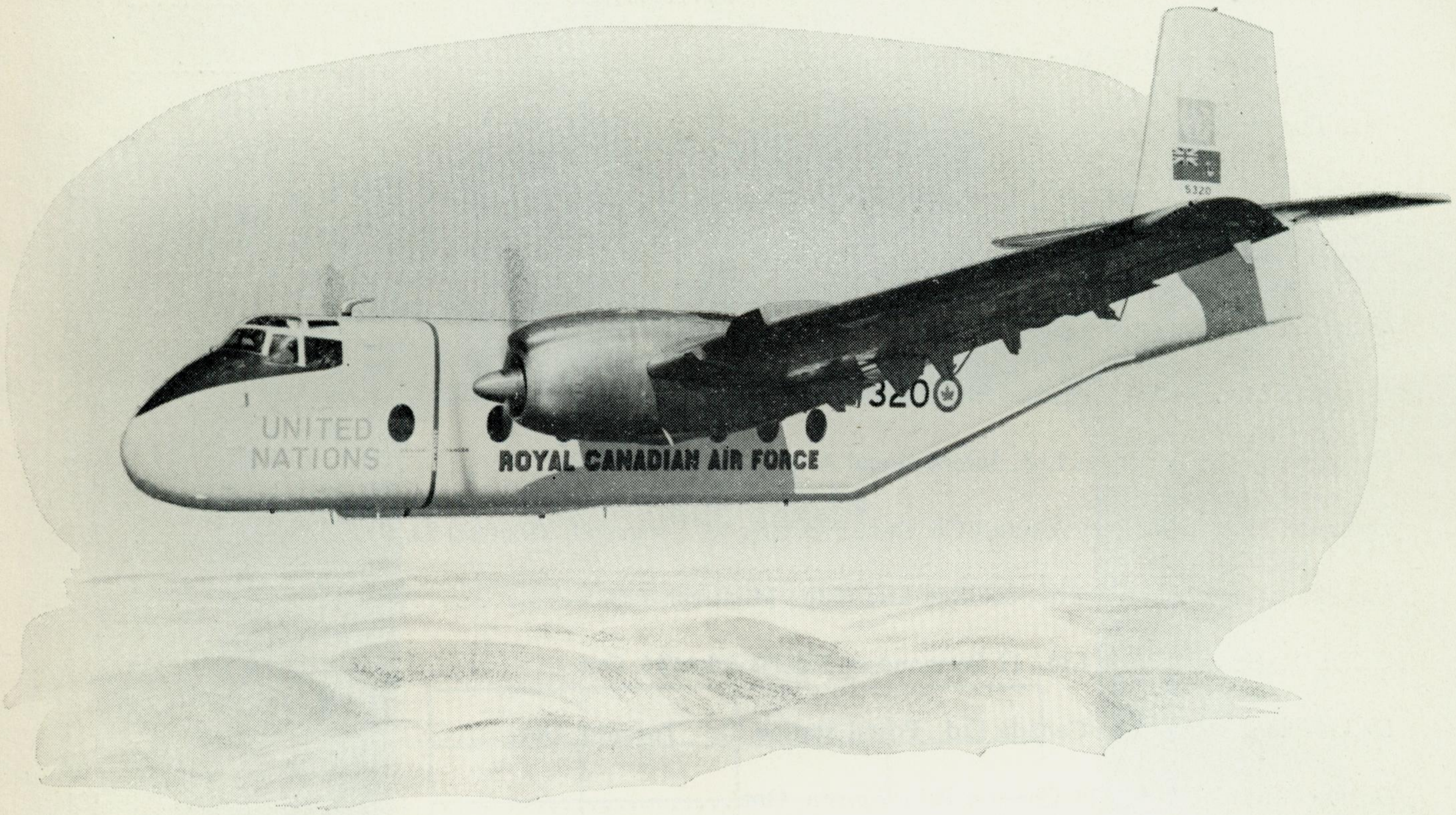

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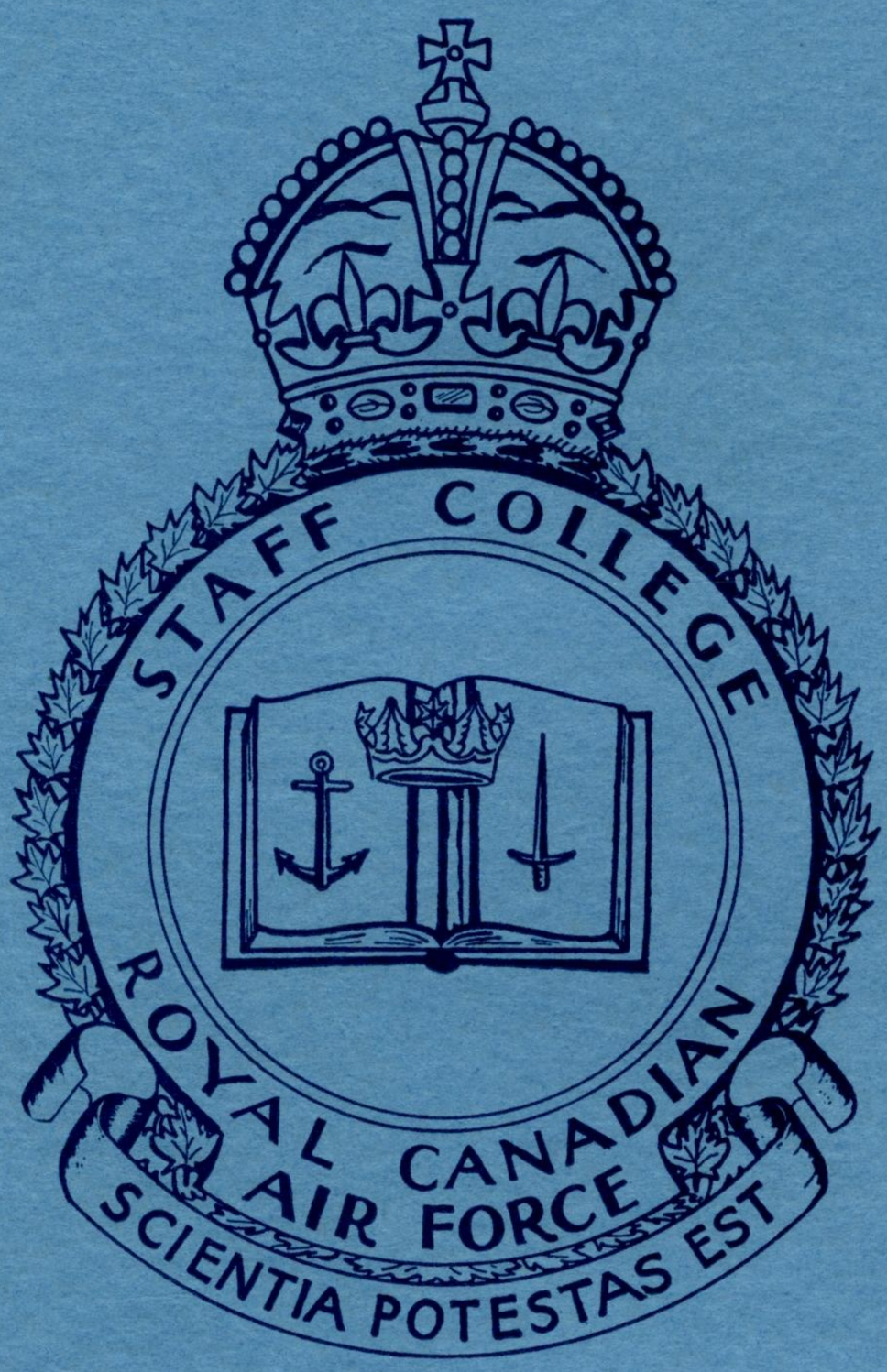
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