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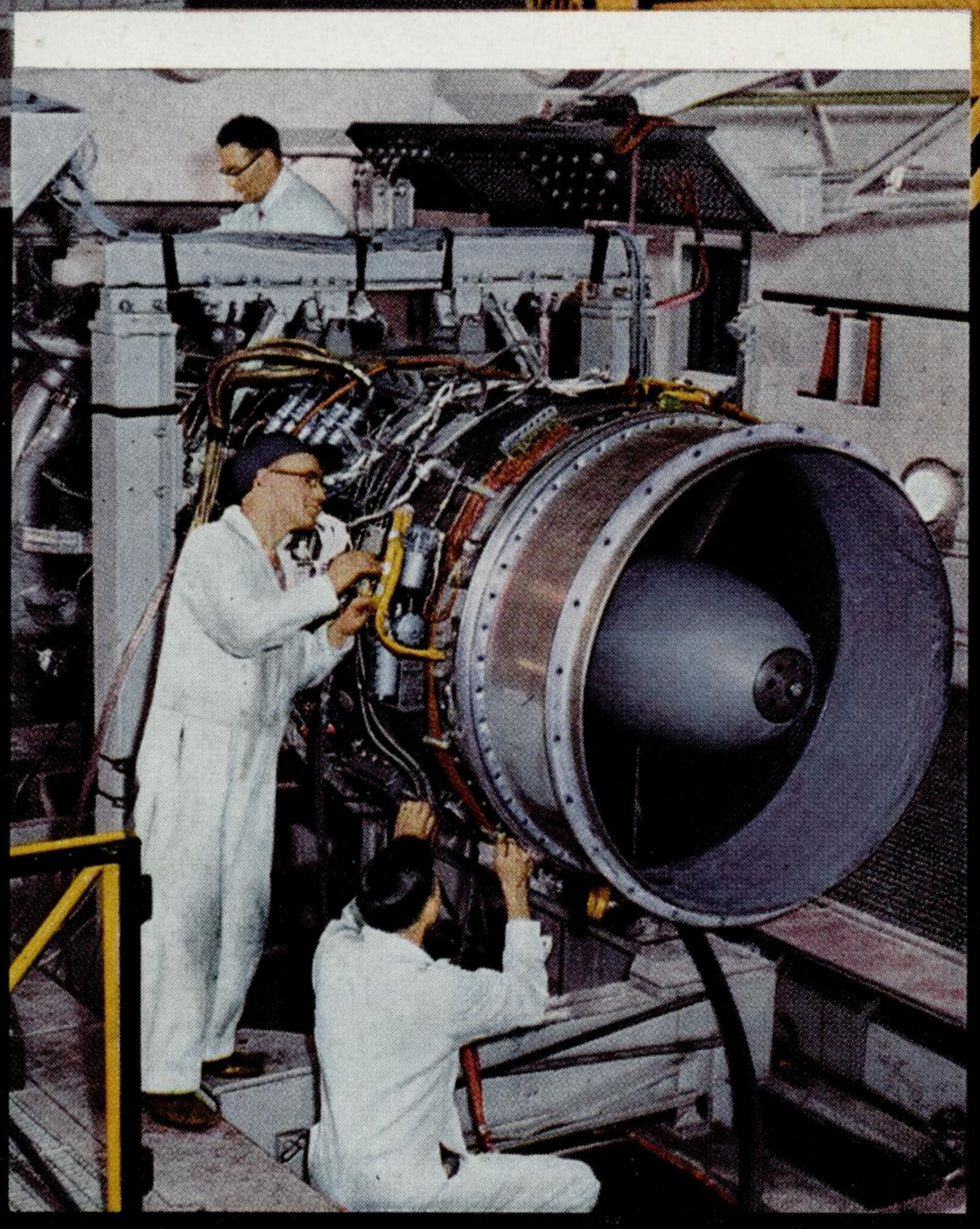
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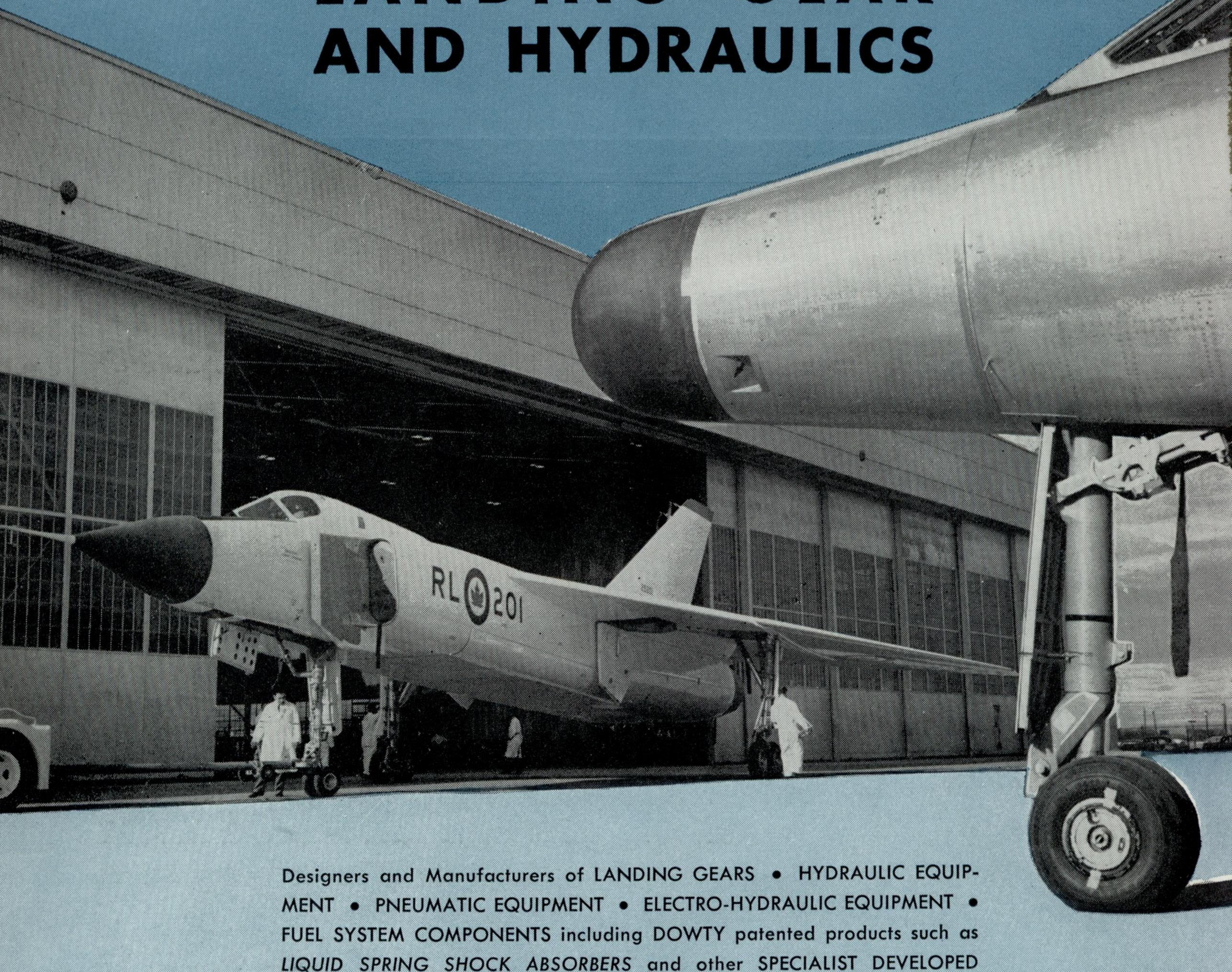
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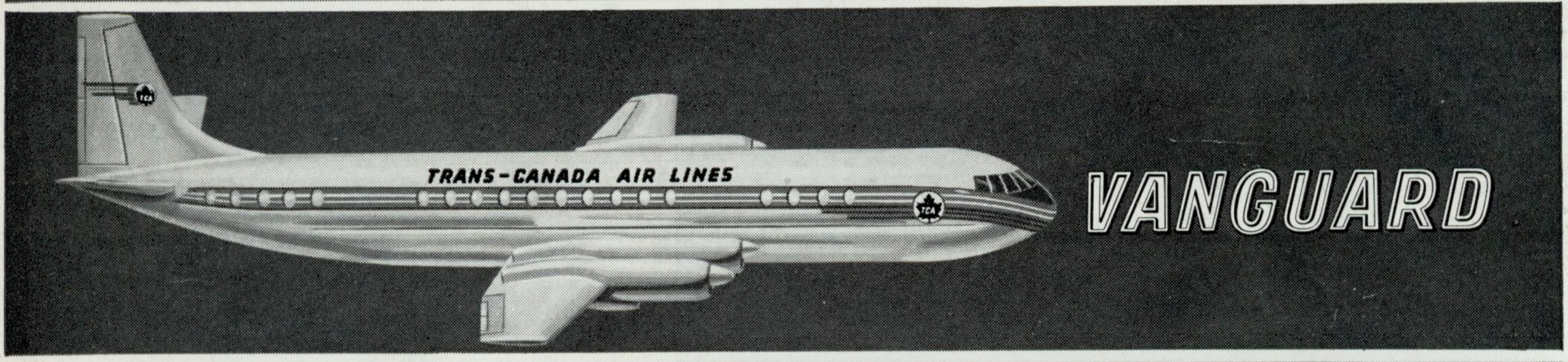
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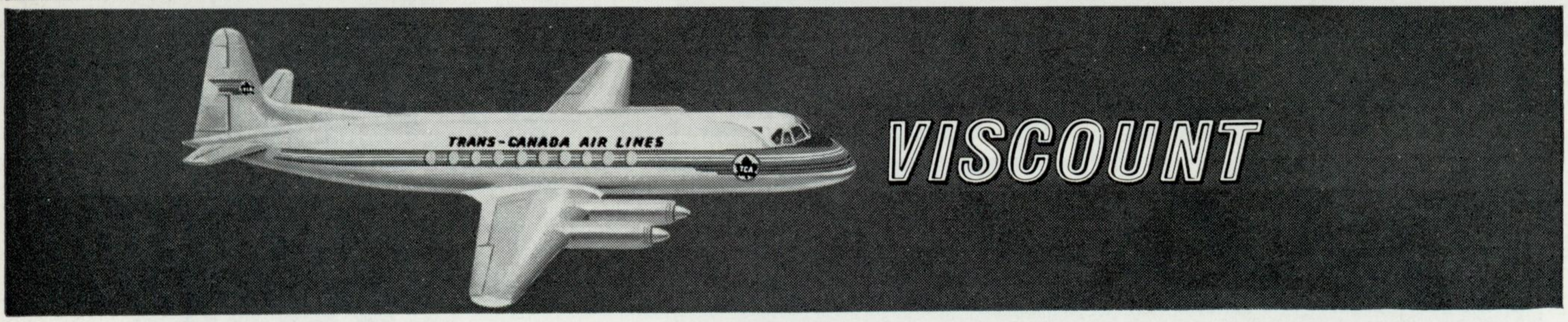
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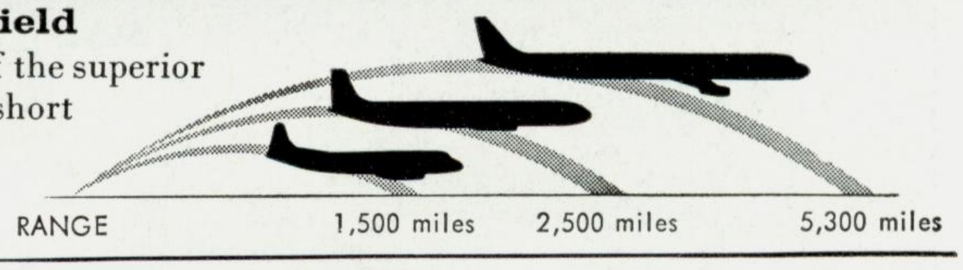






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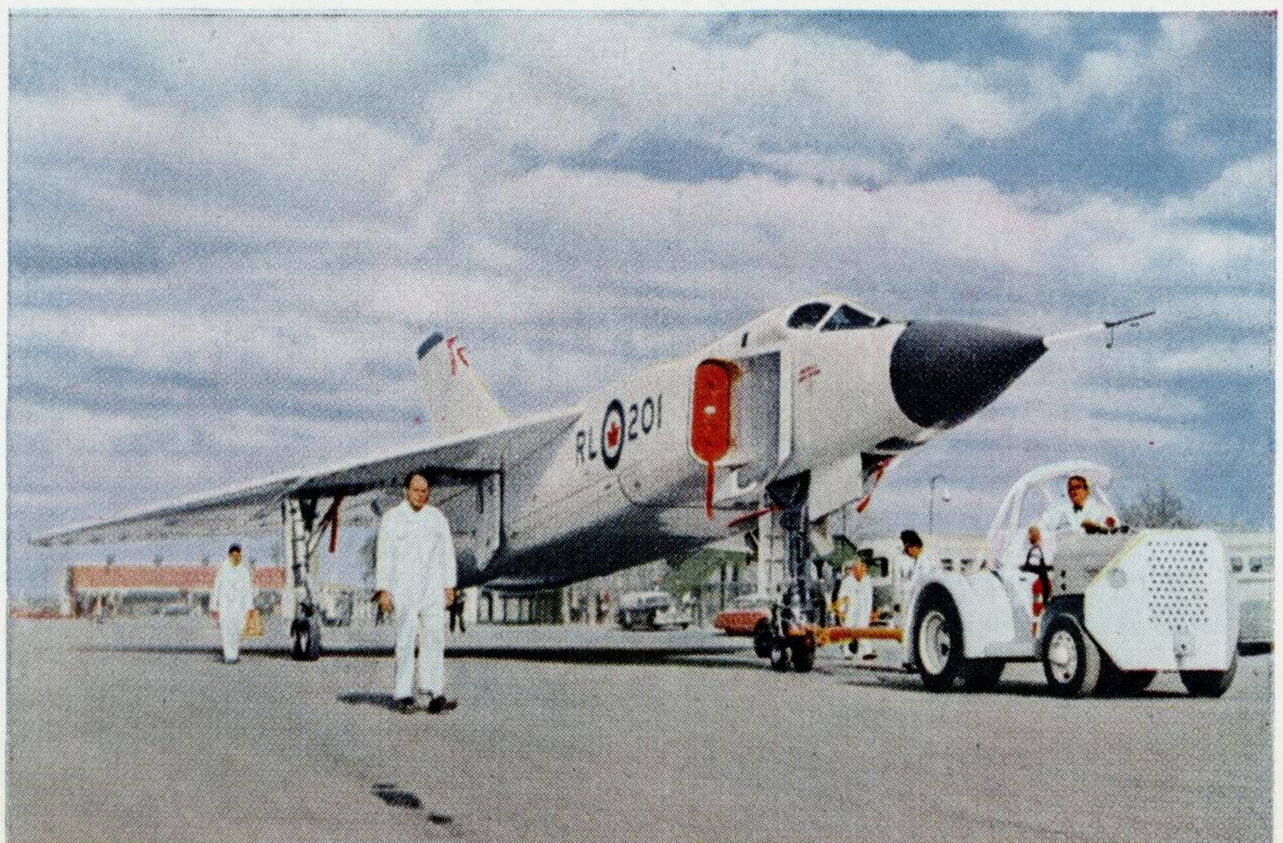


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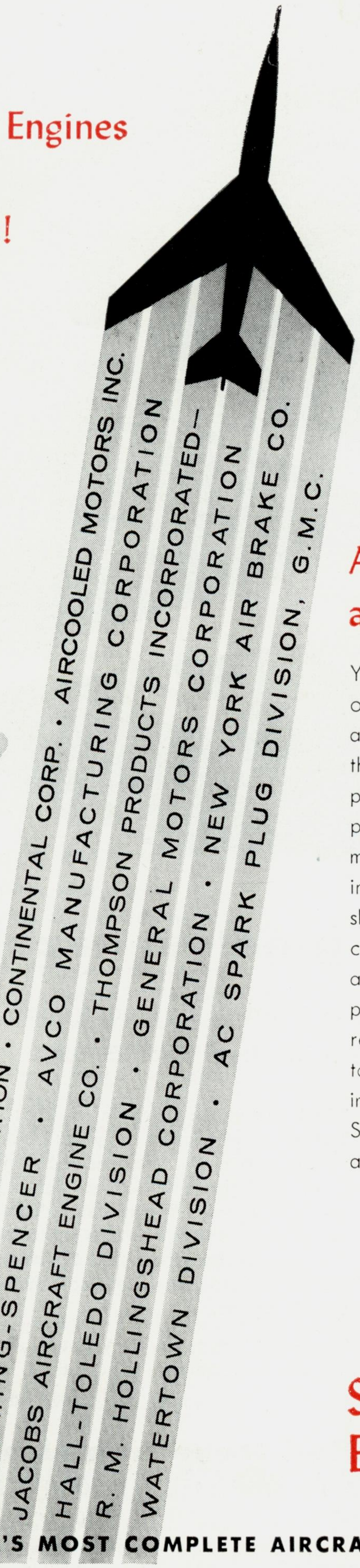
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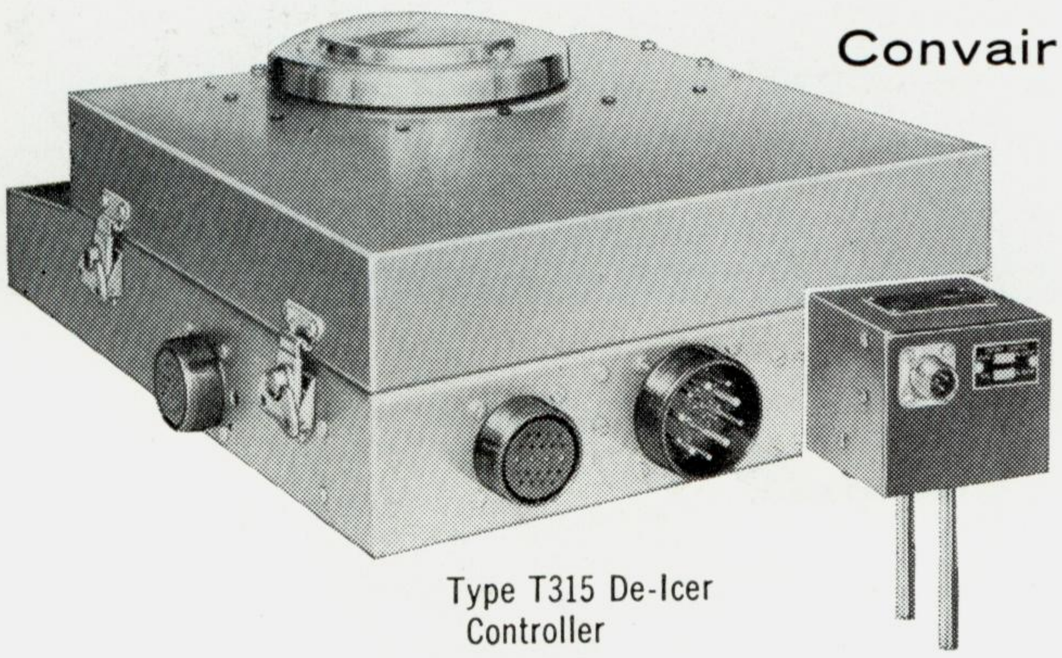
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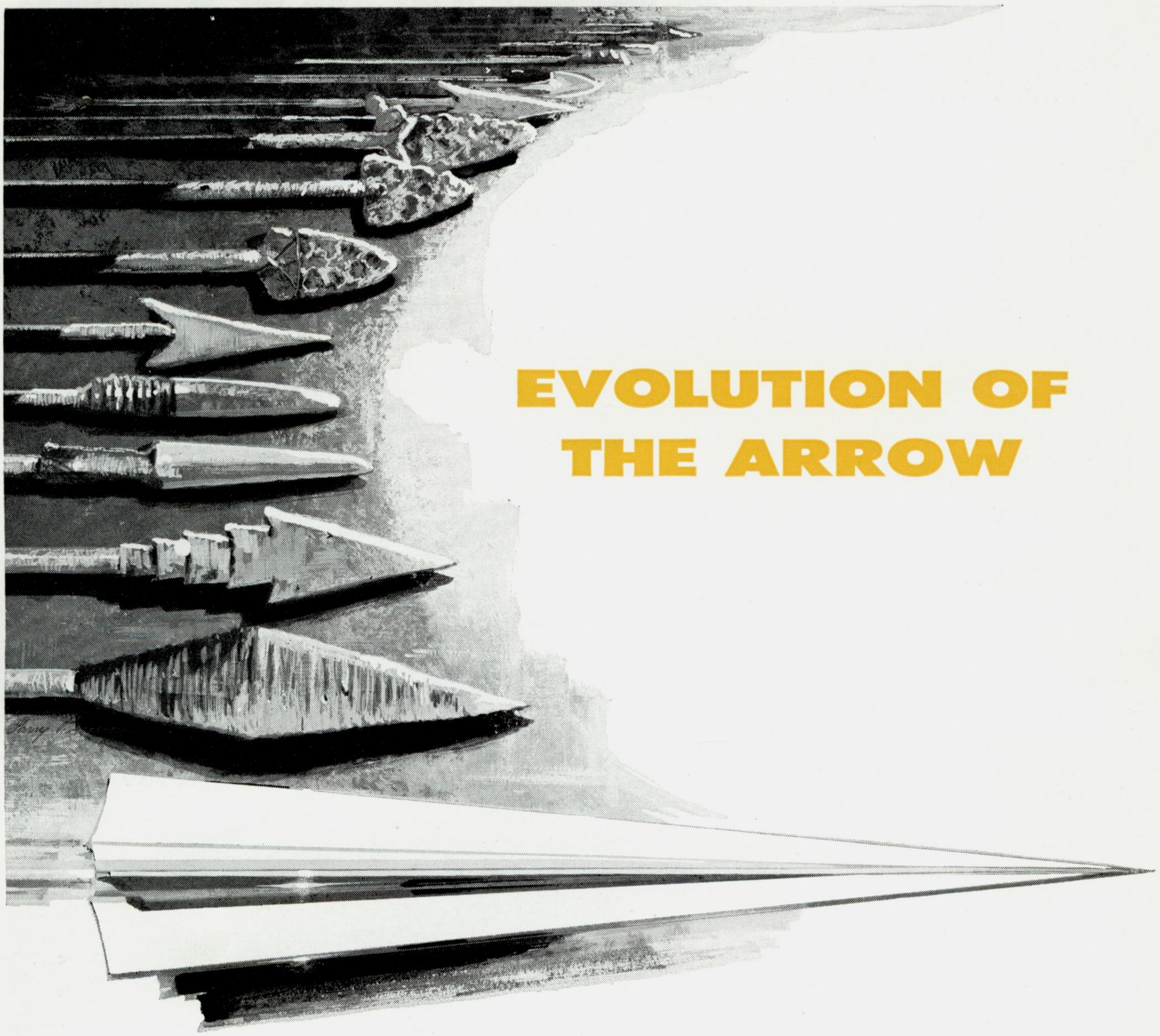
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Introduction

SINCE the last issue of the Journal appeared, intercontinental ballistic missiles have been tested and earth-satellites have been placed in orbit. Much of what is contained in this year's Journal examines the implications of this advancing technology on the contemporary military scene. To provide an understanding of the technical fundamentals Ernest Wall of de Havilland of Canada has provided his article *Guided and Ballistic Missiles.* An insight into the enormous problems of research and development which must be solved to produce modern weapons is given in another descriptive article, *The Significance to Defence Science of Research and Development on Materiel* by Dr. H. Tardif. Dr. Tardif emphasizes that the time when inventiveness preceded understanding is past, and that today research must reveal basic physical phenomena before practical progress can be made.

In other articles the strategic significance of these recent advances is explored. Colonel Harvey Shelton in his *Missile Age Forces,* does not see any immediate transformation of offensive forces into ballistic missile systems, but sees rather the gradual integration of missiles into the offensive force, with several generations of manned offensive weapons still likely. He examines the needs for various types of arms to meet various military situations, and concludes that although the space age presents a military threat of extreme complexity, the same technology that has produced the space age can provide military forces to control that threat.

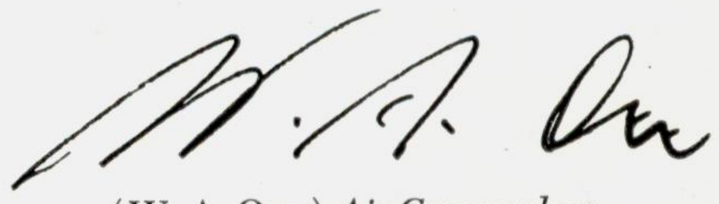
The survey of contemporary military thinking which Air Vice-Marshal Kingston-McCloughry presents in his article, *Western Schools of Thought in Defence,* agrees with Colonel Shelton's thesis in its assessment that total thermonuclear war is too widely destructive to be a rational course of action. Air Vice-Marshal Kingston-McCloughry examines the various military policies from that of massive retaliation, through graduated deterrence and limited war, to disarmament, withdrawal, and disengagement, and relates American and British policy within this framework.

Three other articles, Flying Officer D. E. Sharp's *North American Defensive Requirements in the Missile Age,* Captain Ellis' *Some Military Implications of Disengagement in Central Europe,* and Squadron Leader Emmott's *Air Power and Modern Weapons,* examine particular aspects of the broader picture described by Air Vice-Marshal Kingston-McCloughry and Colonel Shelton. Flying Officer Sharp, at 24 the youngest contributor of a major article to the Journal, examines the defensive requirements for North America, and concludes that while a bomber attack on North America can no longer be profitable, a missile offensive would offer an aggressor some very attractive rewards. Captain Ellis examines the advantages and disadvantages, from the military point of view, of disengagement in Central Europe. He sees that a type of demilitarized corridor might have advantages, but does not see the creation of such a corridor possible until the political problems of German unification can be solved. Finally, Squadron Leader Emmott believes that the potentialities of air power in direct support of armies is a weapon which can be far more greatly developed than at present.

The five remaining articles deal with less closely related but still vitally important issues. Squadron Leader J. Woodrow examines the need for qualified engineers as part of the R.C.A.F.'s management team in the missile age. Wing Commander J. G. Wright's article *Coherency in Organization* provides an original approach to a subject that has been much discussed but little changed in many years.

In his *We Are Not the Best,* Wing Commander John Gellner presents his sober and sobering conclusions about the Western officer. Dr. C. M. Mooney's article *The Military Challange Today,* also examines the military profession, and calls for a militarizing of the armed forces.

The prize-winning essay in this year's Journal Essay Contest is Flight Lieutenant Rippon's *Jurisdiction in Space.* The response to this year's contest was most encouraging, both in the number and in the quality of the entries. The articles by Squadron Leader Woodrow, Flying Officer Sharp, Dr. Mooney, Dr. Tardif, Captain Ellis, and Squadron Leader Emmott were submitted for the contest, and of these, the judges considered those by Dr. Mooney and Captain Ellis worthy of Honorable Mention. The Board of Directors of the Journal hope that the response to next year's contest will be even better.



(W. A. ORR) *Air Commodore,*
Chairman, Board of Directors,
R.C.A.F. Staff College Journal.

Guided and Ballistic Missiles

E. WALL

Mr. E. Wall, B.A.Sc., M.A.Sc., is Chief Engineer of the Guided Missile Division of de Havilland Aircraft of Canada. A radar officer with the Canadian Army during World War II, he has been associated with the development of numerous technical projects of military application.

TODAY, with the ever increasing publicity that is being given to missiles, both guided and ballistic, it is possible for one to draw the premature conclusion that the missile has arrived and is well on the way to replacing most of the older weapons. One is too apt to forget that many of the missile firings reported in the press are simply test launchings which must take place during various stages of development and evaluation. Actually, to the trained observer, the evidence that is available indicates that more than a few years will pass before missiles become the dominant factor in military operations. Furthermore, it is obvious that once developed and operational, missiles will be used for a very long time in conjunction with other conventional weapons, and that it is doubtful that the day will ever come when our military services will rely solely on missiles.

In this article some of the factors and problems relating to the development and operational use of guided missiles will be discussed. The capabilities and limitations of missiles, both guided and ballistic, will be covered as well as such basic logistic requirements as reliability, maintainability, and operational readiness.

For a better appreciation of some of the limitations and capabilities of missiles when used as tactical or strategic weapons, it is perhaps in order to describe briefly their make-up and operating principles. Recently, there have been spectacular advances made in the field of long range ballistic missiles and in view of the tremendous effect they will have on all future military planning and operations, ballistic missiles will be discussed in detail. Also, since the CF-105 is to be developed as a weapon system employing the Sparrow II air-to-air missile, the guided air-to-air missile will be treated in more detail than the other types of aerodynamic missiles.

The role of a missile is that of carrying a destructive payload (warhead) to a target area. At the target location the warhead must be detonated to destroy or disable the target. Normally the payload is housed in an airframe along with the propulsion system, the guidance and control equipment, the auxiliary power unit, and the fuse. The systems which are particularly important to the task of carrying a missile accurately to the target are propulsion and guidance systems, and these systems are receiving most of the attention of today's missile designers.

Missile Types

Missiles which employ lifting and control surfaces to control their flight trajectory come under the broad general classification of *aerodynamic* or *guided* missiles. Such missiles may or may not be powered throughout their flight, but usually are guided throughout their entire flight. All air-to-air, surface-to-air, air-to-surface as well as some surface-to-surface missiles, are of the guided type. A *ballistic* missile is one that is powered and guided for only a very small portion of its total flight; thereafter its trajectory is established by aerodynamic and gravitational forces only. Thus at the moment its fuel is expended, at burnout, the missile's velocity magnitude and direction must be correct for a trajectory that intersects the target. For short range ballistic missiles, most of the flight path is within the atmosphere, whereas long range intercontinental missiles are in the atmosphere only during the very early and the terminal phases of flight.

A missile requires a propulsion unit or power plant to propel it at high velocity. High speeds are essential to lessen the probability of interception and destruction and to provide the capability of intercepting high-speed enemy targets. Sufficient thrust must be developed by the missile's power plant to overcome the resistance of the air (aerodynamic drag) and gravity and to produce the required speed, and this thrust must be maintained long enough to achieve the desired range. Missile power plants are either of the air breathing or rocket type. Air breathing engines, of which the turbo-jet and the ram-jet are examples, require air and can thus only be used within the earth's atmosphere. Rocket

motors carry both fuel and oxidizer and can thus operate outside the atmosphere, in a vacuum, or under water. This air-independent operation characteristic, and their ability to propel the missile at very high speeds, have resulted in rocket motors being used almost exclusively for missile propulsion.

Rocket motors may have solid or liquid propellants. In a solid propellant rocket engine, the fuel and oxidizer are mixed together to form a solid "grain" which is housed and burned in a container. It is relatively simple in design and operation but its action is non-intermittent and of short duration. In most liquid propellant rocket motors, the liquid fuel and oxidizer are carried in separate storage tanks, their flow to the combustion chamber is controlled, and the motor can be stopped or started as required. Compared to solid propellant rocket engines, liquid propellant systems have a longer duration and higher thrust/weight ratios. With rocket motors, gas temperatures rise to the 5000°F region, so that in a liquid propellant system the walls of the combustion chamber must be cooled even though typical operation times are only a few minutes. The problem is not as severe with the solid propellant motor because it is possible to so design the grain and arrange its burning that the propellant acts as an insulator for the chamber wall as it burns.

A typical liquid propellant motor for a missile would have a fuel, such as gasoline or alcohol, and an oxidizer, such as red fuming nitric acid or liquid oxygen (Lox), stored in separate tanks. A pressure feed system would be employed to control the flow of the propellants into the combustion chamber, a common type of feed system consisting of pumps driven by a steam generator or by the propellants themselves. This is a complex system of pumps, connecting fuel lines, valves, and controls and it is perhaps understandable why most of the failures of test firings from Cape Canaveral have been due to the unreliability of the liquid motor system. In addition, liquid propellants are not convenient to transport, store, or handle and will certainly present problems in the field. For example, red fuming nitric acid is highly corrosive and must be stored in stainless steel tanks, its fumes are extremely poisonous and as with liquid oxygen, draining would be necessary if the missile were not fired. The problems of transporting liquid oxygen are being reduced by producing it where required with semi-transportable generating plants, at the expense of adding to the ground support equipment. Another very important consideration is that time is required to fuel the missile, typical figures being from 2 hours to 30 minutes. The problem does not end here; a missile using liquid oxygen as an oxidizer would require continual topping up after loading, to offset the fuel's rapid evaporation due to its very low boiling point.

On the other hand, the solid propellant is not without its problems. Among the more important are accurate control of burnout time, stability and performance at low temperatures, thrust control, and storage life. Solid propellant motors have found wide application in the air-to-air missile field and in some of the short range surface-to-surface missiles where burning times of a few seconds suffice, and have also been used extensively as missile "booster" units. For ballistic missile application, however, the main propulsion must be maintained for as long as three to four minutes, which is too long for today's solid propellant systems. Operationally, solid propellant missiles are immediately available and are easily stored, transported, and handled. Because of their obvious advantages over liquid propellants from both logistics and operational viewpoints, a tremendous amount of development work on solid propellants is being undertaken and the next generation of missiles will probably use solid propellant motors exclusively.

Guidance Systems

After launching a missile, the next problem is to control it to ensure that it travels in the correct direction and eventually destroys its target. This is the function of the missile's guidance and control system, with the guidance unit as the missile's brain continuously measuring the missile's position and generating command signals for the control system, which converts the signals into control surface deflections or changes in the line of thrust of the rocket motor. Missile guidance systems generally include sensing, computing, and directing components, but not all of these need be incorporated in the missile.

Target characteristics have a great influence on the choice of a missile and the type of its guidance system. As a general rule, small missiles are used against moving targets and large missiles against stationary targets. To be effective against moving targets, the missile must always be more agile than the target. Further, even with the most accurate missile it is necessary to know exactly where the target is, or for a moving target, where it will be when the missile reaches it. This is true for all types of guidance systems except the "homing" type, where the guidance system draws information directly from the target during flight.

The most common guidance systems are of two types, the homing type and the external guidance

type. Homing systems react to some distinguishing characteristic of the target: sound, magnetic features, or electromagnetic radiations such as heat, radio, and light. Because an aerial target usually stands out from its background, drawing information directly from such a target is relatively easy, and thus most air-to-air missiles employ some form of a homing system. A major advantage of homing is that the strength of the sensing signal from the target increases — with a corresponding increase in guidance accuracy — as the target gets nearer. A disadvantage is that because the strength of target signal falls off rapidly with distance, effective operating ranges when homing alone is used are limited to a few miles.

Homing Guidance Systems

Homing systems are usually classified as passive, active, and semi-active. Passive homing systems use energy emanating from the target and thus can seek a target without revealing their presence. The energy may be in the form of light, sound, or heat, but the first two are seriously limited in range, and only the so-called heat or infrared homing systems are having an increasing application. Infrared guidance systems are based on the fact that all objects with temperatures above absolute zero radiate electromagnetic energy, the wavelength of the radiation being about 1,000 to 10,000 times smaller in magnitude than microwave wavelengths. This provides a much higher angular resolution of the target location with comparatively smaller sensing and scanning devices. In general, infrared guidance seekers are smaller, lighter, more simple, and therefore more reliable and less costly than comparable radar seekers. Infrared guidance systems are immune to the electronic countermeasures which can so severely reduce the effectiveness of radar guidance systems, and it is doubtful if effective infrared countermeasures for high speed targets will ever be evolved.

Obviously, with an aircraft target, the amount of radiation available will vary with the size and number of its engines and its speed. It will also vary with the viewing aspect, for whether the energy is radiated from the exhaust pipes of a reciprocating engine or from the plume of a jet or rocket engine, there will be positions where the structure of the aircraft will mask the source of radiation. Early infrared detectors, being highly sensitive only to radiations from the hot metal parts of a jet engine, restricted the use of infrared to tail attack or pursuit tactics. However detectors are now available which are sensitive to radiation from the jet exhaust and it is reasonable to suppose that future infrared missiles will not be restricted to the tail attack use. Furthermore, with more advanced targets such as the chemical bomber with a speed in excess of Mach 2, aerodynamic heating of the target becomes significant. Since this effect is most pronounced on the leading surfaces of the target, a considerable amount of detectable infrared radiation will be projected ahead of the target, thus allowing for frontal attacks which will become increasingly desirable as the speed superiority of intercepting weapons declines. Infrared radiation from aerodynamic heating suggests an admirable technique for homing on incoming ICBM's during their re-entry phase.

The most severe limitation on an infrared system's performance is that imposed by background radiation from the sky or earth against which the target is observed. Any target which does not emit significantly more heat than its background will render the system useless, and any extraneous infrared sources such as the sun or brightly illuminated clouds will impose serious tactical limitations. All infrared homing systems have background discrimination devices which can eliminate most of the unwanted signals, but the remaining spurious noise and atmosphere attenuation (which is a function of altitude) imposes a limit to their range, and infrared homing missiles now in operational use are attributed to have ranges of about six miles. A major disadvantage of any infrared system is that its range is reduced considerably by haze and cloud and will be almost zero in heavy fog and rain. Since in the future more and more of the aerial battles will probably take place in the cloud-free upper atmosphere, and since more powerful engines and increased speeds should provide better infrared targets, it would not be surprising to see a great increase to the use of infrared guidance systems.

In an active homing system the missile carries an energy transmitter (normally radar) with which it illuminates the target, and a receiver to interpret the reflected energy and provide steering information. As with the passive homing, active homing is applied most often against aircraft targets in air-to-air and surface-to-air missiles. The maximum operating range of an active radar homing missile depends on the power transmitted and the size of the antenna. In the case of an air-launched missile which must for obvious reasons be small, there is only very limited space for the transmitter and antenna, and thus active radar guidance missiles are inherently short range devices. One major disadvantage of all active radar homing systems is that the transmissions can be detected by the target's equipment and

the receiver jammed by electronic countermeasures.

If the transmitter is located outside the missile, either at the launching station as would be the case with an air-launching, or at a point separate from the launching site as could be the case with surface launching, the missile would require only a receiver to detect the energy reflected from the target. This is known as semi-active homing. Here there are no restrictions imposed by the missile configuration on the size of the antenna and transmitter, and by increasing the transmitter power and antenna area, it is possible to increase significantly the effective range over that of a fully active system. While in operation, the semi-active homing missile does not reveal itself any more than the passive homing missile, but the source of energy without which it cannot operate does announce itself and can either be jammed or destroyed.

Operational Considerations

Prior to the launching of a homing air-to-air missile it is usual for a certain sequence of events to take place. First the interceptor must be directed quickly to the vicinity of the intruder so that the pilot can either see the target or detect it by his airborne intercept radar. This requires a complex ground installation of acquisition equipment, tracking radars, and computers, commonly referred to as a GCI station. In addition to the radar in the interceptor, a complex array of electronic equipment called the fire control system is used to aid the pilot in the selection and launching of his missiles. The missile cannot be launched unless the interceptor is on a proper missile release flight path, the missile can "see" or can lock on to the target, and the target is within range. For every interception there will be a certain acceptable launching zone, which will depend on the tactical situation and such factors as altitude, closing speed, and expected missile performance. When launched within this zone, the missile will have the best chance of effecting a kill.

Since interceptors would normally carry more than one missile under each wing, there is also the problem of choosing and launching the missiles so that the aerodynamic disturbances created by the missiles' departure are at a minimum. To avoid aerodynamic and guidance interference, ripple firing is employed, with the time interval set automatically. If this were not done an infrared homing missile would probably be attracted by the preceding missile's rocket motor, or a radar homing missile by the electromagnetic radiation of the preceding missile. Most missile fire control systems supply the interceptor pilot with steering signals so that he can get his aircraft on an accurate firing run, but as the interceptor and target aircraft speeds increase, these signals will have to be fed directly into the autopilot to eliminate the relatively long response time of the human pilot.

Finally, there are numerous other factors influencing the launching and flight of an air-to-air missile. At the instant of launching a missile, the aircraft's attitude, angles of attack and yaw, can have a significant effect on the initial pitching and yawing motions of the missile, resulting in dispersions from the expected flight path. Dispersion may also be caused by misalignment of the launching pylons or the missile's airframe or fins; or may result from asymmetrical airflow around the missile generated by the aircraft's wing or the launching pylons. The time that the missile remains in such disturbed airflow around the aircraft is dependent on the build-up and magnitude of the boost acceleration which is determined by the rocket motor performance. The flight of a missile depends also to some extent on the effects of altitude and temperature on the burning characteristics and thrust of the rocket motor. Also important is the aerodynamic stability of the missile at the moment of launching but before its controls have been activated. From all this it is obvious that the design and use of a missile weapon system are not simple undertakings. The complexity of factors perhaps accounts for the fact that today, after some ten years of development, there are only four different air-to-air missiles in operational use in the U.S. services.

External Guidance Systems

External systems, such as beam rider and command guidance systems are used in surface-to-air missiles and provide greater operating ranges, but at the expense of accuracy. Because of this they are best used for launching or mid-course guidance, which can be augmented by some form of terminal homing to provide the necessary accuracy. A beam-rider guidance system is one which employs a device within the missile to keep in the centre of a radar beam, the beam being pointed at and automatically tracking the target. Such a system is relatively simple and allows more than one missile to be controlled in the beam simultaneously. Capturing the missile in the beam after launching can be a problem because the beam is very narrow at its point of origin, which usually is also the launching site. At the target the beam is spread out, and it is thus impossible to achieve much accuracy at ranges as great as 25 to 50 miles.

With a command guidance system, the guidance data is transmitted to the missile from outside the

missile. Two tracking radars are required, one to track the target and the other the missile, and in addition there must be a computer which can compute an interception course from target and missile data and generate command signals to be sent by radio to the missile. The missile guidance receiver is extremely simple, but the equipment at the launching site must be complex, and one serious limitation of the system is that a single installation can only handle one interception at any one time.



Ballistic Missiles

Turning to ballistic missiles, we find that the operating problems are no less imposing. As previously mentioned, with the ballistic missile its position in space and its velocity magnitude, and direction at the instant of motor cut-off must be accurately controlled, because from that time on, the missile is on a free-falling ballistic trajectory. Assuming that the locations of both target and launching site are accurately known, and allowing for the fact that the earth is rotating, it should be possible to set in a pre-determined program for the flight of the missile during the powered portion of its trajectory. Unfortunately, however, unpredictable variations in motor thrust plus the effect of winds and other forces can deflect the missile from a predetermined flight path, and thus it is necessary to have a method of making flight path corrections during the powered part of the trajectory.

Command guidance systems to send steering commands to the missile, or completely self-contained inertial guidance systems can be employed. With a command guidance system, since intermediate and intercontinental ballistic missiles climb hundreds of miles during their powered flight, extremely powerful radar and radio would be required. These are in development, but because of their susceptibility to countermeasures and the unreliability of radio contact and inaccuracy of radar location at long ranges, most ballistic missile systems employ inertial guidance. Inertial guidance systems as used in ballistic missiles are completely self-contained, capable of working with complete immunity from enemy counter-measures. Inertial guidance requires the sensing of the accelerations which the vehicle undergoes, from which, if the initial position of the missile launching site is known, the change in the spatial position of the vehicle can be computed.

One type of inertial system employs a gimballed, gyroscopically stabilized platform to establish a co-ordinate system which will be unaffected by manoeuvres of the missile, upon which are mounted three accelerometers. These accelerometers are in effect north-south, east-west and up-down (altitude) sensors, the outputs of which when integrated once will give the velocity, and when integrated twice the position, of the missile in any one of these three directions relative to the starting point. The accelerometers actually measure inertial acceleration plus that due to gravity, and thus gravity must be continuously computed and corrections applied to the measured thrust accelerations. Corrections also have to be made to the orientation of the stable platform to compensate for the effects of motion over the surface of the earth. In addition, the rotation of the earth results in target motion in inertial space during the flight time of the missile, and for this again appropriate corrections must be made. Further, it is necessary to compensate for the somewhat secondary effects of the oblateness of the earth and of disturbances due to local gravity variations over the expected flight path of the missile. All of these corrections are computed and processed by an analog or digital computer carried by the missile. In addition, the computer continuously computes the position and velocity of the missile, compares these values with the pre-determined values set in before

launch, and sends corrective command signals to the control system.

Most ballistic missiles do not employ aerodynamic control surfaces, their flight path being changed by the deflection of the main rocket motor's line of thrust or by the use of auxiliary or "vernier" motors. If the missile is a multi-stage device, each stage would have such thrust control capabilities. While the thrust of the main sustainer motor can be directed by graphite steering vanes in the exhaust stream, the most popular scheme has the rocket motor mounted in a swivel structure that permits tilting the motor through a limited angular travel. Vernier motors are also of this type and serve a multi-fold purpose: just after the launching they can be used to impart initial spin to the missile for stabilization; during the powered portion of the trajectory they can be used to twist or roll the missile into the prescribed trajectory; and just before the main motor is cut off they can be used to correct the forward velocity of the missile.

Problems of Accuracy

The overall accuracy of an inertially guided ballistic missile is seriously dependent on the performance of its guidance components, especially the accelerometers and gyros. For example, gyroscopes whose drift rates are as low as 0.01 degree per hour will cause errors of several thousand feet at the impact point, quite apart from errors resulting from any misalignments which could exist on initial set-up. Or consider the situation where a ballistic missile just before cut-off is travelling at 25,000 feet per second, or approximately 16,500 m.p.h.; a 0.1 percent error in the acceleration measurement would result in an approximate miss distance of 500 feet.

Obviously the exact location of the target with respect to the launching point must be known. Unfortunately, the best available cartography does not give the distance between remotely separated locations, such as New York and Moscow, to the required degree of accuracy. Information obtained from IGY activities and the satellites should improve the situation, but as an example of the difficulty, it was not until 1954 that the distance across the Atlantic was determined within an accuracy of 1,000 feet. Although the location of a land-based launching site is usually known accurately, the location problem is considerably more difficult if the base is a moving one such as a submarine. To launch a ballistic missile from a submarine against a land target would necessitate the submarine carrying a complex array of navigational and fire control computation equipment. The navigational computer, operating on data obtained probably by inertial devices, would constantly compute the submarine's position and the information would be fed into the fire control computer, where target location data, and data on the vehicle's speed and relative motion would be added. Just prior to launching, the outputs of this computer – which would be the desired trajectory and velocity information – would be fed into the guidance computer in the missile.

The accuracy needed in a ballistic missile depends on the type of warhead it carries. Ballistic missiles with atomic warheads must have an accuracy of about one nautical mile circular error to be effective. Considering that a heading error of one minute of arc, produced either by the misalignment of the inertial platform or set in when "aiming" the missile, corresponds to a position error which increases at a rate of 0.28 miles for every thousand miles travelled, and noting the magnitude of some of the errors already mentioned as being typical of contemporary inertial components, it is obvious that it would be extremely difficult to achieve this one mile accuracy. However with a thermonuclear or hydrogen warhead the accuracy can be considerably less, and thus it is the thermonuclear warhead that makes the intercontinental ballistic missile a sound albeit expensive proposition.

Airframe Design

No discussion on ballistic missiles would be complete without some mention of the problems associated with the design of its airframe, in particular its nose cone. Proper consideration must be given to the effects on the main airframe of internal pressure, aerodynamic and engine thrust loads, and high skin temperatures. Materials which are capable of withstanding high temperatures, such as certain alloys or ceramics, are not always suitable for structural use, so that higher strength but lower temperature materials must be used together with some form of internal cooling.

Although skin temperatures can mount to around 1000°F during the boost phase of the flight, it is during re-entry that temperatures on the surface of the nose cone rise to 5000°F and more. The time for re-entry is usually less than two minutes, but since the nose cone carries the warhead, arming mechanism and fuse, protection from the heat is a necessity. Besides the heating problem, on re-entering the atmosphere the cone decelerates with extreme rapidity, imposing a severe mechanical loading problem on the structure. For the most part, the heating problem was solved when it was discovered

that a very blunt, high drag shape would expend much of the great kinetic energy as pressure drag rather than as a skin friction drag. In this way, up to 90 percent of the heat is radiated back to the atmosphere, leaving the skin temperature many thousand degrees lower than that of the boundary layer region where temperatures up to 12000°F exist. The only adequate nose cone cooling system that shows real promise involves the use of a material that will melt, vapourize, or sublime upon absorbing heat at the surface in such a way that the material underneath stays comparatively cool and retains its strength. Ceramics seem to be the most promising materials for this, but reinforced plastics are also being considered due to the difficulty of manufacturing large ceramic nose cones.

Reliability

A high accuracy system with poor reliability will result in few hits. Likewise, a low accuracy system with high reliability also results in few hits. Usually, greater accuracy means increased complexity and less reliability. Therefore, the best weapon system is usually a compromise between accuracy and reliability. However guided missile components must be more reliable than those used in aircraft, for while in an aircraft the human pilot can often correct a component's failure, in a missile no such correction can be made. Take the example of the missile's guidance and control components. Most of the components are in series and failure of any one component can cause the missile to miss the target. However the reliability of a missile depends not upon the *average* but upon the *product* of the reliability of each of the components and it is easy to calculate that, for a missile containing 100 components, each 99 percent reliable, the co-operative use of these 100 components will reduce the overall reliability of the system to 36 percent.

To the military commander, this reliability figure has little meaning. As far as he is concerned, even if a missile performs well after launching, it is useless if it cannot be fired at the exact time required by the military situation. What he is interested in is tactical reliability, which includes the reliability of the military operators as well as the reliability of the weapon. While the user can ensure that the reliability of the operators is maintained and improved by training, it is primarily up to the missile designer to increase reliability by incorporating reliable components and designs and by reducing complexity. The ways of increasing reliability range from the employment of circuit redundancy in critical components to the use of gold plating on printed circuit boards to assure the best electrical conductivity under adverse environmental conditions. The components used must be capable of withstanding severe environmental storage and operating conditions, such as high and low temperatures, altitude shock, sustained acceleration, and vibration, and although the missile is a one shot weapon, each item must have a long life expectancy. This is important because in operations missiles could be prepared for firing, but not fired, quite frequently over a considerable period of time. Even missiles in storage require regular tests to prevent electrical and mechanical components from developing hysteresis and aging effects or being affected by corrosion.



The supporting facilities for missiles will be by no means modest. As an example, a squadron of one intermediate range missile expected to be operational in 1960 will need more than 150 items of major supporting equipment, including such things as launching platforms, fuelling facilities, liquid oxygen generating plants, check-out equipment, and training equipment. Nor will the cost be low. We know that the cost of maintaining electronic equipment each year is about twice the original cost of the equipment, and that one third of military operating expenses are for maintenance. Similar factors can probably be applied to guided missiles since most of them depend so much upon electronic components and systems. Maintenance of complex missile equipment involves the detection and correcting of a malfunction, all of which must be accomplished within a given period of time. To speed up maintenance, designs must allow for easy access to and removal of items, and special tactical field test equipment must be available to allow the speedy checking out of the units. To be effective such maintenance must be able to be carried out at the user's site, and — of considerable importance — by relatively unskilled technicians.

This brief survey has of necessity touched only on the highlights of a very large and complicated subject. From the complexity of the field, and the technical problems that have yet to be overcome, it seems unlikely that the oft-heralded missile age will be ushered in overnight. At the same time, certain types of missiles are already operational and others soon will be, and it is of prime importance that military thinking be directed now toward studying the employment of this revolutionary family of weapons.

Missile Age Forces

COLONEL HARVEY W. C. SHELTON

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ONE of the messier aspects of the missile age is that we shall not pass cleanly into it. To be sure it offers us challenges enough in itself but the melancholy fact is that we must add to those challenges others left over from the waning age preceding, as well as a special body of problems growing directly out of the mixture, *per se*, of two ages. It follows that a consideration of missile age forces – that is, the kind and amount of forces we shall need in the missile age, and how we shall use them – must deal with all of the circumstances one can foresee in the era when the missile will be a routine purveyor of fire power. The problem can best perhaps be attacked in terms of the spectrum of threat we face. It is, after all, only the array of threat that requires us to have military force at all.

As will become apparent in the passages to follow, the total threat considered is that which faces the entire Free World. Largely, however, the discussion of how we counter it will be from the point of view of the Atlantic Community.

The Threat

The underlying threat to the Free World and the primary threat to any of its member nations is Militant Communism. By the term Militant Communism is meant that mass of sociological theory and ideology through which the entire world is to be formed into a "classless society" dominated by a "dictatorship of the proletariat" in the Russian pattern. The focal point of this underlying threat is the U.S.S.R., bolstered somewhat by its satellites and Red China. Militant Communism's doctrine is such that this underlying threat is unique in modern times and more menacing than has been faced by any recent coalition such as the Free World. The underlying threat may be manifested in several forms of conflict, a classification of which follows.

Enduring War

There is an abiding conflict joined, by Militant Communism – with global domination as the ultimate objective – and by the Free World – with liquidation of that threat as its ultimate objective. Here termed Enduring War, this abiding conflict is an envelope of strife in which may be found four types of conflict: Unlimited War, Limited War, Local War, and Cold War. At least one of these latter will be in progress as long as Enduring War continues. Enduring War will continue until the ultimate objective of one side (the ultimate objectives are, of course, mutually exclusive) has been achieved by any of many possible developments.

Unlimited War

This is the desperate, uninhibited exchange of massive firepower, primarily between the U.S. and the U.S.S.R. as power centres of their respective camps. Its objectives must be the same ultimate ones of the Enduring War. In these days of mutual nuclear kill capability, no one wins this war; quite likely neither adversary survives it in any meaningful sense. It therefore will not be initiated for any logical reason; only mad desperation or tragic miscalculation can explain its outbreak.

Limited War

This is a conflict in which the basic antagonism between Militant Communism and the Free World is the central (though likely not the ostensible) issue, but in which both sides – and they may well be proxies of the U.S.S.R. and the Atlantic Community – pursue objectives distinctly more limited than their ultimate ones. There will be many implied and *de facto* limits in such a war – geography, weapons, national forces admittedly engaged, etc. – but the *governing* limits will be those imposed by objectives.

To keep the conflict limited, as clearly serves the interests of both sides, objectives must be chosen and pursued with delicacy. It is unlikely that the objectives can include anything remotely resembling "decisive victory" in the classical sense.

Local War

This is a conflict whose central issue and initial adversaries have no significant association with the basic conflict between Militant Communism and the Free World. It is included in the envelope of Enduring War only because there are many possibilities of its occurring and involving the Atlantic Community, particularly where there is likelihood of a Militant Communist intervention that could result in yet another communist conquest.

THE UNLIMITED WAR

STRATEGIC EQUATION

$$\frac{\text{ATLANTIC COMMUNITY}}{\text{MILITANT COMMUNISM}} = \text{OFFENSE}_{\text{Overpowering}} + \text{DEFENSE}_{\text{Ineffective}}$$

Cold War

This is a type of conflict that really is not war at all, for it does not involve the admittedly premeditated use of fire power. It must, however, find its place in the envelope of Enduring War because it is in progress and its underlying objective (never lost to the view of Militant Communism) is the same ultimate one for each side of the Enduring War. It can be thought of as a special case of the classical play of power politics – special in the sense that only two powers (Militant Communism and the Free World) contest an issue which transcends all others.

FORCES FOR UNLIMITED WAR

The strategic equation of forces of the Free World versus forces of Militant Communism, with respect to Unlimited War, can be stated today as an overpowering offense plus a relatively ineffective defense, *vis a vis* an offense and a defense that are more or less equally overpowering and ineffective, respectively. Revolutionary as space weapons are in terms of massive fire power and associated shock value, reaction time, surprise potential, and other such classical military factors, their impact on the basic strategic equation is apt to be minor, even negligible. Even if one side achieves – for example – a substantial operational ICBM force before the other side does, the strategic equation is not significantly altered as long as the ICBM force cannot be used to kill the opposing bomber force before the latter can strike. Certainly the strategic equation is essentially static if both sides achieve an ICBM force (and nothing more of significance) on about the same schedule. The essence of the strategic equation is the relationship of offense to defense. As long as defense (including a pre-emptive strike) is relatively so powerless, the preponderance and the character of the offense relative to the *opposing* offense are rather unimportant. It is only when the defense (still defined as just above) assumes a promise of decisively blunting its opposing offense that a change in the strategic equation is heralded. When and if that occurs it may again be possible, as it has been in the past, to "win" an Unlimited War.

Size and Composition of Unlimited War Forces

There are a number of things that can be done by manned bombers that cannot be done by ballistic missiles (presumed herein to be the most promising of unmanned, long-ranged attack systems), such as attack of imprecisely located or precisely defined targets. There is nothing today that can be done by ballistic missiles that cannot also be done by manned bombers, except perhaps the attack of heavily defended targets with desirable (not to say tolerable) attrition. There is, therefore, no immediate reason to add ballistic missiles to our offensive force except the likelihood that the state of the defensive art will in time make the relative invulnerability of the ballistic missile much more attractive. As it turns out the latter is reason enough, but the point to be made is that as far ahead as one can see the ballistic missiles not only *can* be, but *must* be complementary to a manned bomber force, rather than substitutes therefor.

There may come a time when the conclusion of the preceding paragraph will no longer have the same validity. If offensive force invulnerability reaches a point where the offensive counter force, no matter what its composition and capability, has no prospect of significantly reducing the blow threatened (or already sustained), then the superiority of manned bombers in a counter-force operation loses much of its significance. Such a circumstance approaches very closely indeed the *Gotterdammerung* and the fact that a ballistic missile force could not be used "surgically" would not detract from whatever utility it had. Nor would the fact that, if it were used it would be in comparatively "blind"

fashion, detract from the deterrent value of an all-ICBM force.

It is not at all clear that any space hardware other than ballistic missiles holds any promise of tipping the strategic equation. Earth satellites, for example, presage no offensive breakthrough; there is no inherent advantage in shooting *down* at something from space as opposed to shooting from earth, *over* at something also on earth. The establishment of outposts on other planets may well contribute to control of those planets and surrounding space, but there seems no reason to believe that it would settle any conflicts on earth, any more than XVII Century Spanish missions in California intimidated Great Britain in Europe. There are many reasons why we must explore space, but earth strategy is probably not one of them.

On the other hand earth satellites offer real promise of defensive capacity. Given satellites of payload larger than, but in the realm of, those demonstrably attainable, the state of other arts (infra-red detection, electronics, optics, etc.) suggests fascinating possibilities for reconnaissance, particularly when some portion of a "system" or "force" can be manned. Disarmament in significant steps, now almost as infeasible as it is fondly hoped for, might become a thoroughly practical possibility if no one could conceal even for hours such things as full marshalling yards, airplane-covered staging bases, evacuated cities, missiles being fueled, etc. Even were disarmament not in the cards, the increased warning that such a system could provide would make the nuclear stalemate far more endurable and manageable.

Until or unless that comes about, the role of forces for Unlimited War must be primarily offensive and must be designed mutually to deter their use through the certainty that the damage they can inflict will be intolerable in spite of any defensive measures that can be brought to bear.

For some years to come, as has already been noted, such forces must include a measure of strength built around the ballistic missile, *in addition to* manned bomber forces in the pattern and in about the effective strength established as the norm by the U.S. between World War II and the present. It almost certainly will be necessary to provide at least one more generation of manned bombers, quite possibly two or three. It is entirely possible that a decade or two hence the development of the ballistic missile art and the still-necessary evolution of the manned bomber will have married to produce something now best described as a manned ballistic missile.

Provision of such dual-character force is compellingly necessary, but undoubtedly will be expensive. Its composition at any time will be based on necessarily prior, and inevitably uninformed, judgments. There is real danger that such faulty judgment could commit more resources than we had, resulting in inadequate forces, or that other judgment — in a last-minute effort to avert such over-commitment — could cut off resources and leave us betwixt-and-between a development sequence, thus disastrously deprived of ready capability.

There are two basic but dynamic factors which must be watched to guide our resolution of the dilemma. One is the objective of the Unlimited War force, already touched on above: as long as counter-force strategy is possible we need counter-force (i.e., relatively precise) capability. The second is the yield-accuracy-dependability relationship of missiles as they are developed. As that relationship approaches that of manned bombers the advantage of the latter steadily shrinks, leaving only one last, clear (but not necessarily governing) advantage: the last-minute applicability of human judgment.

There is one other basic, but not so dynamic, factor in solving the dilemma of what mix and how much force, and it is nebulous in the extreme. As has already been noted, it almost certainly is not possible to "win" Unlimited War. As will be developed (albeit sketchily) below, our best hope for assuming a necessary offensive in grand strategy lies more in the realm of Limited and Local, and still more in the realm of Cold, War. Since there will always be finite limits to resources available, it follows that there not only is a necessary "trade-off" — the purchase of advantages of one by "trading off" advantages of the other — between missile and manned forces for *Unlimited War,* there is another necessary trade-off between *Unlimited* and *Limited, Local* and *Cold* War forces.

Now; there is a vast premium on limiting the forces for these various forms of threat to the absolute determinable minimum. And there is — at least definitively — a vast difference between that which will "win" a "winnable" Unlimited War and that which will "deter" an "unwinnable" Unlimited War. Therefore it becomes extremely important that we know at any given time *if* Unlimited War can be "won". To the extent that we are certain it cannot, we need only the presumably more modest force that will deter it, i.e., *insure* that it cannot be "won". Recognition of this painful fact may spare us the profligate extravagance of "an overwhelming superiority" for its own sake and of no real value.

Deployment of Unlimited War Forces

Three factors govern the deployment of Unlimited War forces: Economy, Survivability, and Invincibility. Because Economy need not, and cannot, be a limiting factor, it clearly is of lesser importance. Between the other two no choice of priority can be made.

As to economy, the only generalized dictum that can be made is that, all other (i.e., survivability-invincibility) considerations being determinably equal, the most economical deployment is the most desirable. There can be a critical difference between the most and the least economical deployment, so this determination is well worth the making.

As to survivability, the pertinent platitude is that the most potent force imaginable is useless if it can be negated by forces that can be brought to bear against it; by contrast, a rather modest force may turn the trick if it can perform its mission no matter what forces are arrayed against it. Just whether these truisms dictate overseas bases, underground installations, some of both, or some other measure is beyond the scope of this paper. The meaningful assertion is that these truisms are true and that, given a particular set of circumstances, their dictates are no mystery.

Closely allied to survivability is invincibility, and its consideration yields a related platitude: a deterrent force, or (deterrence having failed) counter-force force is *valuable* only to the extent that it is *predictably* valuable, i.e., that it will have a previously assessed effect regardless of the effects of chance and opposing counter-measures. Again, adherence to this truism may or may not dictate overseas (i.e., widely dispersed) bases, or various other measures. Whether it does or not depends on strike-force-vulnerability factors, defense-capability factors, and various other things which, in a given set of circumstances, can be figured out. Here, no.

Employment of Unlimited War Forces

Probably never in the history of warfare have forces been employed more unequivocally than would be the forces of an Unlimited War. As the pace of any such war is foreordained by the character of modern weapon systems, the play of combat *must* be pre-planned, through and including the "decisive" phase (though it must be recognized that perhaps the only thing really "decided" would be that – in the American idiom – all concerned have "cashed in their chips"). In the classic sense there is no room for the play of strategy after the first shot is fired in anger. Strategy must have gone before, for command judgment thereafter can encompass only the play of tactics. This view minimizes the significance of the so-called "broken-back" war, whose possibility the author must recognize but whose maximum foreseeable importance is relegated to that of "a noble gesture".

FORCES FOR LIMITED WAR

Rarely in history have defensive *grand* strategies achieved their objective and there seems no reason to suppose that the grand strategy we choose for Enduring War can be an exception to the rule. It must therefore have an offensive character, even though the objective it serves is reactive rather than acquisitive.

This grand strategy must encompass (and shape) the strategies we devise for Unlimited, Limited, Local and Cold War which latter, between them, must somehow lend the necessary offensive character to the whole. We have seen, however, that Unlimited War almost certainly cannot be won, hence offers no hope for a confident offensive. Being somewhat more manageable, Limited War offers somewhat more hope; not enough to tempt toward the initiation of Limited War, but enough to plan a strategy for it – should it occur – that could edge us toward our ultimate objective.

The opportunity for assuming a grand strategic offensive in a Limited War lies in the selection and pursuit of its objectives, and it is, of course, the objectives which define the military tasks to be performed, which in turn dictate the forces required. The number one objective in any Limited War must be to keep the war limited. The others will vary with the locale and circumstances, but will include such things as frustrating the communist aggression (which is the likeliest cause of a Limited War), punishing the aggressor enough to discourage recurrence but not enough to prompt unreasoned extension of the conflict, rolling back or perforating the iron or bamboo curtain, establishing in a particular locale a viable government acceptable to the Free World, etc.

If Limited War objectives have to be treated here generally and conjecturally, the military tasks associated with them are even more elusive. Again, however, examples suggest themselves: speedy destruction of classical military forces; effective and timely destruction or neutralization of non-classical (i.e., guerrilla, subversive, etc.) forces, restorative or organizational occupation, punitive destruction of real estate, neutralization or denial of areas and facilities, etc.

Composition of Limited War Forces

Perusing the above list of Limited War military tasks, and extending it in one's imagination, it soon

becomes apparent that these are space age problems to be solved but that space weapons do not offer much to the solution of most of them. An earlier section treated how readily the space weapons one can foresee adapt themselves to Unlimited War forces. There are at least two factors mitigating against the use of Unlimited War forces, including their intimately associated space weapons, in Limited War. The first, touched on just above, is that the types of forces ideally suited to Unlimited War simply are not very effective at many of the tasks to be performed in a Limited War. The second is that, because Unlimited War forces are frightfully expensive, we shall be under sharp constraint at any given time to provide the minimum that will deter their use (or failing that, come as near to winning as the state of the art permits). Any appreciable diminution of the deterrent force, for Limited War application, will jeopardize the number one objective of any Limited War, to keep the war limited. Further, Unlimited War forces frequently cannot be used unambiguously for Limited War tasks. There is some danger that their employment, with no matter what limited intent, might through enemy misunderstanding precipitate extension of the conflict.

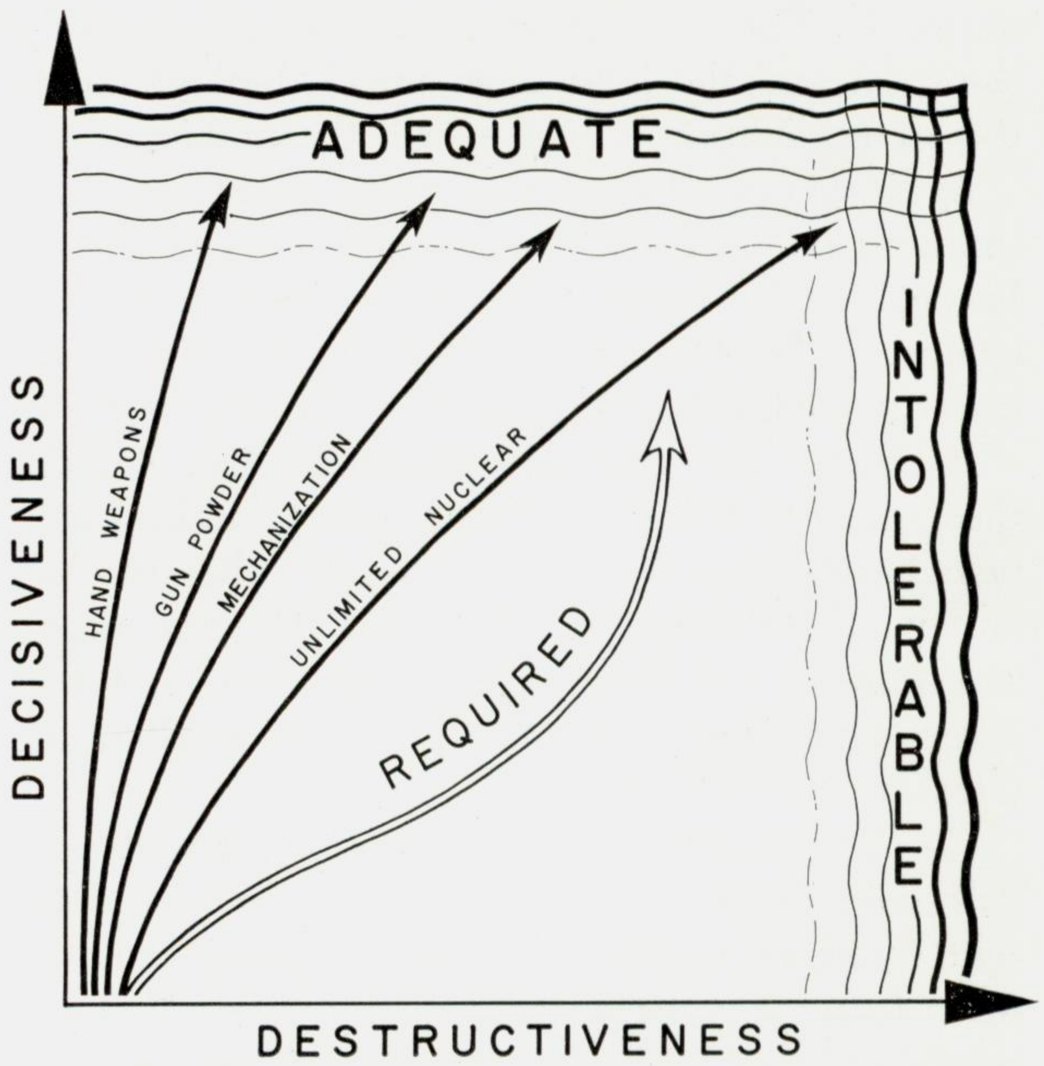
It follows then, that in the space age we contemplate, the forces with which we propose to deal with the threat of Limited War must, bye and large, be different from those provided to deal with the threat of Unlimited War. The distinction must be one both of identification and of composition.

Any quantitative analysis and any explicit qualitative analysis of required Limited War forces is beyond the scope of such a short piece as this, but some general observations can be made that tend to define their composition and, to a lesser extent, their numbers.

It may be noted, for example, that it is not at all feasible to consider matching in kind and number the vast variety of communist and communist-dominated forces which personify the Limited War threat in widely scattered parts of the world. The Atlantic Community, and the U.S. in particular, must continue to foster regional alliances providing indigenous forces at the points of threat. There are, however, many and well-known limits to the capability of such forces and with few or no exceptions they cannot alone counter the threat they face. They must be bolstered by Atlantic Community capability.

Recognizing that space weapons are not to be a major contribution to this required bolstering capability is not to say that our other available weapon systems and forces are or will remain adequate. They are not. They are not numerous enough to be in place at all threatened places. They are not mobile enough to react at a point of acute threat with timely decisiveness. They are not trained and equipped to deal with some of the tasks to be performed. The technology that is producing the space age must be leaned upon heavily to remedy existing and developing deficiencies.

TRENDS IN WARFARE



Throughout military history we have tended to equate decisiveness with destructiveness, although it has been philosophically recognized that destructiveness *per se* has no virtue. The nature and effects of weapons, simply, have suggested this equation. We now see a circumstance wherein decisiveness, before reaching adequacy, has approached a degree of destructiveness that is intolerable or otherwise impractical. There is required some means of reversing that trend, of achieving more decisiveness with less destructiveness.

Again, Clausewitzian doctrine teaches that strategic decision is achieved through the destruction, capture, or neutralization of opposing force. As stated above, in many cases destruction is denied us as a means. Capture is often not feasible because the enemy is too numerous or too ill-defined. There must therefore be more reliance on neutralization. The principal military technique to this end is denial.

Denial weapons of any of several sorts could be exploited far more than they have been. Present and predictable technology, for instance, should be able

to produce highly sophisticated land mines, capable of being laid in many and expeditious fashions, to deny to an enemy a variety of areas or activities. Biological and chemical agents likewise have great promise as denial agents and that promise should not go unexplored because of the rather unreasoning dismissal of such weaponry as "horror weapons". Actually, it is the public image of gruesome plagues and awesomely lethal nerve gases and the like that account for the bad name of BW-CW. In other specialized circumstances radiological agents, coupled with a properly publicized ultimatum, perhaps could have great utility in denying to an enemy force or activity a city or area for a selectable and predictable period of time.

There is a requirement, in connection with Limited War, for paramilitary forces of a type not available today, but suggested by several precedents. To name a few, there are the military government structure established in Germany by the Allies after World War II, the Air Control operations by the R.A.F. in Aden during the early 1920's, and contributions to civil stability in Nicaragua by the U.S. Marines during the mid-1920's. The purposes of such forces would be to recognize and foil overt and covert communist activity, foster — and provide as necessary — civil stability, bolster and support acceptable indigenous administration, and the like. Generally such forces should be and seem as unmilitary as possible. The subleties and scope of their tasks involve more than any normal military force, without special training, skills and equipment, could dispatch simply "in addition to their other duties".

For virtually all types of forces that might be required in Limited War, there is required mobility and compactness vastly greater than is now available. Technology has a wealth of enabling developments to offer, ranging through such random possibilities as VTOL fighter-bombers, "airborne jeeps", water-based air logistic carriers, portable nuclear power plants, etc.

Deployment and Employment of Limited War Forces

The preceding passage had to be more of an imagination-tickler than an inventory of the weapon systems and the forces that are tailored for the Limited War threat. Even so it pictures a complex, highly specialized, highly trained force that inevitably will be expensive. In competition — economically — with the Unlimited War force it must be as modestly priced as ingenuity can make it. As a general assertion, mobility (both local and global) can be bought more cheaply than can numbers, particularly if the number must — as an alternative to mobility — be fixedly deployed to cover the seven thousand nautical mile arc, from North Africa through Pakistan to Japan, along which Limited War threatens continuously to some degree.

It follows that the deployment of the Limited War force must be central, this deployment combining with truly quick availability and greatly flexible adaptability. The scheme of maneuver is that a screen of indigenous forces of optimum* capability, accompanied by token Atlantic Community forces, together provide an *appreciable* delay to aggressive action and a nucleus of control for more decisive reaction. The central Limited Force, must provide the bone and sinew that can frustrate a determined aggression. Just *how* central this "instant reserve" can be depends mainly on the reaction time and mobility that can be built into it. The criteria are that it must be able to provide massive *presence* and *markedly increased resistance* with, say, a dozen hours, and be able dramatically to start turning the tide of the most determined battle within, say, three days. There is a clear trade-off between mobility and flexibility on the one hand, and consolidation of deployment on the other. The more mobility and flexibility can be provided by technology and straightforward preparation, the less dispersion and diversification is necessary to meet the reaction criteria, hence the more economy through centralization can be achieved.

Forces for Local War

Local War differs from Limited War in that there is no *communist* aggression to thwart or to punish (if there is the conflict has become Limited War by these definitions). They may, of course, be other-than-communist aggression, and there probably will be. If so some punitive, as well as restorative, action may be necessary to lessen the likelihood of recurrence.

The opportunities for exploiting Local War and for seizing a limited initiative in the context of the Enduring War are few. They consist for the most part, if they occur at all, of opportunities to lessen communism's prestige through foiling its successful intervention. Any such opportunities for initiative, however, will be accompanied by relatively little risk.

Should the Atlantic Community find it necessary to intervene in a Local War, its objectives obviously will be quite different from those for Limited War. *Military* objectives on the other hand are apt to be quite similar, and military tasks to be performed

* i.e., consistent with manpower and other economic facts of life, etc.

will be of essentially the same variety, varying if at all only in scope and intensity.

It follows that no distinctive or additional forces need be provided for the Local War contingency, beyond those already recognized as necessary for preventing or dealing with Limited War.

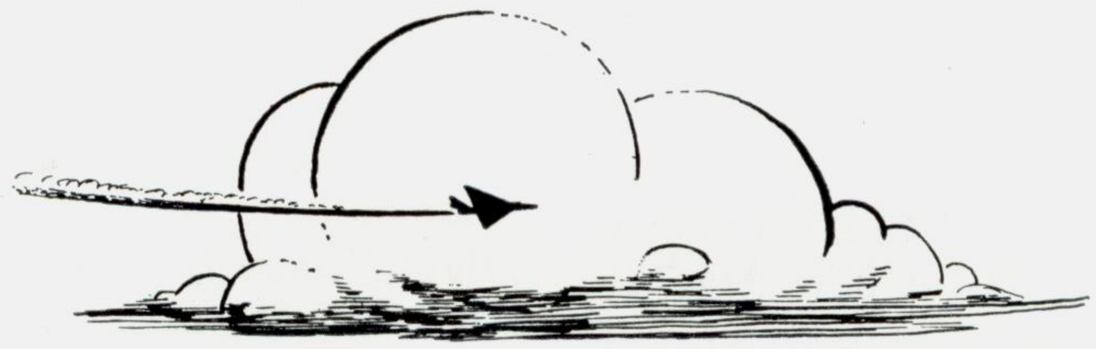
Forces in Cold War

The Cold War is not in essence a military undertaking. Nevertheless, the contribution that military force can make to Cold War strategy is both massive and elusive; it is far more psychological than material, not so much forces we will acquire as things we will do with or say about forces we already have because they are otherwise required.

There may well be a great utility in a 1965 counterpart of President Theodore Roosevelt's "Great White Fleet", as an unequivocally peaceful show of force. If so, what is needed is only a coat of white paint and an appropriate advertising campaign, rather than any new and different military hardware and associated personnel. If met, the demands for forces for Unlimited and Limited War will satisfy the force requirements for Cold War.

Conclusion

The Space Age, coincidentally for the most part, confronts the Atlantic Community with a military threat of unparalleled complexity. Among our sources of hope is the fact that the same technology which is producing the Space Age offers unparalleled opportunities for fashioning broadly effective military force. There is no valid reason why we cannot have the force that we must have.



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Western Schools of Thought in Defence

AIR VICE-MARSHAL E. J. KINGSTON-McCLOUGHRY

Air Vice-Marshal E. J. Kingston-McCloughry, C.B., C.B.E., D.S.O., D.F.C., R.A.F. (Retired), is a widely-known authority on contemporary military affairs. He has written numerous articles on strategy and air operations, and is author of the books "Winged Warfare" (1937), "War in Three Dimensions" (1949), "The Direction of War" (1955), and "Global Strategy" (1957).

INTERNATIONAL affairs provide a mirror reflecting contemporaneous history but they are more immediately the public expression of the strategic fears, inhibitions, and ambitions of nations whether they are in amity or enmity with each other. National strategy will be meaningless unless it is seen against this wider background. At the present time, however, the peculiarly baffling character of the international scene has much of its origin in a confusion of defence policy and strategy. Instead of these two facets of national policy being allotted their true and relative importance with, at the same time, a realistic recognition of their interdependence, the authors of defence policy and strategy are each obsessed with the difficulty of procuring the means to make their own measures immediately effective. In so many ways Western policy and Western strategy give the impression of being unrelated, or more correctly, unco-ordinated. First the Western allies lean heavily on policy and diplomacy and a willingness to negotiate, then they lean just as heavily on the military scale, thus distorting what at any time is an extremely delicate balance.

Defence policy embodies the elements of strategy and while it expresses strategy in political terms it also dictates its dimensions in military terms. Policy and strategy are thus more than ever complementary to each other in a flexible two-way, and continuously evolving sense at all stages of action: that is, in the formulation of policy and strategy, in the political implementation of policy and strategy, and finally in the practical application of policy and strategy. Today the issues involved are so great that the responsibility for the execution of defence policy, in the realm of strategy, is being rapidly abrogated by the political direction. Chiefs of Staff and Commanders-in-Chief will have to submit to a much increased political direction in the execution of their strategy and other military duties. It is thus important for political circles to appreciate the influence and effect of strategy on defence and foreign policy, and vice versa.

It should be remembered that defence problems as a whole must be considered in conjunction with other governmental affairs. These include Finance policy, Foreign policy, Trade policy, Home policy including manpower, and the policy of Scientific Development and Technology. These are always in relation to each other and are often affected by that relation, both individually and collectively they all have their effect on defence policy. In framing its defence policy a nation has also to solve a variety of additional problems. First, it must assess what forces it would require at the outbreak and during the course of an assumed, total, limited, local or cold war, and then deduce the minimum peacetime preparations to ensure the availability of the appropriate forces for each category of war. Concurrently, and even more important, it must consider how far these several preparations or even alternatives thereto will actually prevent war.

These are illustrations of national difficulties and give an indication of the extent of allied difficulty. We take some pride in the diversity of the West, and even consider disagreement, pressure groups, national and service prejudice to be the very touchstone of democracy. There is a general optimistic hope that, like the new stage show, everything will be right on the night. We cannot, however, afford to be quite so casual; and it is well to be aware that at this point in history the political problems so overlap the military that policy should take precedence over strategy. This is not simply a national concern but it is an international one. In the West this lack of cohesion and integration is our chief weakness while Russia negotiates and manipulates the pieces on the chessboard from a position of great political power joined to a formidable military force.

The Specific War Threat

We are unlikely to get far in understanding the modern problems and various schools of thought which range round Western defence policy and strategy unless we are clear about the specific war

threat and its possible consequences in the world today. It is also essential to appreciate, prepare for, and negate the specific political threat. The whole subject stems from two main issues:

(a) The fear of total war. This affects both aggressor and defender in view of the possible direct and aftermath effects of nuclear weapons on both sides as well as on the whole of civilization.

(b) Whatever lies behind international frictions, whether economics or national pride, world troubles are expressed finally in ideological terms. On the one hand, there is the democratic way of life in the free countries, and on the other, the totalitarian way of the Communist countries. The two systems, we are told, are inimical and unlikely ever to be reconciled, each by its essential nature cancelling out the other. The absence of any possible compromise between the two is emphasised by the explicit determination of the Russians to extend their creed of Communism to the whole world. There are some people who believe that, in the end, one way of life or the other must go under. It is conceivable of course that both sides may be transformed: though that is not a view to recommend itself to the dogmatists on either side, it may be something which the nature of war and the weapons of war will impose on both.

The initial problem is the clarification of the political and military aspects of Western thought. These two facets have first to be disentangled but not divorced. The current situation is unique in history; and solutions to the Western impasse range from the doctrine of massive retaliation to withdrawal in Europe and unilateral disarmament of nuclear weapons. One of these possibilities can be discounted, and while by the nature of the subject and the space allowed, this review of the issues can only at best be somewhat superficial, it is nevertheless necessary to examine the implications of several of these ideas.

Massive Retaliation and Total War

It is noticeable that throughout the whole range of the ideas just mentioned the balance of military and political thought is uneven. The military aspect is predominant in the massive retaliation approach while in the case of unilateral nuclear disarmament in the United Kingdom the political concept is uppermost. To say that the real solution is in the middle of this range of ideas where the politico-military balance seems complete, is much too simple. Even within a short space of time events may change the picture so drastically that the emphasis on either a military or a political approach may become irrelevant and have to be modified or changed.

Extreme views thus lend themselves to a hardening of the arteries of strategic or political thought and encourage a dangerous static condition which makes it difficult (figuratively) to turn round and view the picture afresh. The total war school believes in nothing less than the deterrent based on a large stockpile of nuclear weapons and the means of delivering them from surrounding secure bases, and at short notice into the heartland of the aggressor. They do not believe in the possibilities of a graduated deterrent or that any limited war would remain limited but that it must of necessity lead to total global war.

The view has been expressed that British and American forces should withdraw altogether from an area which is costing both nations a great deal of money to 'defend' politically and to retire behind a nuclear curtain. This is a return to a policy of isolation and political dark ages from which the United Kingdom and the United States have only lately emerged. It would be astonishing if two World Wars originating in Europe had not taught us that we cannot isolate ourselves from her destiny. This school of thought has much in it that is irrational and emotional. It is, to say the least, naive to suppose that there are only two courses, that is, total peace or total war. Yet it is against such a background of thought that United States policy has become welded to the use of, or the deterrent value of, nuclear weapons to the exclusion of lesser concepts of defence. It is therefore not surprising if a certain muddle arises in ideas on relative importance of political and military advantages in withdrawal in Europe.

Disengagement or Withdrawal in Europe

Here policy and strategy are ineradicably mixed. It may seem at first glance that strategically the Western countries have everything to lose in any withdrawal and everything to gain by standing fast. Nevertheless it could well be that the political advantages of withdrawal might be so overwhelming as to discount any military advantages which may accrue from a standfast decision. Actually this is not so.

In substance withdrawal means defining new frontiers which might reduce some of the geograph-

ical and possibly national causes of friction and so lower world tension. It does not, however, offer any strategy for peace nor any method which can be applied generally. Indeed, it could only be applied in selected regions and it would seem that in most troubled areas it would create more new problems than it would solve. A genuine Russian desire to make such a policy work would be essential. Consideration of the Rapacki Plan for a nuclear free area in Europe is not really very rewarding because arms limitation, inspection or the thinning out of troops leaves the political situation unchanged. A nuclear free zone in central Europe means nothing in terms of intercontinental ballistic missiles: here the military situation, from the point of view of the larger powers, remains unaltered.

There are several facets of disengagement each carrying its own problems like a hedgehog his prickles:

A Disarmed Central Zone. This would necessitate an unarmed Germany whose frontiers would be guaranteed by a European security pact: but this emasculated position is something which the Germans would find most unwelcome. It would diminish considerably the influence she could reasonably be expected to have on her neighbours. Politically, Germany is dynamite, and as time passes is unlikely to be content with a back seat. Despite a European security pact and the installation of early warning devices such a neutral zone would place almost insuperable difficulties on the role of NATO forces.

An Armed Central Zone. This posits not a military vacuum but instead an armed Germany which must inevitably cause some anxiety to both East and West. An armed Germany in this situation must be a strong Germany since if she were weak she would be open to infiltration and subversion: and yet a strong Germany might create tensions every bit as dangerous as those we are trying to solve. A pro NATO force composed of East European countries like Poland, Czechoslovakia and Hungary, including a re-unified Germany, as visualised in some quarters, is a dream which bears little resemblance to reality. A rearmed Germany must inevitably dominate whatever pro-Western alliance there could be in Europe.

Complete Withdrawal from Europe. Complete withdrawal of United States and United Kingdom forces from the Continent implies a belief in the continued effectiveness of the Deterrent, but without adequate land forces a move of this kind would expose Western Europe to gradual subjugation without the United States even having a justifiable cause to launch her vast power of nuclear weapons against Russia or against Russian forces in a limited war in Europe.

Mr. Kennan's motive in suggesting such a withdrawal is more concerned with the political advantages though he is not unmindful of the military consequences. In this respect he advocates the formation of strong national conventional forces: the 'citizen' army of other American commentators. Mr. Kennan does not think that the arming of Western Continental allies with nuclear weapons will facilitate any Russian withdrawal or German re-unification, ever. If this is true, and it is an opinion which we must respect, then it puts the West in an awkward position because the logical end of the Western Deterrent concept is the rearming of Germany with nuclear weapons.

Containment and the Citizen Army

The tendency in NATO to break apart takes its rise in the prime difficulty of resolving the military and political dilemmas, both national and international. The decay of enthusiasm for the objects of NATO is illustrated by the efforts of both the United Kingdom and France to revive their economies by cutting down their forces and tending to limit their commitments. The United States however are trying to renew this enthusiasm by the establishment of tactical nuclear weapons and of intermediate range ballistic missile bases in Western Europe in an effort to replace manpower.

Western strategy is likely to alter when the United States may become directly threatened by the Russian intercontinental ballistic missile. Hitherto the United States has given nuclear protection to Europe, whereas with the establishment of intermediate range ballistic missiles Europe will provide a certain amount of protection to the United States. The flaw in the American attitude today is that while politically the United States might like to see disengagement in Europe she has not thought out the military implications thoroughly enough.

The situation of Europe, that is the political siege of Berlin and the captivity of the East European states creates a growing tension which underlines the present disadvantages of allied occupation. There can be no doubt, however, that the containment policy of the last twelve years, and, among other factors, the creation of NATO, has prevented a Russian domination of Europe. The armies of NATO today are admittedly designed on a less ambitious scale of deterrence. They are concerned to prevent small incidents from gathering momentum or the Communist feeler from becoming a pincer. Thus the real deterrent to wide-spread

Russian aggression in Europe is still the nuclear deterrent.

The problem of containment is not only a European one although that is the area which is most vital. The ramifications of the cold war makes it an intensely political as well as military problem; it is a situation where the military aspects are unequivocal but where the political dangers and solutions are less obvious. There is therefore a great deal that is rewarding in the idea of a citizen army. Support of a citizen army role in NATO could be made to the political front as well as the military. A citizen army could represent part of the deterrent force and deal with infiltration in the cold war. It could certainly aid the standing army during an invasion and support the Home Front in occupation or during a nuclear attack. Finally it would be a valuable aid for any government in the task of rehabilitation after war.

United States Defence Policy

President Eisenhower's recent pronouncement on Defence Organisation was foreshadowed in *The Rockefeller Report: The Military Aspect.* This document outlines with lucidity the Western, and especially the United States' defence impasse, but regretably offers few solutions. The most remarkable passage is the one just mentioned, that on Defence Organisation. Here are outlined three vital defects of defence thinking which are not necessarily peculiar to the United States, but because of her size and vast wealth of resources have become even more pronounced there than elsewhere. It is pointed out that:

(a) the roles of the separate services have become competitive rather than complementary:

(b) the present organisation of the Joint Chiefs of Staff prevents the development of a comprehensive and coherent strategic doctrine for the United States:

(c) the Secretary of Defence beset with inter-Service wrangles is unable to resolve the first tasks of his office, that is, the initiation of high military policy.

This is a profound evaluation of the politico-military situation and takes us at once to the root of the matter: the functional allocation of roles. Modern weapons transcend the traditional roles allocated to the services; and the difficulties of a genuinely integrated national strategy are due to an inability to determine at the highest level what the roles of the services should be. The defects of the Joint Chiefs of Staff and the office of the Secretary of Defence are in part the cause and in part are aggravated by this situation.

It is not only the specific roles of the services or the overlapping and duplication of the weapon systems which are here criticised. The initial questions of supply, mobility and transport, are also at the mercy of service prejudice and prerogative and perhaps an indifferent liaison. The weakness, however, extends into the Defence Department itself and may account for the tendency of the United States' policy to flounder in the wake of her strategy and vice versa. The authors of this Report point out how difficult it is, "democratically", to achieve unity among the allies in the West: but how much more so does it seem impossible to achieve a cohesion in respect of policy in the United States itself.

The West has been severely criticised for failing to evaluate accurately and readily the specific threat to peace, and for slowness off the mark in relation to limited conflict. This tendency is more than a reflection of national or allied inability to formulate an adequate strategy. It is the unfortunate effect of a variety of domestic factors, the prime factor being the actual composition of national government in which civil and military departments compete for their share of what is, after all, a limited national income. It is therefore ironical that the autonomy in civil and military departments which we most consider signalises freedom should present, in a measure, obstacles to that same freedom. National differences in government are remarkable insofar as the President of the United States, for example, hedged as he is by constitutional safeguards, is less likely to overcome separate and partisan enmity or departmental and public indifference to a wholly national strategy, than is the United Kingdom Prime Minister.

Apart from the clash of interest between civil and military departments in a government, democratic and liberal countries are also distinguished by the fact that they have both Government and Opposition. Since the political, economic, and foreign policy aims of these two bodies are essentially different it may be difficult not only to maintain national unity, but to provide a framework of political aims from which to shape strategy. Mr. Eisenhower's invitation to Mr. Stevenson to take part in the NATO deliberations was an effort to overcome this difficulty. But that Mr. Stevenson only went halfway with the President demonstrates, not simply how hard it is, but how essential it is to solve such a delicate problem of national unity without losing so much that is vital to a democracy.

United Kingdom Defence Policy

The United Kingdom White Papers on Defence for 1957 and 1958 are remarkable in the sense that they emanated from the same source on matters of policy, and that the later Paper is a confirmation of the earlier one. We still rely on the deterrent of nuclear weapons and aver our intention of using them; but it should not be forgotten that another world war restricted to the use of so-called conventional weapons could result in destruction many times greater than the last war and the United Kingdom could be subjected to damage vastly greater than it then suffered. The United Kingdom could scarcely engage alone in a nuclear war with Russia and to some it seems a little unnecessary that we should maintain a force which at best can only be a fraction of either that of Russia or the United States. The United Kingdom nuclear force will be simply complementary to the Strategic Air Command.

This reliance on the nuclear deterrent is thought to justify the reduction of conventional forces which in view of our commitments in NATO, the Baghdad Pact and SEATO is somewhat contradictory. We may be proved wrong in this respect since we could need greater conventional forces, armed perhaps with tactical nuclear weapons, to deal with the major problem of today, possibly local or limited wars. We ought to resolve what kind of force we should have and what we are going to do with that force when we get it. These are questions which need to be answered otherwise our emphasis on machines and weapons may make our concept of defence top-heavy and unadapted, as well as unadaptable, to the job it has to do.

Unlike that of the United States where the prime problem is the strategical one for which she needs hydrogen weapons and strategic forces, the difficulty facing the United Kingdom, while not of such obvious dimensions, might over a period prove fatal if not correctly evaluated and handled. Although the United States could get involved in a local war, say, in Formosa, it is unlikely because of her extensive cover against total war plus her immense political power. In contrast, because of our limited political, economic, and military power, and our world-wide commitments, we are more likely to get involved in local than in total war, in which latter case the United States would help us anyway.

United Kingdom obedience to the pressure of weapon development, as with the United States, has imposed a strategy on her. New weapons are often far ahead of the strategic ideas of the time and they are very often in advance of the political direction which presumably will control their use. It is perhaps only fair to keep this idea before us in discussing disarmament.

Disarmament

The possible success of a policy of disarmament depends very much on the genuine desire of Russia and the United States to reach a settlement. From the Western point of view it must include both nuclear and conventional weapons, and must be subject to adequate inspection and control. There can be no doubt that any substantial reduction in the level of armed forces would be of extreme importance in relaxing world tension, and in easing the crippling financial burdens which armament has imposed on many European countries, not least on the United Kingdom.

As in the case of withdrawal in Europe, Disarmament is yet another example of the complex relation in Western defence policy and strategy. The great difficulty is how to sort out one facet from the other, still leaving policy the dominant feature. It might be that national policy factors could and ought to overrule the military and strategic factors involved in the retention of nuclear weapons, and a ban on the manufacture, testing and use of all nuclear weapons could indeed be the major political triumph of this century. The political advantage in a renunciation of all nuclear weapons would place the moral victory in the grasp of one or other of the major contestants for world power. But such a concept must make us ask ourselves the following questions:

(a) How would the deterrent to total war continue?

(b) How in war would nuclear disarmed democratic countries fare against Russia who has conventional naval, army and air forces many dimensions greater than those of the West?

Such considerations must surely sweep away at once all the moral and political advantages which might accrue from giving up such weapons, but it is precisely this and no less that the latest school of thought on this matter are demanding of us.

Sir Stephen King-Hall asks us to go "through the thought barrier". What lies behind this picturesque phrase is a praiseworthy attempt to view war and its problems from a non-traditional standpoint; and in brief he advocates that the United Kingdom should unilaterally and at once abandon nuclear weapons entirely. His very laudable aim is to preserve from the holocaust those institutions which make a democracy what it is, but in a disarmed United Kingdom these are the very things which would disappear. The right to combine freely with other

European nations would be the first thing to vanish; and it is difficult to believe in non-violent resistance as a "dangerous psychological deterrent". Though the Red Army need never set foot in the United Kingdom – and Sir Stephen's plans for their reception in that event are unrealistic to say the least – an enforced and permanent occupation of these islands would be certain. The pressure of a maritime blockade itself would achieve the Communist purpose and we should not delude ourselves, nor should Sir Stephen, as to the effect of such a blockade.

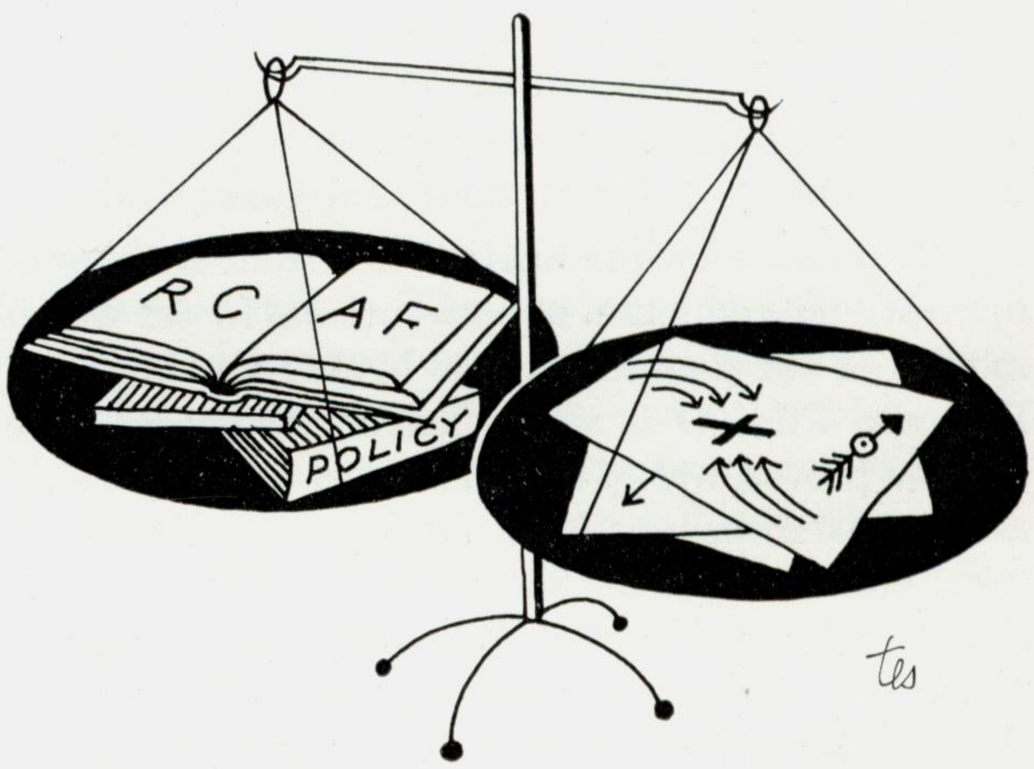
Deprived of the means of any kind of effective resistance we might find a large percentage of our population indifferent to the fate of our institutions: and while many others might sacrifice these same institutions with some regret they would nevertheless sacrifice them. Though we might cling to our values for as long as possible they would gradually be jettisoned and the population would be driven to consider only their own individual good, and in the circumstances could scarcely be blamed.

Graduated Deterrence and Limited War

There is something mystical about the theories of Mr. Kennan and Sir Stephen, and for that matter there is also a lot of good sound commonsense. We ought not to overestimate Russian intentions nor be panicked into absurd political or military positions from which we may have to climb down with some difficulty. Yet while these theorists are dreaming dreams and seeing visions we are faced with solving immediate problems in the arena, be they political or military.

Hydrogen and other nuclear weapons have provided a remarkable deterrent to total global war, so much so that it would be unrealistic to suppose that any major power would initiate an all-out nuclear war. Thus, at the big end of the deterrent we can accept the concept of deterrence against total war without getting involved in discussion as to how such a war would be fought should the deterrent fail. It cannot be assumed however that an adequate deterrent has yet been secured at the small end of the scale: that is, against local and even limited wars. Obviously we cannot tackle this problem with the same simple concept of deterrent as at the big end of the scale. Not only have we to make it clear to our own peoples and to possible enemies that we intend to use clean tactical nuclear weapons but we must investigate fully the application of these weapons in local and limited wars, and follow through all the repercussions entailed. This emphasises some of the difficulties inherent in such a concept.

Many enthusiasts for a system of graduated deterrence possibly try to put too close a definition on the term. In particular, there is a tendency to define the size of the geographical area, the nature of the targets, and the size of the weapon which should be agreed upon by all nations as limits for attack by tactical nuclear weapons in limited war. It would be very easy to get bogged down in definitions of all kinds unrelated to the reality of war. In any event, there is no certainty that an enemy would keep to any definitions or rules, or that they would interpret such rules in the same way. It seems certain that an approach of close definition to the problem offers little prospect of immediate or satisfactory solution.



The functional approach is more realistic. Let us divide the problem into two parts:

(a) Strategic bombing of the enemy heartland, even by conventional weapons, would inevitably lead to nuclear attack, including hydrogen weapons and probably ballistic rockets.

(b) The operation of surface forces, the army and the navy, with air operations in support, which in themselves need not lead to global nuclear war.

Every endeavour should be made to get international agreement not to resort to the first of these, and there does seem some chance of achieving this agreement. In any event it would be wise for the Western nations to declare that they will not initiate such action.

The advantage in approaching the problem of limited war functionally, is that it avoids the necessity of defining limited geographical areas for nuclear operations. Surface operations bring their own geographical limits with them and the theatre of operations is automatically defined. It is true, of

course, that there is bound to be some vagueness over the twilight zones of the approaches to the theatre.

Any discussion of limited war posits two questions: first, can we guarantee that the war will remain limited; and secondly, is such a war likely to achieve its aim? These two questions are intimately connected because if the war *remains* limited it is all the more likely to achieve its aim: thus each side will have a double incentive to keep it limited. If the tempo is increased and the weapons and armament stepped up, the original aim will be transformed into something else.

The weapons used will be an expression of the aims of the belligerents, and if the aims are limited so will the war be limited. There was nothing moral about the exclusion of gas in the last war: it was mere expediency; and this is going to be the criterion for the use of tactical nuclear weapons. An immensely important factor will be the ability to foresee the breaking point in each side: that is, either a willingness to negotiate or the likelihood of an extension or a new departure in the use of nuclear weapons.

Conclusions

It may seem contradictory to assert, after such a lengthy discussion of the matter, that the strategic and political situation in Europe is stable and composed compared with other areas. Without the crescent moon of NATO the situation is by no means stable and composed. It is in this sphere that we can expect the continued challenge and perhaps even an extended local challenge. This posits the demand for a strong national strategy in the same way as the East-West situation in Europe demands a strong allied strategy. The traditional watchdog of the Afro-Asian continents, the United Kingdom, no longer holds the same sway or political power, but she has still extensive commitments. These call for forces of extreme mobility and flexibility and shaped for the task in hand.

What is disturbing is that the Communist powers can apparently choose which challenge to make, whether to France in North Africa or to the United Kingdom in any of her now vulnerable areas. This means, and it is not at all fanciful, that someone (or a group) in Russia is deciding where and what to attack, or subvert the unaligned countries, and may be, indeed, deciding the destiny of the world. Yet no one in London or New York is really planning where or what to defend, or how best the Western countries can keep the good will of the unaligned countries. The Western nations seem content to take whatever the tides may bring and are planning simply from a national and therefore negative standpoint.

This reflects a vital lack in Defence thinking at the present time: strategic ideas are only now beginning to come alongside and to take account of war in terms of the new weapons. The numerous cul de sacs into which strategy has forced policy is something we ought to have foreseen ten years ago; and we ought now to be able to foresee the logical outcome of current trends in war, in strategy and in policy, ten years hence.

That we should get war into perspective may seem a trite observation: but unless we do so we may find ourselves unprepared for that eventuality which could mean so much, not only to the United Kingdom but to her allies. Just as the internal national differences of civil and military departments should be resolved at national level so must national differences be resolved at allied level. Only when Western strategy is conceived in this light as an urgent necessity are we likely to escape the bane of domestic conflict and partisanship or the consequences of our international rivalries. There are surely enough salutary parallels in history where allied peoples squabbled while a busy enemy, by devious means, sapped the very defences which up till then gave them the liberty to squabble. Let us consider well which we can most easily sacrifice — our love of contention or our Defence.

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We Are Not the Best

J. GELLNER

Wing Commander John Gellner, D.F.C., C.D., LL.D., practised law in Brno, Czechoslovakia, until the German occupation of that country. During the war he flew with Bomber Command. He has been in the R.C.A.F. since early 1940, and was on the faculty of the R.C.A.F. Staff College — now retired from the R.C.A.F.

THE title of this essay has been purloined from a remarkable and very courageous article by Hanson Baldwin ("We're Not the Best in the World"; "Saturday Evening Post", 15 July 1950). In it, the author, speaking about the U.S. Forces in the Second World War, made the blunt statement: "Given equal armament and equal numbers, the enemy usually won." And he ended with the warning, addressed to the United States but equally applicable to the other Western democracies, that as we can be pretty certain that we will not enjoy numerical superiority in a future war, and as we cannot even count on being superior in matériel, we will have to put "greater emphasis than ever before upon quality — quality of men . . . quality of leaders . . . quality of weapons . . ."

The "quality of leaders" is undoubtedly the most important of these three requirements. In modern war, good officers are much more important than good troops; Field-Marshal Montgomery was not over-simplying when he said: "Failure in war is always due to one of two causes: to faulty command or to bad staff work, or sometimes to both. I can think of no instance where failure has been due to a failure of the fighting man." It is equally plain that the revolution in weapons technology which has occurred in these last fifteen years has not made the task of the military leaders easier, but in fact has made it more difficult than it ever was before. To take military decisions in modern warfare (and that, at times, even on a comparatively low level) requires thorough professional knowledge, a sharp intellect, and, perhaps more than anything else, a highly developed sense of responsibility and great firmness of character. Only the very best officers will be equal to their tasks. In this article, an attempt will be made to examine why we (and "we" means the British, Commonwealth, and American Forces) have in the more recent past not produced officers' corps of particularly high standard, and most certainly not the world's best officers' corps; and a searching look will be cast at where we stand in this respect now. "Know thyself" is a good maxim but one which is not often observed, mainly because to be complacent is much easier and much more pleasant. The trouble is that today we cannot afford even the tiniest dash of complacency.

The Verdict of History

History has passed its verdict, and a very harsh one it is, on Allied generalship in the First World War. It was perhaps best characterized by C. S. Forester who likened it (in "The General") to the attempts by a group of savages to extract a screw from a piece of wood. It never occurs to them that all they need do is turn the screw. Instead, they try to pry it out using more and more force. As it was, the Allied Command was in the end able to assemble enough brute force (including that furnished by hundreds of thousands of fresh troops from America) to tear the German screw out of the hard plank which was the Western Front. It was a crude operation, and victory was gained at prodigious cost.

Lloyd George, a man who was as exasperated at the professional soldiers as the latter were exasperated at him, blamed the "military mind (which) regards thinking as a form of mutiny" for the failure of the Allied High Command to devise any other strategy than to hurl ever more shells against the German fortifications, and ever more soldiers against the German machine-guns. "Men of great intellectual powers," he wrote in his "War Memoirs", are not tempted to join a profession which offers so little scope for the exercise of their powers, and where the rewards have no particular reference to special capacity. To be a good average is safer than to be gifted above your fellows." Lloyd George had diagnosed correctly the root of all evil: *the rejection of intellectuality* in the British Forces, the belief that study and thought harmed rather than helped a man who would be a military leader. Instead, inborn qualities of leadership and practical experience were unduly extolled.

All this applied to the British Army (and to the tiny Dominion armies which in 1914 were just its replicas) more than to the Royal Navy or to the

American Forces; and "Colonel Blimp" became part of our vocabulary as the prototype of the crusty, narrow, tradition-bound, lovable old incompetent in command of long-suffering troops. He was the inevitable product of a system which refused to consider the officer's job a profession, let alone a learned one. In his delightful book, "Gallant Gentlemen", E. S. Turner describes the consternation that gripped many British officers when they realized that, as a consequence of the abolition of purchase, (this, mind you, happened only in 1871) promotions of officers would have to be by selection: "Selection would mean advancing those who took the profession of arms seriously — a thing no self-respecting officer could afford to do." This sounds like exaggeration. There is, however, an abundance of evidence that brilliance of intellect was a quality not sought for in a British officer during the hundred years preceding the First World War. To quote but two instances, the Duke of Cambridge, who for almost four decades was at the head of the British Army, fought hard to prevent the establishment of an army staff college; and King Edward VII, himself a penetratingly clever man, keenly opposed the founding of an "Army Journal" because "nothing but damage to discipline could result from allowing serving officers to express their views on military topics". On a lower plane, there is preserved, for instance, an assessment passed on a Lt. Dunne who apparently "suffered from new and original views". He had committed this crime by designing and demonstrating in 1912 a revolutionary delta-wing aircraft, (the War Office was not interested).

Lest these last paragraphs be dismissed as a mere flogging of a dead horse, we should hasten to make the point that suspicion of the intellectual officer persisted for a long time after the First World War, and that to a certain degree it exists even today. True, our military leadership in the Second World War was very much better than it had been in the First, and it was even brilliant at times and at certain levels, especially on the sea and in the air. Yet, by and large, it did not compare favourably with German, or on occasion even with Japanese, leadership. Again, we suffered from lack of originality and of elasticity of thought. Again, we found no alternative to the use of the sledge-hammer (e.g. parts of the bomber offensive; Cassino), although at least we wasted matériel rather than men. A typical enemy critique of Allied generalship speaks of "unwieldy and rigidly methodical techniques of command . . . over-systematic issuing of orders down to the last detail, leaving little latitude to the junior commander . . . poor adaptability to the changing course of the battle" ("The Rommel Papers", edited by B. H. Liddell Hart). The strategic masterpieces of the war, like the German campaign in France in 1940 or the Japanese advance through Malaya on Singapore in early 1942, both achieved with exemplary economy of effort, were performed by the enemy. Even in the Korean War, against an enemy superior in manpower but inferior in matériel and military know-how, we persisted in our ways and relied on heavy pounding to bring us victory. Here, the political consequences of the unnecessary damage inflicted were particularly unfavourable.

Originality of Intellect

The fact is that comparatively little original military thought has come from our professional military men. Even today, the Clausewitzes and Jominis of the English-speaking world are more likely to be sociologists or physicists than generals (a small but brilliant group of retired senior R.A.F. officers are an exception). Apart from the traditional rejection of intellectuality to which we have pointed, the victories in two world wars may have acted as an obstacle to the development of a type of learned soldier in our Forces. As H. A. Kissinger put it (in his, "Nuclear Weapons and Foreign Policy"): "Nothing stultifies military thought so much as a victorious war, for innovation then must run the gamut of inertia legitimized by success". On the other hand, in Germany and France, and above all in the Soviet Union which today has the richest military literature of all countries in the world, it is almost exclusively the professional officers who do the thinking, writing, and lecturing in the field of military art and science. To put it very generally, the Russian officer wants above all to be a "scientific soldier"; ours would still rather be a good leader of men and keep away from books and papers. And, if he follows that path, he is still favoured under our system of judging an officer's performance.

The reader will by now have perceived that the subject with which we are dealing is a difficult one and that, given the space limitations of a magazine article, we could not do much more than support somewhat dogmatic statements with rather scanty evidence. The proposition which we have tried to advance so far is briefly this: In the West we have regarded, and we are still regarding, war in the main as a contest of matériel, and to a much lesser degree as a contest of masses of men. We have largely overlooked the influence which *will* and *intellect* have on the conduct of modern war. Having won two great world conflicts principally through the prodigious efforts of our industries which allowed us to smother

the enemy under a deluge of shells and bombs, we still have as our recipe for victory old Nathan Bedford Forrest's injunction "to git thar fust with the most". This is not enough in modern war when time scales are compressed and quantity alone is of little significance – and when we cannot count on having quantitative superiority, not even in matériel. What we must strive for is qualitative superiority, more than anything in the moral strength and intellectual capacity of our military leaders.

Logically, the next question that we should now ask ourselves must be whether our methods of *raising and training our officers' corps* are likely to produce the extraordinarily high quality of military leadership that modern war demands.

Among the obstacles with which we have to contend here is the absence, among the English-speaking peoples, of an *ethos* of the military profession. In the antique, in the middle ages, and in the first centuries of modern times, the military leaders (i.e. the officers, not usually the common soldiers) were set apart in a social class which, in return for its self-denying and self-sacrificing services, demanded and received special honours from the community. Inside the officers' class, careful selection and a stringent code of behaviour ensured a high quality of the membership. Plato's "four basic manly virtues" (expressed in the "Politeia") constituted the minimum demands made of an officer. These demands became gradually more onerous until they produced completely dedicated, loftily idealistic military leaders in the knights of the semi-monastic fighting orders which sprang up in the Holy Land during the Crusades, and in Spain during the Moorish invasion. The idea of the officer-knight (in the sense of his moral value) has been preserved to our days, for instance, in the Japanese officer bound by "bushido", or in the Prussian officer bound by the unwritten code of the "Junkers" class. In the West, we heard a good deal about the arrogance of the Japanese or the Prussian officer, but we tended to overlook his professional competence, devotion to his calling, moral and physical courage, qualities which made him superior as a military leader to his more easy-going counterparts in other countries. Today, in the Soviet Union, a deliberate attempt is being made to create an ethos of military leadership as the spiritual basis for effective command in war.

In the English-speaking world, too, the concept of *the military profession as a vocation* persisted for a long time. It produced such officer-knights as Robert R. Lee; and vestiges of it are still discernible, for instance in the officers' corps of the Royal Navy. Unfortunately, industrialization, and the consequent materialization of our society, have produced a new picture of the professional soldier, that of the "citizen in uniform". It is a picture of a civilian who, having chosen as his job to be an officer, wears the special garb demanded by that type of employment and submits to some special regulations governing it. The true nature of the profession of arms is thus effaced, just as the true nature of a clergyman's calling would be effaced if he was looked upon simply as a "citizen in a cassock".

The Citizen Soldier

The concept of the "citizen soldier", and the idea that the military profession is just another job, are, however, by now firmly embedded in our society. Thus we have to accept the fact that our young men will choose to become officers for such purely material reasons as that the job offers the type of life they like, and economic rewards generally comparable to those available in business and industry, and better than in the civilian sections of public service. This being so, we cannot count on a burning desire on the part of our young officers to reach excellence in their profession, on what we might call the "inner fire". In its stead we must rely on a system of continuous training of a kind that will develop to their utmost both professional skills and mental capacity. Again, we cannot in this article enter into a detailed discussion of our methods of officer development. Quite generally it can be said that as far as the development of skills is concerned, these methods have been fairly, in some fields outstandingly, successful, but that much too little is done to give scope and depth to the officer's mind. Usually, he is not faced with a real intellectual challenge for the first twelve to fifteen years of his service, nor is he encouraged toward serious study that would expose him to such a challenge. The staff colleges – they vary greatly with country and branch of the service – sometimes give an impetus toward creative thought, but it is not a particularly strong impetus, nor is there any follow-up. It is but seldom that an officer during his entire service career is brought up against the necessity to think as systematically and creatively as a student in a better Postgraduate Course. On the other hand, in administration and some other fields of logistics, officers quite often have to tackle problems as difficult as those faced by top executives of big business concerns. This, however, is training toward developing the ability to provide the wherewithals of modern war, not the

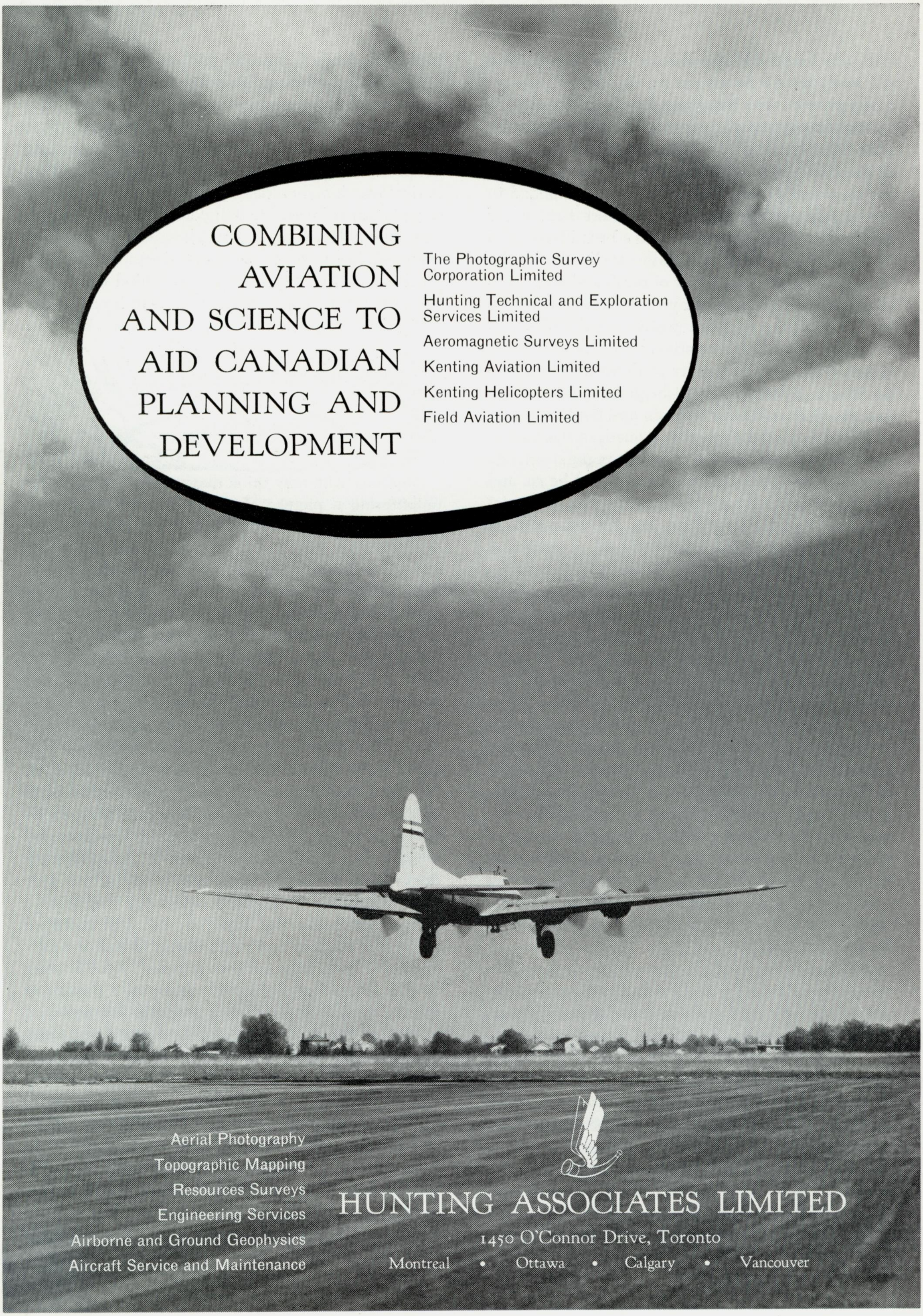
ability to "out-think" the enemy — and this is what will really matter in any future contest.

The *position* which the regular officer occupies *in the community* determines to a considerable extent what type of young man will seek a military career. In the two great militarist nations of our times, Germany and Japan, the officers' class belonged to (and in Prussia formed) the highest stratum of society. Selection was rigid, from a broad basis, and those selected were generally well above the national average in qualities of mind and character. In the Soviet Union of today there is a similar relation between the elevated position of the officer in Soviet society and the relatively (to the rest of the educated class) high quality of those who aspire to be officers. Among the English-speaking nations, the regular officer is in Great Britain and the Dominions respected but not very highly valued; in the United States he generally enjoys even less popular esteem. There are many reasons why this should be so, and we may mention some of them: The last two great wars were won by dint of glorious improvisations in which civilians-turned-soldiers played a prominent (but often overstated) part. There is "oversensitivity to the economic and social nonproductiveness of armies . . . the . . . nation has never yet evaluated its security as being in enough danger to warrant the expense and social contribution necessary to maintain a large regular army" (Col. O. K. Marshall, "The Military Function and the Soldier"; "Military Review", July 1957). The successful businessman is the leader of society, and among those drawing salaries, the executive with an income in the tens and hundreds of thousands. Material values, perhaps because so many of them are attainable, outweigh ethical values rather more in our type of society than elsewhere. It all adds up to the result that the Services do not attract the cream of our youth. This is one more reason why officers' development in the Services should be so very much better than in fact it is.

As a consequence of the comparatively low position he occupies on the scale of values of our society, the regular officer often lacks true self-confidence, while being almost invariably hypersensitive to public opinion. He is not supposed to be too conspicuous lest he disturb his civilian fellow-citizens' "pursuit of happiness". He is expected to go out of his way to make himself and his Service liked by the public. Above all, he must not have too strong opinions, not even on matters concerning his own profession, and if he has such opinions he must keep them to himself even if the security of the nation should demand that they be shouted from the rooftops. But when a war is upon us, then that same meek and self-effacing little man is expected to ride forth as a knight in shining armour, chesty, blunt, exuding confidence, putting heart into a worried nation. Such startling transformations just are not possible. The little man accustomed to look worriedly over his shoulder in peacetime, will do the same in time of war. He will perhaps bluster, but he will not act decisively. To be self-reliant, to shoulder responsibilities, to make bold decisions without flinching, all this requires a state of mind which it is possible, but certainly not easy to acquire amid the restrictions of peacetime soldiering as we know it.



Anybody who may think that we have painted too unflattering a picture of the regular officer in our Forces should have a good look in his own mirror of introspection. The author has done so many times, and so have other professional soldiers who are concerned over our capability to win future wars. The public is concerned, too, but in the main over a matter as to which we can feel comparatively secure, namely the weapons that we will have to fight a war. If past experience is any guide, we will be well equipped, if perhaps somewhat scantily, but this is not quite as significant today as it used to be in the past. That same experience indicates that we will suffer from weaknesses in military leadership. An objective examination, such as we have attempted in this article, of who our officers are, what motivates them, and what they are doing themselves and what is done for them to heighten their capabilities, does nothing to dispel this suspicion. In future wars there will be no wall against which we will be able to put our backs and fight on; nor will there be periods of months and years during which we may be able to learn from our own mistakes. No "Miracles of the Marne" are likely to occur, no "Battles of Britain" to save us by a hair's breadth. We will win, if "we are the best" at the moment war breaks out. We will be the best if under the weight of responsibilities such as have never yet been assumed by officers in war, they will make the right decisions unhesitatingly. It is submitted that we are not likely to have military leaders of that calibre in the required numbers, and that we consequently could well lose the decisive battle of wills and wits, unless we try earnestly to be much better than we are today.


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Yours sincerely,

J. Geoffrey Notman

$250 PRIZE ESSAY

Flight Lieutenant Rippon's paper, "Jurisdiction in Space", was judged the prize winning essay in the 1958 Journal Essay Contest. The judges were Air Commodore W. A. Orr, Air Commodore F. W. Ball, Lieutenant Colonel J. E. Leach, and Professor J. I. Jackson.

Jurisdiction in Space

FLIGHT LIEUTENANT C. L. RIPPON

Flight Lieutenant Clive L. Rippon, D.F.C., LL.B., M.L., served in the Royal Air Force during the Second World War. He joined the Royal Canadian Air Force in 1952, and is now a legal officer with 1 Air Division at Metz.

ON THE 8th September, 1944, the first V2 Rockets were fired from Holland by the Germans against London and Paris. Almost exactly three months later, on the 7th December, 1944, delegates from thirty-seven States signed the Chicago Convention on International Civil Aviation. Whether from lack of foresight or lack of appreciation of the potential development of a new era of aviation which the V2 heralded, the delegates to Chicago restricted their deliberations to conventional aircraft and their flight in atmospheric space. Probably, in the erroneous belief that they were enunciating the widest jurisdiction in space, the delegates agreed, in Article 1 of the Convention, that:

> "The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory."

The belief was erroneous in that experience has today shown that Article 1 of the Convention has in fact restricted national sovereignty to a height of approximately one hundred and twenty miles above the surface of the earth, this being the probable limit of space above the ground in which there is atmosphere. That the Convention restricted its application to atmospheric space is corroborated by the fact that throughout its articles the instrument of flight to be regulated is termed "aircraft". This term is defined in Annex 7 (Aircraft Nationality and Registration Marks), which was adopted by ICAO, as:

> "any machine that can derive support in the atmosphere from the reactions of the air."

With the launching of the Russian Sputniks and the U.S. Explorers and Vanguard, it is apparent that once again technology has outstripped the law, and States must reach agreement without further delay on regulations to govern use of space outside the range of the atmosphere. That some form of agreement is necessary should be apparent because at the present time there is a vast volume of space being used by man but to which no rule of law applies. This results in there being no rights, duties, or liabilities for any act which may be carried out therein. As a practical example, satellites from two different States could be put into such close orbits that they might collide. Without duties existing in respect of methods of operation there would be no liability in either State for the loss by the other of a very valuable piece of equipment.

Sovereignty in Airspace

ROMAN LAW. The development of the law governing the control and regulation of airspace has advanced step by step with each technological discovery. Primitive man had little or no concern for events or material things outside his reach or view, but the advent of ownership of land and the erection of buildings brought about the necessity for regulations to cover not only the ownership of property but also undisturbed use and enjoyment thereof. This included the use of the airspace over the property.

Some of the earliest records of laws governing control of the airspace above land are to be found in

the Roman Law. Professor J. C. Cooper, in Publication No. 1 of the Institute of International Air Law, states that:

> "Roman Law recognized that space is the reservoir for the air which man breathes and is the access to the heavens from which comes the light and heat of the sun but man uses parts of space when he walks in a public road or private path, or when he builds a house, or grows crops or trees. Space above the lands of the Roman State was recognized as an integral part of the habitable earth."

Cooper's statement is borne out by many sources. *Corpus juris civilis* gives the landowner under Roman law the control of the air column above his property at low altitudes; e.g., height of buildings, of trees, etc., and implies that this private control could be extended to any altitude.

In Book XLIII of the "Digest" (Pandects of Justinian), Venuleius states:

> "If a person shall have built a projection or allowed rainwater to fall from a roof into a sepulchre, even though he may not have touched the grave monument himself, he could readily be summoned for action by violence or stealth since not only is the actual place of interment part of the sepulchre but also of the sky above it."

In 1625, Grotius, writing on the freedom of the seas, stated in De Jure Delli Ac Pacis:

> "The extent of the ocean is in fact so great that it suffices for any possible use on the part of all peoples for drawing water, for fishing, and for sailing. The same thing would need be said, too, about the air, if it were capable of any use for which the use of the land also is not required, as it is for catching birds. Fowling, therefore, and similar pursuits are subject to the law laid down by him who has control over the land."

Pietro Bonfante, in his "Corso Di Dirotto Romano", written in 1926, came to the conclusion that under Roman law the rights of a Sovereign State extended upwards as far as human dominion could be exercised but the private property rights had to have an economic basis and the upper limit of the individual's ownership was that point at which he ceased to have an economic interest or purpose.

Common Law. When the Roman legions invaded Britain they brought much of their law with them, including that pertaining to the rights in airspace. Croke's report of the case of Bury v Pope, in 1856, contained the comment *"Nota — Cujus est solum ejus est summitas usque ad coelum"* (to whom is the land, to him is the highest place as far as the skies).

Coke, writing on Littleton in 1628, also quotes this maxim as follows:

> "and, lastly, the earth hath in law great extent upwards, not only of water, as hath been said, but of ayre and all other things, even up to heaven, for *'cujus est solum ejus est usque ad coelum'*."

In 1663, John Selden amplified the maxim, concluding in his thesis *"Mare Clausum"* that:

> "therefore, surely wee are owners of the ground, hous and space which wee possess that everyone for his best advantage may freely and fully use and enjoy his bordering aër (which is the element of mankind) how fleeting soever it bee, together with the space thereof in such manner, and restrain others thence at pleasure, that hee may bee both reputed and settled owner thereof in Particular."

One hundred years later, Blackstone also reported the maxim, holding that:

> "Land hath also in its legal signification an indefinite extent upwards as well as downwards. Cujus est solum . . . . is the maxim of the law upwards, therefore, no man may erect any building or the like to overhang another's land . . . . so that the word 'land' is not only the face of the earth but everything under it or over it."

The concept of private rights in airspace has been carried through to the present-day law of ownership and property. The English courts have upheld claims that a cornice overhanging a neighbour's land is a legal nuisance and a farmer's horse which kicked and bit a neighbour's mare through a wire fence committed a trespass. In the United States the same views have been upheld. For instance, overhanging branches constitute a legal nuisance. Overhanging eaves of a barn is trespass, as also is reaching a hand across a property boundary and stringing electric wires above a neighbour's land.

Air Law. In France, in 1783, the Montgolfier Brothers were the first to master the art of flight, and the sovereignty which States had asserted up to that time to protect the rights of their subjects on the ground were thereafter extended to regulate activities in airspace above the ground. This is a natural extension in that if exclusive territorial sovereignty is exercised in a fixed area for one purpose, it is exercisable for all purposes within the same area. The early flights which were made in balloons were regarded as novelties and little thought was given to any legal implication in the field of sovereignty. Even the first important international flight from Dover to Calais in 1785 by Blanchard, a Frenchman, and Jeffries, an American who lived in London, was in no way questioned. Perhaps the fact that they carried a French and English flag with them satisfied the then requirements of international travel.

Control of airspace was questioned during the Franco-Prussian War of 1870-1871, when Bismarck objected to the use of balloons as a means of travel and communication in and out of the besieged city of Paris. Bismarck claimed the right to, and in fact did, shoot down some of the overflying balloons on the very practical ground that the occupying army had a right to control the airspace up to the range of cannon.



Exclusive sovereignty in the airspace above a State was questioned in 1901 and 1902 by the French jurist, Paul Fauchille, who advanced the theory that the air should be free for navigation. The only limit he suggested was a security zone extending up to 1,500 metres, within which all flying was to be under the control of, and regulated by, the subjacent State. This theory received little support and, finally, in 1919, the Paris Convention "Relating to the Regulation of Aerial Navigation" was signed by thirty-eight States. Article 1 of the Convention stated:

> "The High Contracting Parties recognize that every Power has complete and exclusive sovereignty over airspace within its territory.
> "For the purpose of the present Convention the territory of a State shall be understood as including the national territory, both that of the mother country and of the colonies and the territorial waters adjacent thereto."

Again, in 1944, when the Chicago Convention on International Civil Aviation was signed, Article 1 contained the same statement of law.

Two of the more important words in these Articles are "recognize" and "airspace". By using the word "recognize" the contracting States were declaring that the law was to be as it had been in the past and this emphasized that sovereignty in airspace was not a newly-created situation. With regard to the word "airspace", almost all air lawyers have agreed that sovereignty under the Convention applies only to the space above the earth which contains atmosphere. Space beyond the atmosphere is a vacuum, both in the literal sense and in so far as control and regulation are concerned.

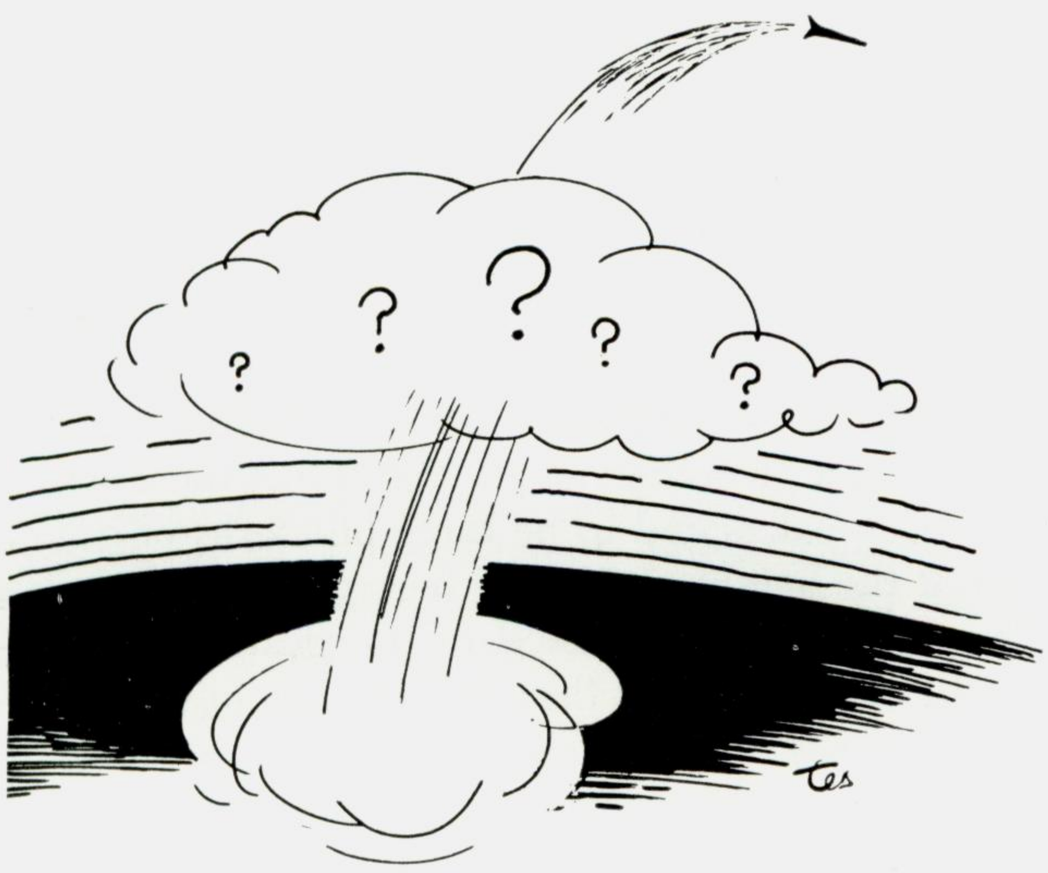
Before discussing possible rules to cover the use of outer space it might be well to ascertain where airspace ends and outer space begins. The most important element in the atmosphere, as far as human life is concerned, is oxygen. This element is almost non-existent at the comparatively low altitude of ten miles. However, atmosphere in an ever diminishing amount goes much higher than this. It is generally accepted that it is not until a height of approximately one hundred and twenty miles is reached that the air becomes so thin that it no longer offers resistance to a moving object. On this basis, some scientists have set about one hundred and twenty miles above the earth's surface as the point where space begins. This figure, however, is by no means a constant which can be stated to delineate exactly the barrier between airspace and outer space. Atmosphere can also be measured by calculating the average distance between molecular collisions, a method used to indicate the density of the air at a given height. At 65,000 feet the distance has been calculated to be three-billionths of a foot, yet at the height of 393,700 feet, or about 75 miles, the distance is considered to be greater than five-sixths of a foot. It is these differences in the calculation of the height of the atmosphere that have up to now made the solution to jurisdiction in space so controversial.

A further complication to the determination of the extent of the space jurisdiction in airspace itself is the definition of aircraft, given earlier, for although in science the atmosphere extends to about one hundred and twenty miles, there is not sufficient air at that height to support an instrument of flight by the reactions of that air. During 1957 the United States operated a manned balloon up to 102,000 feet, or just over nineteen miles, and the North American Aviation Experimental X-15 is expected to operate up to thirty miles high, but these altitudes are far short of one hundred and twenty miles. On the other hand, to define the limit of airspace as the maximum altitude attainable in flight by a balloon or aircraft

would mean a constant change in vertical jurisdiction with each new and improved design.

Theories on Space Jurisdiction

Of all the writers and experts on Air Law and the new field of Space Law, perhaps the greatest contributions have come from Professor J. C. Cooper, former Director of The Institute of International Law at Montreal. As early as 1951, in an article for the Transport and Communications Review (United Nations), Vol. 4, No. IV, he discussed the question of space jurisdiction. He opined that there must be a limit to the upper boundary in space to the territory of a State, because, under no possible theory could it be said that a State can exercise sovereign rights in outer space beyond the region of the earth's attraction, calculated to be about 161,000 miles above the earth's surface. (One of the reasons behind a State exercising sovereignty over airspace above its territory is to protect its subjects from damage caused by falling bodies, hence the reference to the earth's attraction).



Even a claim to sovereignty for this distance is not very tenable because, due to the rotation of the earth, any missile fired 160,000 miles into space would, before it returned to earth, have passed over the territory of many other States. Professor Cooper, at that time, concluded by suggesting that a State's territory should be considered as extending upwards into space as far as scientific progress, at a given time, enabled the strongest State in the international community to control the space above it. This rather indefinite distance would thus depend upon the armed might of the strongest nation and would again be a variable.

By 1956, Professor Cooper had modified his views somewhat and, in an address before the American Society of International Law, in Washington, D.C., he proposed a three-zone concept of sovereignty, as follows:

> "Reaffirm Article 1 of the Chicago Convention, giving the subjacent State full sovereignty in the areas of atmospheric space above it up to the height where 'aircraft' as now defined may be operated, such areas to be designated 'territorial' space.
>
> "Extend the sovereignty of the subjacent State upward to three hundred miles above the earth's surface, designating this second area as 'contiguous space' and provide for a right of transit through this zone for all non-military flight instrumentalities, when ascending or descending.
>
> "Accept the principle that all space above 'contiguous space' is free for the passage of all instrumentalities."

Dr. Alex Meyer, of the University of Cologne, replied to Professor Cooper's address at the same meeting and questioned the practicability of the three-zone concept. He considered it impossible to extend a State's sovereignty into outer space and even doubted the possibility of establishing a "contiguous area". Even by establishing fictitious borderlines above the territorial boundaries of a State it seemed to him impossible to fix an area in outer space which would correspond exactly to territorial boundaries. He explained that there was little similarity between the situation on the earth and that of the air and outer space because no determined shore exists between airspace and outer space, the air having the peculiar quality of gradually becoming thinner and thinner.

Two diametrically opposite views on jurisdiction have been put forward by Mr. C. Wilfred Jenks, of the International Labour Office in Geneva, and Ming-Min Peng, a Nationalist Chinese air lawyer and scholar. In 1956 Mr. Jenks, in an article entitled "International Law and Activities in Space", expressed the view that though one could theoretically conceive of the atmosphere, the ionosphere and the zone used by earth satellites, and interplanetary and interstellar space beyond as a series of zones subject to different legal regimes, there would, however, be serious difficulty in defining the boundaries of the successive zones. Even if this difficulty were overcome and such an approach to the problem were to be adopted, the projection of the territorial sovereignty of a State beyond the atmosphere above its territory would be so wholly out of relation to the scale of the universe as to be ridiculous. It would be

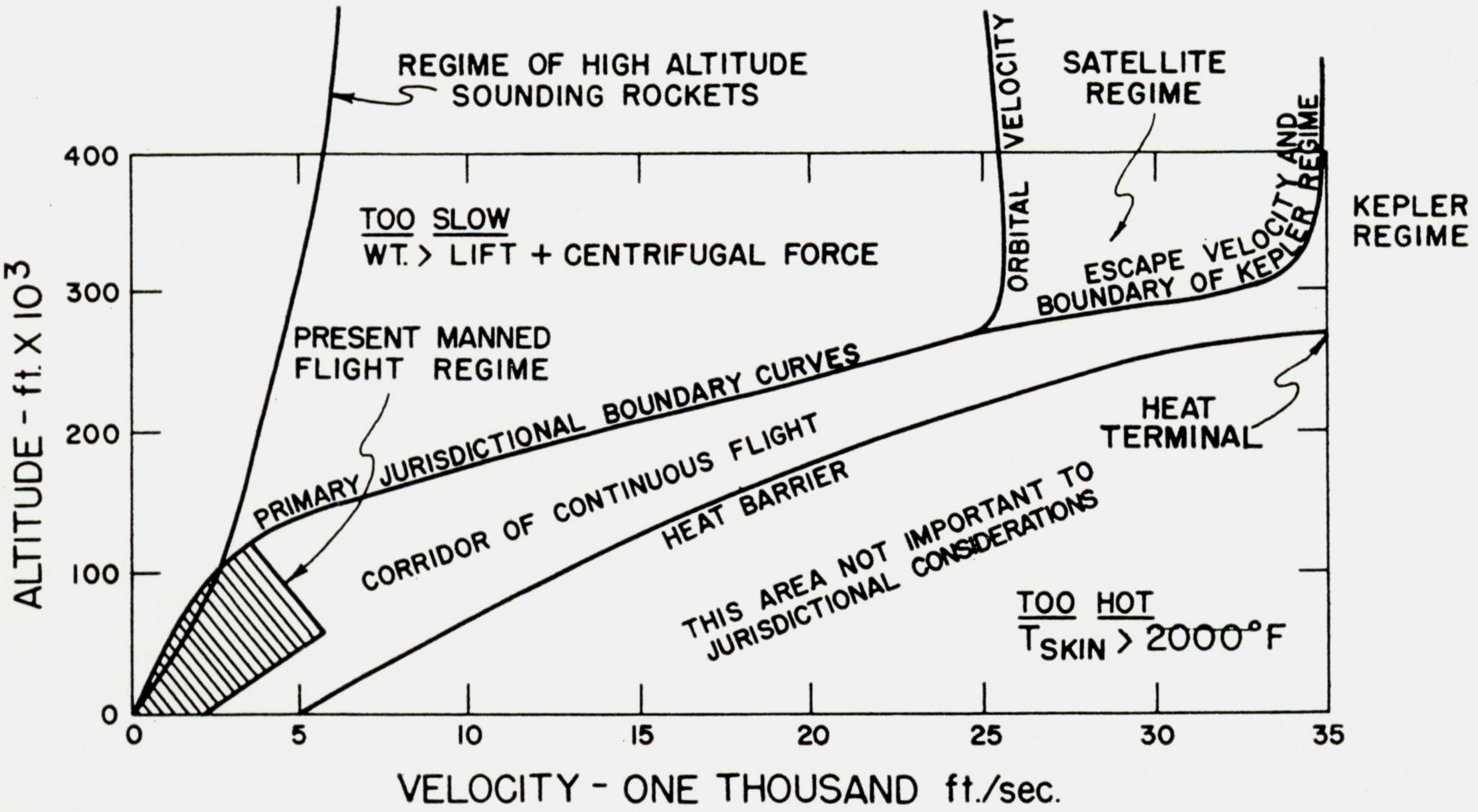


FIGURE I

DIAGRAM SHOWING REGIMES OF ATMOSPHERIC AND EXTRA-ATMOSPHERIC FLIGHT AND DEPICTING THE JURISDICTIONAL BOUNDARY LINES

rather like the Island of St. Helena claiming jurisdiction over the Atlantic. Any projection of territorial sovereignty into space beyond the atmosphere would be inconsistent with the basic astronomical facts. The revolution of the earth on its axis, its rotation about the sun and the planets through the Galaxy, all required that the relationship of particular sovereignties on the surface of the earth to space beyond the atmosphere is never constant for the smallest conceivable fraction of time. Only activities within the atmosphere of the earth would appear to be susceptible to a degree of control, similar in general nature to that which can be exercised in territorial waters or over a wider maritime frontier belt. Mr. Jenks' views have been supported by Mr. Oscar Schacter, the Director of the General Legal Division of the United Nations.

Ming-Min Peng, on the other hand, writing in the June 1952 edition of the Revue de Barreau, maintained that at least, until interplanetary travel became a reality, the sovereignty of nations over the airspace above them should be considered to extend to the limits of all flight and suggested that the Chicago Convention conception of sovereignty should be extended to an unlimited distance outside the atmosphere.

An original and mathematical approach to the problem of jurisdiction was presented last year by Andrew G. Haley, the General Counsel to the American Rocket Society, at the Society's Spring Meeting in Washington.

Mr. Haley suggested that the boundary line between airspace and outer space should be the boundary of what he terms the Keppler Regime. This boundary line is calculated by the use of simple aerodynamics. For a body to accomplish aerial flight, that is to circle the earth at a constant altitude, a condition must exist in which the weight of the body equals the aerodynamic lift plus centrifugal force. Centrifugal force, or Keppler force, increases with the speed of the body through space, whereas the aerodynamic lift decreases with altitude because of the decreasing density of the air. Thus, in order to maintain continued flight beyond zero lift, the Keppler force must take over. Mr. Haley gives the following examples to demonstrate this fact. The manned United States X-2 rocket aircraft, flown last year at a height of 126,000 feet, indicated an aerodynamic lift of 98% of its weight and only 2% Keppler force. On the other hand, an object travelling at 35,000 feet per second at 275,000 feet would have zero aerodynamic lift and 100% Keppler force.

He goes on to suggest that if a graph were plotted, having as its coaxials speed and height, the resultant curve or boundary of the Keppler Regime would be used as the jurisdictional boundary graph.

There appear to be some serious objections to the use of the Keppler Regime. Firstly, whether the limit of airspace is taken to be 150,000 feet or 400,000 feet there will still be a considerable area above the primary jurisdiction boundary curve that will fall within the airspace and hence within the Chicago Convention formula for State jurisdiction. Secondly, within the limits of airspace none of the factors that make up the equation are constant for different instruments of flight: weight and lift will vary with design and hence the Keppler force will also vary. With so much variance the primary jurisdictional boundary curves will never be a constant line of demarcation within the airspace.

As an alternative to these suggested methods of determining sovereignty and to add fuel to the fire of controversy, I would suggest that it is impossible to reach agreement on control and regulation of outer space by attempting to correlate the flight of the instruments with territorial jurisdiction.

International agreement is required, the terms of which will be focused on the instrument itself. The agreement should first define the instrument and with that definition place responsibility for its control and actions on the launching State. To avoid possible collision, orbits should be assigned by an international body within the United Nations organization, in much the same way as the International Telecommunication Union controls radio frequencies. The agreement should recognize the provisions of the Chicago Convention in respect of State Sovereignty over airspace and, thus, the flight of any instrument through the airspace of another State would be subject to bilateral agreement.

If agreement could be reached that responsibility for the instrument itself rests upon the launching State, then regardless of where an incident occurred the launching State would be placed in the position of having to answer for the results of that incident.

R.C.A.F. STAFF COLLEGE JOURNAL ESSAY CONTEST FOR 1959

The R.C.A.F. Staff College Journal Essay Contest will be held again in 1959. 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.

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, 1959.

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BATAWA, ONTARIO

The R.C.A.F. is Unprepared for the Guided Missile Age

SQUADRON LEADER J. WOODROW

Squadron Leader J. H. Woodrow, B.A.Sc., served as an Observer with 425 Squadron in the Second World War. An aeronautical engineer, he is now stationed at Gimli, Manitoba.

"TECHNOLOGY has become the backbone of our national strength." These words were uttered recently in a speech by Admiral Lewis Strauss, Chairman of the U. S. Atomic Energy Commission. They apply equally in Canada with ever-increasing force as our military services become more complex.

One of the most important functions of the management of any organization is long-range planning. For the peacetime armed forces, this function overshadows all others since the value of the armed forces is their ability to fight future wars. The military's long-range planning chiefly concerns the weapons to be developed and the type and quality of men required to maintain and use these weapons. The evaluation of the usefulness of weapons that have not yet been built will be most difficult, and yet present and future weapons of war are extremely expensive. No country, not even the wealthy U.S.A., can develop all the weapons that are possible, and therefore these weapons of the future must have their military worth evaluated well in advance. Since our long-range planning is becoming more and more technical, it would seem that the people involved in making these military decisions should combine an understanding of technology with that of military operations

With the rapid advance of technology, civilian industry has had a similar problem for no industrial company can afford to develop all the ideas which might become modifications to existing products or turn into new products. The problem has been solved by sending an ever-increasing number of engineers to management positions. It has been found that engineers who can evaluate the difficulties of manufacture and also the worth of the product in a technological society, must form part of the management group that accepts or rejects the ideas. A survey by Fortune Magazine of the hundred largest companies in the United States showed that engineers occupied 45% of the administrative positions in those companies. As a corollary to this, these companies must have personnel policies that attract engineers and these policies must be developed with the help of engineers. These companies cannot afford to say that their engineers are too valuable to be assigned to managerial work. They are so valuable to the overall functioning of the company that some engineers must be, and are being, assigned to all levels of the management function.

The armed services are travelling in the opposite direction. The Services tend to isolate their technical officers from higher command. Although military technology is an inherent part of the military management team's decisions, there seems to be very little room on that team for technical officers. Consequently, the road to advancement and to the most influential and best-rewarded positions is not through technical knowledge and experience. Civilian industry has found that it cannot hope to compete without the full participation of researchers and engineers in the decisions of top management. Yet decisions concerning great expenditures for research and engineering development of new weapons are being made in our armed forces without any real top-level participation of career technical officers.

Admittedly the need for technical competence is not as essential in management positions as it is at the working level, and all technical personnel have not the necessary attributes for top-management jobs. But officers with technical competence must participate at all levels of management and for those technical officers who possess the required managerial attributes, any amount of technical knowledge will not be too much.

This statement is the exact opposite to the way in which the armed forces and the R.C.A.F. in particular operate. The present policy is that technical personnel should act as staff advisors only in their particular technical specialty. In our present technological age, this is a very unsound policy. The Air Force of the future, through necessity, will become a highly-trained technical force, and consequently officers of technical competence will be needed at all levels of the Air Force management team. Is the Air Force willing and ready to face this change in their management structure?

Situation in the R.C.A.F.

During the first few years after the end of World War II, it seemed to be Air Force policy to fill approximately fifty percent of its aeronautical engineering branch vacancies with N.C.O.s and Warrant Officers commissioned from the ranks (C.F.R.s). The other fifty percent were filled with direct-entry university engineering graduates or the equivalent. The percentages may have varied from year to year, but it seemed to be a fairly even split. The theory behind this policy was twofold. It gave an opportunity for advancement to our top calibre N.C.O.s and W.O.s capable of holding commissioned rank. This in turn gave the branch a solid nucleus of experienced aircraft maintenance officers. On the other side, the service had a corps of bright, young, eager and well-educated men who were capable of filling positions which required trained engineers. These are mostly staff positions which demand both practical and theoretical knowledge.

This policy was being followed, as far as can be gathered, quite closely, until the last two or three years. The policy had to be drastically changed because the number of direct entrants dwindled to a bare trickle and most of these were immigrants from the United Kingdom. A look at the student intakes of the R.C.A.F. Aeronautical Engineering School at Camp Borden and now Aylmer would be enlightening:

Year	Number of Students	Canadians with Degrees	From U.K.	C.F.R. or Remuster
1949 - 50	33	33		
1950 - 51	34	34		
1951 - 52	41	40		1
1952 - 53	18	17		1
1953 - 54	15	12	2	1
1954 - 55	9	7	1	1
1955 - 56	10	5	5	
1956 - 57	5	2	3	
1957 - 58	6	1	4	1

As can be seen, the intakes started to drop when our latest Canadian boom started to roll in 1952 with its consequent higher civilian salaries. The number of direct entrants has continued to drop until in 1956-57 it has almost reached zero. It might be pointed out that Aircrew Pay started in the summer of 1956.



The recruiting situation for graduate engineers has become so desperate that even our advertising has become misleading. A recruiting advertisement appearing in most metropolitan newspapers early this year was headlined: Opportunities Unlimited for Electrical Engineers in the R.C.A.F. The advertisement went on to say, in part:

> "Every day new developments in aviation point to exciting thresholds that are about to be crossed. Now more than ever there is a real challenge and scope for electrical engineers in the R.C.A.F.
>
> "Technology today is a dominant factor in modern military planning . . . In this sphere the electrical engineer is a key figure.
>
> "The range of duties he will assume during the course of his career in the R.C.A.F. is as broad and diversified as the Air Force itself."

These statements simply are not true. Under present manning policy the typical electrical engineer would not have employment as diversified as the Air Force itself. The Service must be concerned indeed, if it is willing to shade the truth in its recruiting advertising. Since the Service is concerned with the low recruiting rate for engineers and since its advertising seems to be having no effect, the only valid conclusion that can be deduced is that the R.C.A.F. is not offering to the young Canadian engineering graduate a worth-while career in comparison with civilian industry.

The final result of this manning situation cannot be satisfactory. The percentage of C.F.R.s in the Technical branches will gradually increase until they have a top-heavy majority. Take the present year as an example. The table showing the Aylmer intakes indicates one Canadian direct-entrant compared with 23 C.F.R.s. This commissioning from the ranks is a marvellous opportunity for advancement for our Warrant Officers and N.C.O.s but its value for the R.C.A.F. as a whole is very doubtful. The crux of the whole problem is that the end result will be a general lowering of the educational standards and qualifications of the Technical Officer branches at a time when the Service is becoming more technical and complex. C.F.R. personnel are topnotch men in their field and well deserving of their commissions, but they do not have advanced educations. With the advent of guided missiles and the increasing use of civilian engineers and scientists, our C.F.R.s will be at a distinct disadvantage due to their lack of theoretical knowledge.

Twin Problems: Pay and Opportunity

The problem can be broken down into two distinct parts. First, action is required to influence young engineering graduates into the service. Secondly, the proper incentive must be provided in order to keep them in. The solution to the first aspect of the problem is in pay, and to the second is by increasing opportunity and prestige.

Let us examine the pay problem. To a new graduate fresh out of engineering school, salary is probably all important. He may have incurred a few debts along the way in order to get through university. He is perhaps contemplating marriage. Both these items require money, and consequently salary is a vital concern. Dependent on who is doing the arguing, statistics can be produced to show that engineers in the service are better off than their counterparts in civilian industry or vice versa. It is a question that is almost impossible to answer because of all the intangibles involved.

But the comparison of engineers' salaries in or out of the service is not the crucial point. In our present-day materialistic way of life, the normal person compares his lot or station in life with that of his fellow workers in the same organization after comparing the demands placed upon each other in knowledge, ability, and effort. What do we find in the R.C.A.F.? Consider the impressions made upon an R.O.T.P. or U.R.T.P. engineering student on summer employment at an R.C.A.F. station. It must be remembered that this young man will be comparing his future job with that of his fellow officers, including aircrew. What does he see? He sees technical officers working very much harder usually than aircrew officers of the same rank. He sees that either their educational qualifications are much higher or their length of service much greater. He also sees that jobs of the technical officers demand more officer-like qualities than that of the aircrew officer. He also sees the end result — all this ability and effort is rewarded by a salary of over one hundred dollars per month lower for equivalent ranks.

We now come to the second problem — how to provide a satisfying career to engineering graduates so that they will be satisfied with their role in the R.C.A.F. In a nutshell, this boils down to two words — opportunity and prestige, or rather the lack of it.

What is the present situation in the R.C.A.F. concerning opportunities for advancement? Up to the present, the service has tended to isolate its technical officers from higher command. The belief and practice seems to be that technical officers should act only as staff advisors and must work only at their technical specialty. It has been indicated that in our increasingly complex technical service this belief is very unsound.

At present the only personnel being trained for top management jobs in the R.C.A.F. are aircrew, especially pilots. With the introduction of missiles just over the horizon, it is possible that they will be incapable of dealing with the problems presented without competent personnel from the technical branches with them on the management team.

The present belief is that pilots have to manage the Air Force because an understanding of the operation of aircraft is necessary to management. Under this premise, pilots have no place in a Missile Force, for the commanders then should be missile operators. This whole belief is very unsound; its fallacy is shown when we realize that a railroad company does not insist on an engineman as president, or when the president of a steamship company does not have to be a former ship's captain. It must be remembered that the right man for command may show up in any line of endeavour.

In the final analysis, the engineering graduate sees his career being limited to one small segment of the R.C.A.F. This is entirely different from the approach used by civilian industry. There the only limiting factors on his progression to the top are his ability and capacity for work. He knows the top-level management jobs are not limited to personnel belonging to a select group or profession. This lack of opportunity will always be a stumbling block to the enlistment of graduate engineers into the R.C.A.F. This situation causes an engineer in the

service to feel the R.C.A.F. is not giving him enough scope or challenge, which leads to many of our officers asking for their release.

The Solution

On the salary side, some system of equalizing the present pay differential is required. Aircrew pay was instituted to recognize the complexity and the hazard of the aircrew job. Professional pay for doctors and dentists was instituted as an inducement for enlistment to members of these professions. Recognition of this type is now urgently required for engineers. Pay alone will not attract the number of engineers needed by our future complex Air Force, but it will be a step in the right direction.

On the opportunity side, a drastic change in thinking is required in order to put the R.C.A.F. in step with the times. An organization is required that will open up advancement opportunities for all officers with the necessary qualifications and attributes. In view of the increasing technical complexity of the military organization, this is especially so for highly qualified technical officers.

In our future Air Force, two routes for advancement should be open to all officers. Those with the required experience who have ably demonstrated their managerial ability, will be given employment in various specialized and non-specialized executive appointments to give them a chance to show their adaptability and ability to carry added responsibilities. The others, because of their attributes or their desires, will continue in specialized posts. In any system there will be officers, as their careers progress, who tend to become intensively specialized. If their aptitudes and preferences lie in that direction it will be best for all concerned to allow them to continue to specialize.

All staff and station positions that do not demand specialist knowledge will be open to all officers, irrespective of branch. Only a pilot could command a fighter squadron; likewise only a doctor could properly command a hospital; further, only an engineer could command a guided missile squadron. These are what are meant by specialist appointments. On the other hand, if an officer has the experience commensurate with service and rank and possesses the required administrative and leadership abilities, he should be capable of commanding a station or base formation, or of holding administrative staff appointments, again irrespective of his branch.

Under this plan officers of any branch, after initial specialization, would be eligible for the executive ladder if they showed the necessary administrative and leadership abilities. Officers with ambitions for top management would be continuously educating themselves by studying both Air Force aspects outside their specialty and subjects beyond the limits of Service life. The executive officer would be given many different posts in order to see how he adapts himself — this is one way of measuring a man for higher command. Under this system the essential requirement for our managerial officers would be wide experience and administrative ability coupled with a whole-hearted belief in the purpose of the R.C.A.F. All officers would have an opportunity to advance to senior executive posts. The service would then be competitive with civilian industry and have a chance of recruiting its requirements of graduate engineers.

The R.C.A.F., in the face of the relentless advance of military technology, will have to face and solve this great problem — the need for technical competence on the management team — if it hopes to stay in the ascendancy. Field service representatives, part-time scientific consultants, and committees are all right in their place, but they cannot take the place of career personnel. In fact, as the technical problems become more complex, the need for highly qualified technical officers becomes even greater so they can integrate the work of these representatives and consultants into the service management team.

The solution to this problem is difficult and urgent. But the first requisite is to recognize that the problem does exist. Then it can be attacked and solved, since it is imperative that the R.C.A.F. get its share of the country's graduate engineers. Until it does get its share, the R.C.A.F. will be unprepared for the coming guided missile age.

North American Defensive Requirements in the Missile Age

FLYING OFFICER D. E. SHARP

Flying Officer Duane E. Sharp, born in Regina in 1934, graduated from the Royal Military College in 1955. After training in the R.C.A.F. as an observer/air intercept he joined an all-weather fighter squadron and is now serving at Zweibrucken, Germany.

A DISCUSSION of our changing defence requirements is best prefaced with a statement of the aim of the defending forces. Our aim in the defence of North America is two-fold. Firstly, we aim at survival; but survival alone will obviously not suffice. Therefore the second part of our aim requires that sufficient military strength be retained to launch a counter-attack against any aggressive power which attempts to invade the North American continent.

How can this aim be achieved in the missile age? What changes are necessary in our present defence forces? And how soon should these changes be initiated? It is my intention to discuss these questions in the light of recent changes in Soviet military thinking, and in consideration of the rapid technological advances with which these changes have been accompanied.

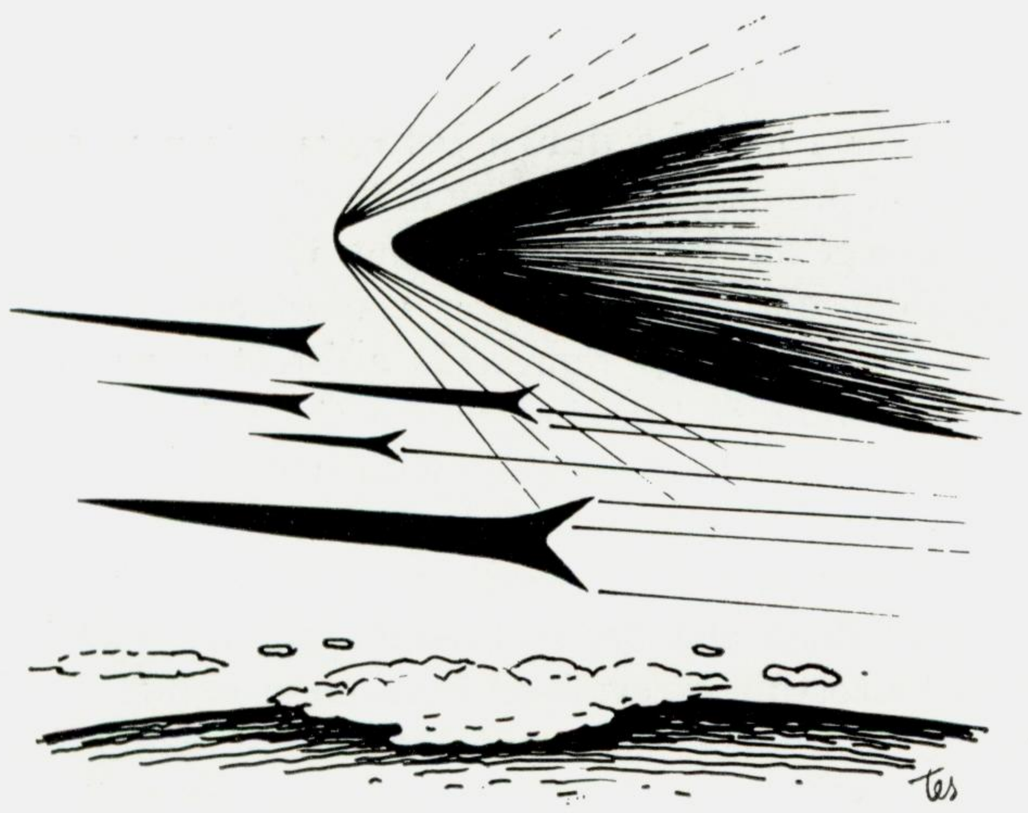
Soviet Military Policy

Since early 1955 a change has been evident in the military policy of the Soviet Union. In February of that year, Marshal Vassily Sokolovsky gave his arguments in support of this change in Russian military thinking in the newspaper "Izvestia". Briefly, he contended that "one must deprive the aggressor of the surprise factor". This was followed by a series of pointed arguments by other military leaders, such as the one in the Russian magazine "Military Thought". In this article, General P. Kurochkin stated that "we must be in a state of complete combat readiness and must know how to strike pre-emptive blows against an enemy who is preparing to attack". The essence of this new military policy is pre-emptive war, in contrast to the former Soviet policy advocating preventive war. A comparison may be drawn between this new concept and pre-emptive bidding in the game of bridge, the object in both cases being to surprise the opponent and to prevent a counter-attack. This "first-blow" strategy represents a direct reversal in Russian military thinking, which since the time of Napoleon has been content with a defensive attitude. The chief aim of the new policy is to minimize the retaliation from defending forces. The implications of these changes in Russian military doctrine may be readily ascertained from an examination of the new offensive weapons which have become available to the Soviets, in particular those weapons with a strategic role.

Until quite recently, the threat of a bomber attack had been held to be of prime importance in the defence of North America. However, the announcement by the Soviets in the fall of 1957 that they had developed a long-range ballistic missile with a maximum accuracy of plus or minus six miles, coupled with the previously-stated change in Soviet military policy, leads me to believe that the probability of a bomber attack is rapidly decreasing. This decreasing rate is proportional to the speed with which the Soviet is solving her missile production problems. To launch a bomber force, Russia would have to be prepared to accept a counter-attack of some strength, which is inconsistent with a "first blow" strategy. Stated in terms of the price of a war, this means that a bomber attack no longer provides enough profit to be worthy of consideration.

On the other hand, a well-timed missile offensive could quite conceivably fulfill the profit requirements. Apart from the military advantages which could result from a missile offensive, we cannot ignore the economic advantages, especially in the face of today's increasing arms expenditures. Let us

take an example from contemporary U.S. experience; recent plans for the establishment of ICBM bases in several Western states estimate the cost of each missile to be about two million dollars. This is approximately one-fifth the cost of one SAC bomber and its crew. To state the proposition differently, five missiles can be purchased for the price of one bomber. And we have barely scratched the surface in the manufacturing methods used in missile construction; more economy is certain to result from improved production methods — methods we can be sure that Russia is also doing her utmost to develop.



In June, 1957, the Society of British Aircraft Constructors stated that the main problem in the development of the ICBM was one of accurate guidance. As previously mentioned, the Russians claimed not six months later to have developed such a long-range ballistic missile which could come within six miles of a target. To ascertain the plausibility of Russian claims in this field, we may look back to the rapid strides which the Soviets made in the development of nuclear weapons, strides which were surprisingly swift when we consider that they were made under the burden of a ten to fifteen year deficit in knowledge of nucleonics. For evidence of the similar swiftness of technological advances in the development of rockets, we have only to refer to the launching of the first earth satellite by the Soviets.

As is the case with any type of offensive weapon, the successful use of the ICBM hinges on the ability of the Soviets to obtain these weapons in sufficient quantity to fulfill the dictates of their latest military policy. It is my contention that at least a few of Russia's ICBMs are operational and that she is now producing them in quantity. The saving factor inherent in all this talk of offensive missiles is the obvious need for a vast number of missiles of all classifications to initiate a full-scale war. They would have to be launched almost simultaneously to strike Allied bases in the U.S. and overseas, to ensure a minimum retaliation. To aid in guaranteeing this minimum retaliation, Russia has established intermediate-range missile bases from Finland to the Black Sea; from these bases missiles could be launched against NATO bases in Europe.

Defensive Weapons

In the battles of medieval times, a wall surrounding a city was not enough to prevent would-be invaders from gaining entrance. It was still necessary for the defenders to have weapons ready to repulse the enemy. And so it is today. Our radar fences would in themselves be even less effective against a potential enemy than were the walls of medieval times, for they could hardly even slow an attacking force. Without the backing of a good defensive weapon, they could only forecast impending disaster.

Manned interceptors make up the greatest portion of our defensive weapons, and our intelligence agencies would have us believe that our interceptors and anti-aircraft missiles are an effective deterrent to a Russian bomber attack, fulfilling their part in maintaining our defensive aim alongside the mighty deterrent of Strategic Air Command. Just how adequate our defences are in terms of the toll which could be exacted from a bomber raid is a much-debated point. Even if we were to assume the adequacy of our present defence set-up, we are still faced with this problem: with what weapons do we meet the Russian threat of missile invasion? The probability of attack under present conditions appears very slight, but we cannot afford to rule it out in an examination of the effectiveness of our defence system. The "present conditions" in which we find ourselves today may not exist tomorrow.

Equipping our interceptors with air-to-air missiles, despite the fact that these weapons are new and unproven in combat, is a sign that we are at least making an attempt to raise our defensive potential to a point from which we can look at the enemy on eye-level. However, as a defence against offensive missiles the manned interceptor faces problems which are insurmountable. On the other hand, a ground-to-air missile with its own guidance system and a speed equivalent to or greater than

that of the ICBM would certainly provide a solution to many of our present and future defence problems. Since it has been estimated that Canada will not be able to develop an anti-missile missile of her own for seven years, we would initially be dependent on the United States for weapons of this nature to be placed at selected locations in Northern Canada.

It is very likely that a shift to defensive missiles will result in economic advantages comparable to those for the offensive, once the technical difficulties have been overcome. The problems in production of such weapons are new, but considering the accelerated progress which has been made in the missile field, it should be only a matter of two or three years before the problems are solved.

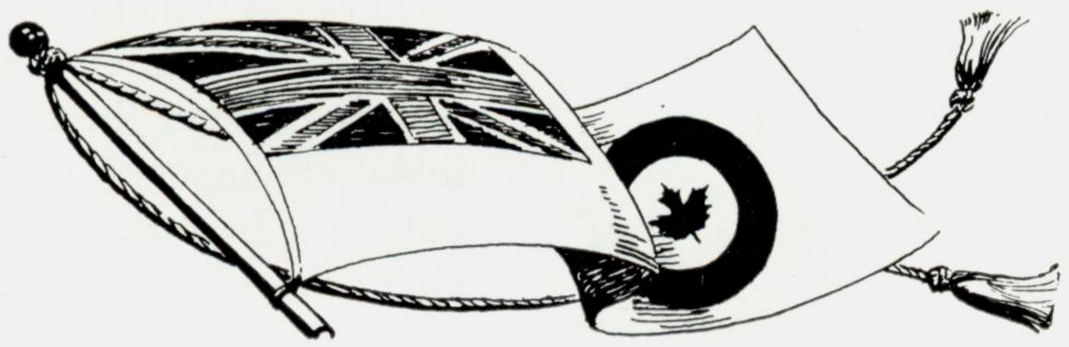
Insofar as Canada's contribution to the defence of North America is concerned, it would be prudent to examine closely the economic implications of an extensive manned interceptor programme over the next five years. Certainly no one will question the flexibility of the manned interceptor, but what is the price of flexibility? Surely a great degree of flexibility could be exchanged for a stronger and more certain defence. Initially, manned interceptors and missiles would be employed as complementary, with the interceptors rapidly being replaced by missiles to the point of minimum flexibility. Exactly how many interceptors would be needed to provide a minimum of flexibility would have to be determined by consideration of several factors, which would include the likelihood of a bomber "follow-up" offensive, which might succeed a missile attack. However even if the threat of a bomber attack remains a noteworthy component of the total threat, the interceptor missiles could still be used against bombers as well as against ICBMs. The important factor is that the manned interceptor has only a bomber defence capability, and this factor must determine how and when we must make decisive changes in our present defence set-up. These decisive changes must be initiated *before*, not after, our opponent has obtained sufficient weapons with which to carry out his military objective. We have underestimated his progress before in the field of nuclear development and in other technical fields; it would be a serious error to underestimate his ability to make similar advances in the missile field.



Summary

In maintaining our defensive aim in the missile age, we must strive to shorten the transition period between manned interceptors and missiles, not only for military but also for economic reasons. This does not mean that Canada must sacrifice her present defence forces on the altar of missile development, but it does mean that plans should be considered immediately to locate U.S.-developed interceptor missiles in Canada's far North as soon as they are available. It is my opinion that the Soviet Union is striving with all her technical and industrial resources to accumulate enough missiles to launch an offensive, and her rate of progress is much swifter than many people would have us believe. A reduction in the ever-present time lag between offensive and defensive weapons should certainly be attempted in an effort to offset this rate of progress.

Finally, in any analysis of our swiftly-changing defence requirements, we cannot lose sight of this vital determining factor: the useful life of the manned interceptor in the defence of North America will be a function of the time required for the successful development and incorporation of long-range missiles as offensive weapons of war.



The Military Challenge Today

C. M. MOONEY

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"Wishful thinking about war constitutes a major element in scientific thinking about war. An evaluation of faiths is an indispensable key to the future. The student of war must recognize that wishes, opinions, and beliefs, including his own, are among the phenomena with which he deals. He cannot exclude them from his predictive formulations as may the physicist. With all their intangibility, imponderability, and changeability, he must do his best to reduce them to order. He cannot do this unless he combines persuasion with analysis. He must try to perpetuate in the society the beliefs which constitute the postulates of his study, or his analysis will be undermined."

QUINCY WRIGHT, *A Study of War.*

IT STRIKES me that statesmen and scientists are assuming too much military responsibility, and soldiers too little. The corrective — if my conceptions of war, military function, and current military realities are at all valid — would seem to be for our military leaders to weld themselves and their forces into a single, powerful military arm. I suggest that this is the major challenge to military leadership today.

I recall Aristide Briand's remark to Lloyd George during World War I that "war is much too serious a thing to be left to military men". I have in mind the later jibe by H. G. Wells: "The professional military mind is by necessity an inferior and unimaginative mind; no man of high intellectual quality would willingly imprison his gifts in such a calling". And I have before me a recent paper by Ellis Johnson[1], head of U. S. Army Operations Research, urging a point of view held by many scientists who work on military problems, to the effect that military strategic planning and technology should be given over entirely to outside bodies of civilian scientists, leaving to the military only the roles of combat, combat training, and the development of war plans.

[1] Ellis A. Johnson, *Jour. Op. Res. Soc. America,* 6, 11-34, 1958.

It is true that the grand strategies of international conflict have been the prerogatives of heads of state. It is true that military men have often been reluctant to adopt new methods of warfare. And it is true that the military exploitation of the physical, chemical, atomic, and biological resources of science calls for technological specialization. But it does not follow that war is preeminently a matter of diplomatic conception or technological accomplishment; it is, above all, a military enterprise.

Today, when the weapons of choice in the east-west diplomatic duel are atomic missiles, it might justly be remarked that war is much too deadly a thing to be left to statesmen and scientists. In its cold actualities and hot potentialities, it manifestly calls for joint collaboration of statesmen, scientists, and soldiers, in the coordinate realms of national policy, scientific technology, and military operations — in which it must never be overlooked that the military underwriters are the soldiers.

The responsibility of the military is an ultimate one, implied in and lying beyond all that is accomplished or fails of accomplishment at diplomatic and technological levels. It requires military professionals to contemplate — even when the civil power does not, or in ways the civil power may not — the ultimate conduct of a war offensive or a military defensive by force of arms *in ways and at times most likely to be successful.*

The existence of the "push-button" does not necessarily determine the nature of war or its outcome. The conclusive implication of the "atomic ultimatum" simply makes it imperative that international "hostilities" be waged always, if possible, at diplomatic and technological levels (by summit conferences and sputnik contests, for example). It is clear that it should be waged with the full knowledge and consent of military men; not only because war, in its most sophisticated forms, is still, essentially, a military undertaking, but for the further reason that if the "winning" diplomatic offensives do not win, and the "successful" technological defensives do not succeed, the final inheritors of a run-away war will most certainly be the professional military men and their fighting forces — and they will not want to be unprepared.

Indeed, there is a grim logic to the idea that if we are to maintain ourselves in a state of a military strength and readiness we should maintain ourselves *as* a military state. We do accept the necessity of the military oligarchy and the regimented society during the acute crisis of armed warfare because we are aware that the military "model" permits a unification of purpose, a massing of resources, and a coordination of effort not otherwise possible. Should we conceive ourselves now to be in grave military danger, and note that the hostile nationalities which threaten us possess, through the workings of historical chance, a society, culture, and technology built upon the military "model", then we might wisely adopt the same posture.

But this is unlikely. Our society is cast in the liberal, humanistic tradition. The democratically responsible civil arm will not readily grant executive power to military professionals short of the clearly perceived brink of disaster. The nation must, paradoxically, accept the greater risk of going down democratically than surviving autocratically. The military is thus constrained by the "soft" facts of national life, on one hand, while attempting to confront the "hard" facts of international life, on the other.

Here, then, it is essential that we have the minimum insurance of a strong military arm which would assume full management of all military operations, and collaborate with other executive branches of government on military aspects of national and international affairs. Should the civil government be reluctant to initiate this, it could be accomplished by our military leaders.

The first requirement would be, of course, an agreement by military men on the need for a strong military arm. There would then seem to be two avenues open to them. One would consist in rigorously militarizing the present armed forces at all levels of organization and in all fields of operations. The other would consist in unifying the existing forces within a single command and thereafter extending the influence of the military arm into all collateral activities of government having any military consequences. The question may arise here: would not the strengthening of the individual forces work against their unification? This will be answered, I think, when we contemplate the nature of the command function.

The Command Function

War is any hostile activity between opposed entities. In highly developed form, it is the deliberately planned, rationally controlled application of force by one national alliance upon another, employing moderate and sufficient methods of coercion so far as possible, and the extreme methods of armed warfare when necessary. Its efficient execution in all moderate and extreme forms is the business (or science or art) of military professionals. The incorporation of military professionals into a military arm, the conjunction of a military arm with the civil arm, the subordination of a military arm to the civil arm, are arrangements governing the use of military force, and do not bear on the essential nature of war and the essential business of military professionals.

A military arm is an organization of professional military leaders and forces operating within general statutory regulations and under executive limitations imposed by the civil power. The arm exercises exclusive command over its members and estates and stands in a *liege* relationship to the civil power. Within its military domain it possesses a whole apparatus of government. It is a stronger arm than the civil, since it could survive alone, while the civil arm could not.

The exercise of power known as the *command function* is what makes the military truly military and distinguishes it from all other organizations (the religious "Orders", anciently derived, are, perhaps the only parallel). The command function is achieved by merging *judicial* and *executive* functions (which are separate, in civil government, from each other and from the *legislative*). It is delegated from the top command down through descending ranks in open (published and public) regulations enforceable under an open code of military law (legislatively "given" to the military by the civil). It is delegated in sub-unitary fashion *so that authority and responsibility are commensurate and have a precise locus everywhere within the organization.*

This has the consequence of giving the military organization a capacity for rapid, decisive action, and enables it to act as a concerted whole or independently in its several parts. From this regimental integration of structure, function, authority, and responsibility the military organization derives its great structural rigidity, functional flexibility, and corporate viability.

Militarizing the Forces

With these concepts in mind, let me turn to the first of the two avenues to be exploited — militarization of the armed forces. This would mean strict adherence to the principle: every person and every activity essential to the operations of the military organization should be subject to military command. Exceptions to this principle (for example, nonmilitary) would be regarded as vitiating military capacity. Wider application of the principle (for example, decreasing military dependence on nonmilitary organizations) would be regarded as adding to military strength.

Since the militarization program would be in the nature of a "corrective", it could be seen as amounting, in effect, to this: no *civilianism,* no *bureaucratism,* no *scientism.*

By *civilianism* I mean that civic attitude which leads to a view of the military organization as a kind of business, industrial, or educational enterprise; chooses to see soldiers as work-a-day citizens; and prefers permissive methods of management to authoritarian. It is the antithesis of the military attitude, and its effects have to be seen as corruptive of military efficiency.

By *bureaucratism* I mean the practice of delegating responsibility but withholding authority, of prescribing action but proscribing decision, of centralizing the whole "mind" of management at the top. This, however necessary to the regulation of governnment business by its civil servants, is unnecessary to the management of military affairs, and its practice in the military should be regarded as weakening the command function.

By *scientism* I mean unwarranted faith in scientific practicality, whether held by the scientific "doctor" or the management "patient". It springs out of the desire — often the pressing need — of top planners and executives to attain greater certainty in management, and their belief that they can achieve it through the "optimizing" methods of science. It resides also in the growing confidence of increasing numbers of consulting "management scientists" that they can evolve practical answers to operational problems more effectively by scientific methods than can otherwise be done by professional managers. This is all legitimate, provided the problems are what might be called the "cost-accountable" ones. But when scientists believe they can apply exact scientific methods to the making of top policy decisions, and when executives believe that scientists have "scientific" means for determining "right" policy decisions, the combination of scientific naivete and managerial credulity amounts to *scientism,* which can be corruptive both of science and management.

There are many fields that might be exploited in militarizing the armed forces. To illustrate, let me take two — military professionalism, and military management.

Military Professionalism. A program designed to accentuate military professionalism could have two objectives: one, underwriting the sense of professional pride and self-regard on the part of military men; two, enlarging their professional stature.

For this, there is a rich ground to be exploited. The military profession is an old and honorable one. It is a profession not simply because its members are in the armed forces, but because it embodies special knowledge and skills, possesses a history and traditions, observes a professional code, and confers formal training and qualifications. In exploiting this ground, the moves would be thoroughly conventional; but in the context of this whole argument they seem to assume more than ordinary significance.

The "marks" of the military, its dress, insignia, decorations, honors, music, ceremonies, privileges of rank, and the respects and compliments that attach to military position, would be sedulously preserved. Along with this an intensive study of the military in its historical aspects would contribute not only to professional self-identification, but drive home those principles and precedents that count towards professional competence.

An important measure of a profession is its adherence to an established code of behavior. The code of the military — where each man pledges his life to unquestioned obedience, absolute loyalty, courageous endeavor, and stoical endurance — is an heroic one. Much of it is implicit in practice and tradition, some of it specifically embodied in military law, and some set forth in precepts (behavior on being taken prisoner-of-war, for example). More of it, perhaps, could be formulated in simple, compelling language, as a kind of recitative or catechism. All who violated it (by, for example, breaches of military security, brutal or stupid excesses in command, theft of property, abuse of civilians, mutinous behavior, cowardice, premature surrender) would

invariably be subject to severe punishment, making it evident that what a soldier *is* he must *be*.

The military man's professional warrant is founded on military competence. It does not derive from his particular technical training, or from the specialized nature of the tasks he performs. Thus, the medical officer is a military man first and a doctor second; his medical work is incidental to his military role. The electronics engineer is a military professional not because of that qualification, but because he has an essential task in the realization of the purposes of the military unit. Professional military competence seems, then, to reside in such things as knowledge of military organization, command functions, military methods — in short, all things military whereby a man may be judged a professional "man at arms". Thus, training in military fundamentals might be seen as an imperative requirement for every military rank, no matter how technically specialized or esoteric his particular "place" in the military scheme of operations.

The list of military fundamentals might well be extended. When military directors must routinely "command" numerous technologies, they should have a general knowledge of the maxims underlying these technologies. This would embrace a knowledge of the theories and practices, facts and fictions, uses and abuses, of such "generalizing" sciences as psychiatry, sociology, psychology, political science, economics, and of such "particularizing" sciences as communications theory, operational research, human engineering, and industrial engineering.

Military Management. I described in an earlier paper[1] the complex nature of military management, emphasized the management power inherent in the command function, pointed out the manifest usefulness of various sciences and management techniques, and indicated how they could be integrated into the military. I did not deal with the dangers of undue reliance on science in management.

One motive behind the suggestion that professional military training might be extended to develop greater sophistication concerning the uses and limitations of the applied sciences was the idea that military managers should not become unduly dependent on advisory scientists or consulting technologists in making their military decisions.

It is all right for scientists to bring their methods to bear on military management problems and assist military directors to have a well informed and thoroughly reasoned basis for their operating decisions, provided this does not displace the locus of military decision or vitiate its force. There are ways of minimizing this possibility. One is to insist on the personal responsibility of military men in all decisions they make, however advised during their preliminary appreciation of critical issues. Another is to cut off all intercourse between the military and outside advisory agents, or, preferably, perhaps, to put all useful or necessary scientific services into the military organization, subject to military command.

By taking the scientists into military service, their sciences would become responsible military technologies. The scientists would be held militarily accountable for the pertinence and competence of



"answers" to problems which they elected as theirs. With this, the command function would no longer be in danger of being split between scientific experts and military professionals, and military professionals would be freed from the "intellectual reproach" tacitly represented by experts studying military problems from the outside.

The question of scientific independence will arise. To my mind, a scientist engaged in scientific administration, or solving practical problems out of scientific knowledge with scientific methods, is an administrator or a technologist. Thus, the proposition to put technologists into uniform constitutes no threat at all to those scientists in appropriate "free" settings in the universities, in the armed forces, or elsewhere, who pursue those theoretical, speculative, wide-open studies that fortuitously contribute to the sum of human knowledge.

This same idea applies not only to scientists. For example, it would be considered undesirable to employ civil servants in military establishments, to effect routine repairs and maintain military equipments with civilian tradesmen, or to man military installations with civilian operators, for the reason that military commanders cannot "command" civilian employees. It would follow that only military men would command military personnel or direct

[1] C. M. Mooney, Scientific Aspects of Military Management, *R.C.A.F. Staff College Journal, 1957.*

military operations. Skilled civilians would not be employed in military executive capacities, because civilian "officers" cannot exercise authority without corresponding powers of command. All such, if needed by the military, would go into uniform.

On this matter of being in uniform: is it, incidentally, a small point, or as large as the principle involved, that all military personnel should wear military dress in the performance of military duties? Military command calls for authority to be openly indicated. The officer or non-commissioned officer carries the authority and responsibility shown by his rank. Should he not, then, be in uniform?

There are but a few of the ways, or kinds of emphases, that military leaders could employ in developing a most highly disciplined and competent soldiery in the armed forces.

Unifying the Forces

With three separate military forces, army, navy, air force, there are, manifestly, three separate command functions. It follows: they do not and cannot constitute a true military arm of government. Though sharing one shoulder socket and wrapped about with a single "defence department" sleeve, they are not one military arm, nor are they three. There is, in this situation, no command function compatible with the idea of a single military arm of government — or, to put it another way, the command function supposedly vested in the defence department has no single military arm and is not, in effect, a command function.

I have suggested that the unification of the three forces into a single military arm would have to be accomplished by military leaders. It may be supposed that it is a step that would only be forced upon the three forces by the civil government; and it might be supposed that it would be a point of honor with the forces to oppose any such step. But these are suppositions that might be viewed in reverse. The civil power could not force the arms to integrate; moreover, the civil power could want no better guarantee of military dependence than their present division. *Per contra,* military leaders can want no better way — and one within their own province — of achieving a truly military arm than through unification. Whether the civil power wants it or not is of lesser consequence than whether or not military leaders want it. That they should want it has been the whole burden of my argument. And it would appear that they could accomplish it quite directly.

The step to be taken would be the singularly simple one of replacing the present three command functions with one. This would mean one Commander in Chief, and, of other kinds of HQ members, one each — in short, one military HQ instead of three, and an end to tri-service committees.

The unifying process, from this point on, would become a planned military "operation", calling for careful staff planning, and rigorous use of the strength inherent in the command function. Its success would depend on two things: first, unanimity of purpose by top leaders of the forces; second, such a hardening of the forces by the program of militarization that we have foreseen that they could sustain the traumatic effects of the merger. It is obvious that the operation would not be simple or pleasant on the human side, and that there would be many personal "costs". But it has to be supposed that these would be stoically accepted.

As the single arm came into being it would be, in effect, *the military arm.* The tactics in making it a strong arm would be the same militarizing tactics that we have discussed. They would continue within the force, with an intent now aiming at the development of a sense of the unity of the arm, professional community, and identity of purpose. Thereafter, the arm, by virtue of its singularity and strength, would be able to exert, in realms of diplomacy and technology, the military influence that our national security would seem to demand.

There is just one question: what would bring our top commands together in a compact of this kind?

I do not profess to know. I let it stand as the essence of the challenge to military leadership today. If you believe, as I do, in military *genius,* you may agree it is a legitimate challenge.

Beyond this, I can only say with T. E. Lawrence: "All men dream; but not equally. Those who dream by night in the dusty recesses of their minds wake in the day to find that it was vanity; but the dreamers of the day are dangerous men, for they may act their dream with open eyes, to make it possible."

The Significance to Defence Science of Research and Development on Materials

H. P. TARDIF

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THE uses to which various materials are applied throughout ordnance science and technology depend to a large degree on their properties and on the facility with which they can be processed. Materials are used to produce concrete realizations of design concepts, which can be translated into physical end-items only if materials of the required characteristics are available.

The operating requirements of new weapons systems, however, have become so severe during the past few years that materials have been taxed to their limit in being submitted to previously unknown environmental conditions. Continuing development in the armament field can be possible only if it is supported by parallel developments in the large families of materials. There is no doubt that the tremendous advances in defence science of the past few years have been due largely to the extensive use of newly developed materials. As an example let us consider the increase in gun barrel strength since the 1800's. In those days cannon had strengths of 25,000 psi, whereas today gun barrels have strengths of the order of 200,000 psi and above. This advance was made possible by the continued development of better steels, forced by the demands of steel structures designers. The search for new materials is a necessary and never ending activity, being of utmost importance to the advancement of new weaponry, for in many cases, especially in the high temperature fields, lack of materials is holding back practical applications of newly discovered scientific principles.

In general, new materials are developed for specific requirements. They may come from existing materials slightly improved to produce an increased range of the property desired, they may be obtained from a completely new approach and show improvement in a specific property, or they may be materials having new properties never before utilized in practical applications.

Such developments may involve years of laboratory research, pilot plant production, and testing. Once an apparently promising material has been obtained it remains to evaluate it as follows:

(a) Chemical analysis.
(b) Macroexamination: visual, etching, magnetic particle methods, electro- magnetic and ultrasonic methods, etc.
(c) Microexamination: optical and electron microscopy, X-ray diffraction, etc.
(d) Physical properties: magnetic, electrical, electronic radioactivity, etc.
(e) Mechanical properties: tension, compression, band impact, fatigue, hardness, notch effect, creep.
(f) Availability of the materials, freedom from stategic elements, etc., and availability of necessary facilities to manufacture it.

In many cases, correlation of test and practice can be very difficult, and simulated service testing may remain the most important test. There is in fact no better way of determining the behaviour of a product than to submit it to actual service, but this is often impracticable due to the time and cost involved, so that resort is made to laboratory simulated service or environmental testing, where material and equipment are tested under conditions resembling those to be met in service. Environmental testing thus concerns itself not only with the effects of natural meteorological forces but also with environmental conditions created by man, such as extremely high temperatures, vibration, shock, etc. The various environments are classified by the U.S. Air Research and Development Command as follows:

Natural Environments
Altitude
Solar and cosmic radiation
Rain, sand and dust erosion
Humidity, salt spray, ozone

Biological-bacterial and fungal growth
Low temperatures

Induced Environments
High temperature
Thermal shock
Noise and vibration
Explosive atmosphere
Acceleration
Mechanical shock
Corrosion-fuels, rocket gas, etc.

Because of the severe conditions under which materials are used in new defence applications, new dimensions have to be introduced in material testing in order to correlate laboratory tests with actual service conditions. For example, during re-entry into the atmosphere materials may be subjected to extremely high temperatures for a very short time. In other instances materials may be heated from low to extremely high temperatures in a matter of seconds. In such cases unstable materials like cold-worked or precipitation-hardened steels may be satisfactory if the time at temperature is not sufficiently long to cause softening.

Consequently, materials must be tested under similar drastic conditions and new testing techniques have to be developed. This new field of testing is now reaching a stage where the variables involved are known well enough to permit development of testing equipment that will provide accurate and reproducible data.

Short-Time Tensile Properties of 2024-T3 Aluminum at 600° F.

Testing Variables		Properties at 600° F.		
Soak Time	Testing Time	Ultimate Strength	Yield Strength	Elongation in 2 In.
90 min.	2 to 5 min.	14,000 psi.	11,000 psi.	—
30 min.	2 to 5 min.	19,000	15,000	—
2 sec.	3 sec.	27,500	—	—
10 min.	30 sec.	28,000★	—	—
100 sec.	0.08 sec.	34,000	31,700	7%
30 min.	0.08 sec.	26,500	22,000	11
100 sec.	25 min.	17,300	17,100	7
30 min.	25 min.	13,500	13,000	10
	1 to 2 min.	20,000	—	—

★Extrapolated.

Figure 1: Showing the effects of testing variables on properties of Alcan 24S-T aluminum alloy.

Many changes will occur in a material during heating up to an elevated temperature due to variables such as strain rate, creep rate, ageing or other metallurgical changes. These changes, depending on the rate of heating, time at temperature, and testing time, will be complete to a greater or lesser degree, and the mechanical properties affected accordingly. This is strikingly illustrated in Figure 1.

It can be seen in this example that the tensile strength of 2024-T3 (Alcan 24S-T) aluminum alloy can vary from 13,500 to 34,000 psi at 600°F depending on soak and testing time. The attainment of high temperatures in very short times, coupled with the problem of measuring stress and strain under these conditions, is quite complicated. However, many machines of this type based on various principles have been constructed. One of them at Southern Research Institute, Birmingham, Ala., can heat a specimen to 2250°F in a matter of 10 seconds. A closer approximation of aerodynamic heating is obtained in another machine at Convair where the specimen is heated by the use of a hot fluid flowing around it, the rate of heating being controlled by the velocity of the fluid.

Other testing machines not likely to be met in an ordinary materials laboratory include the rocket-driven impact sled, the rocket-driven centrifuge and the explosion chamber that tries equipment within the blast itself. Great advances have already been made in the fields of development and testing of materials for applications in the guided missile, atomic and electronic fields. A few examples taken from a multitude of recent developments will be discussed further, especially material applications for high-speed and multiple-mach aircraft.

Super-High Strength Steels

When aircraft designers started to use the light and high strength 75S aluminum alloys of 70,000 psi tensile strength, the steel producers were forced to develop steel of 210,000 psi range to compete with the three-times lighter aluminum alloys. This strength was then possible with existing steels of the 4340 type for example, but the impact and ductility properties were too low. There was an obvious need for a steel of 210,000 to 230,000 psi tensile strength, with the same impact properties as the flight- and time-tested 4340 (heat-treated in the 180,000 psi range) and this was met by improving heat-treatment practices or making slight changes in chemical composition. However, the need soon arose for steels of still higher strength coupled with reasonable impact properties, and after years of research many new compositions were developed for strengths up to 300,000 psi. Steels such as the Super Hy-Tuf and Tricent are typical. As an example of a practical application, our Canadian CF-105 Avro *Arrow*, believed to be the world's fastest interceptor, uses a landing gear of forged ultra-high strength steel, heat-treated to about 270,000 psi.

High-Strength - High-Temperature Steels

In the aircraft of a few years ago, aerodynamic heating was unknown. In modern supersonic aircraft, however, the structural materials have to be chosen on the basis of their strengths at high temperature. At 40,000 feet the skin temperature of a Mach 2 aircraft will rise to 200-250°F. At Mach 3 the temperature will have climbed to 550°F while at Mach 4 the order will be of from 800 to 1000°F.

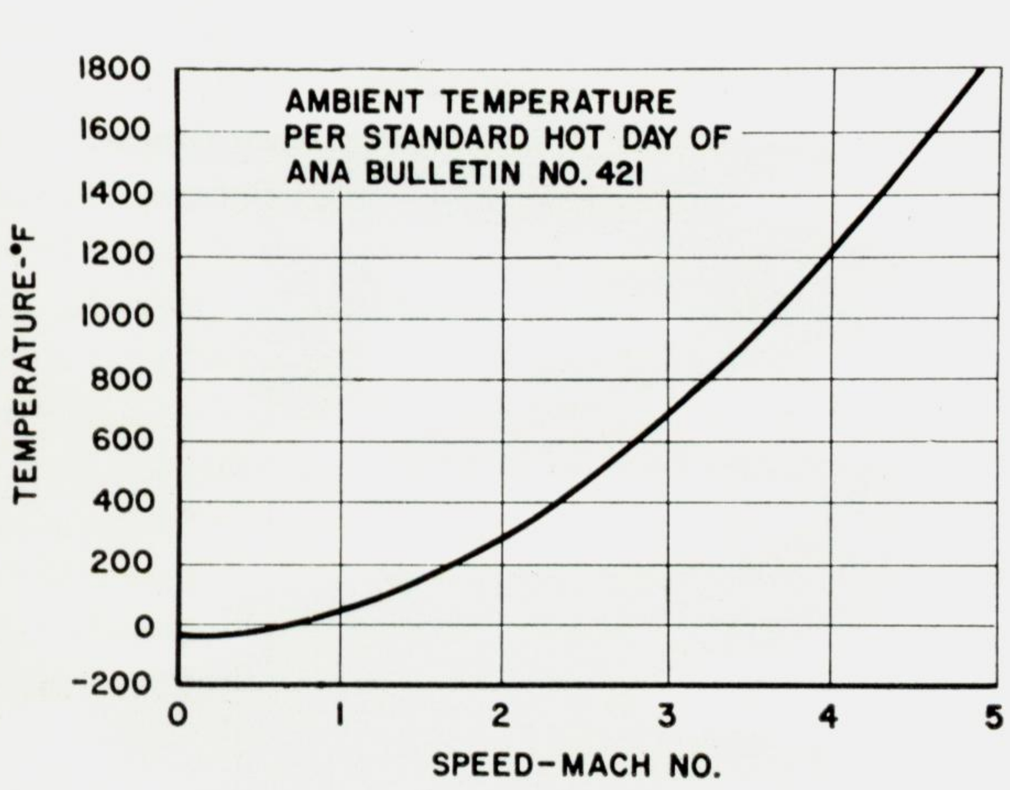
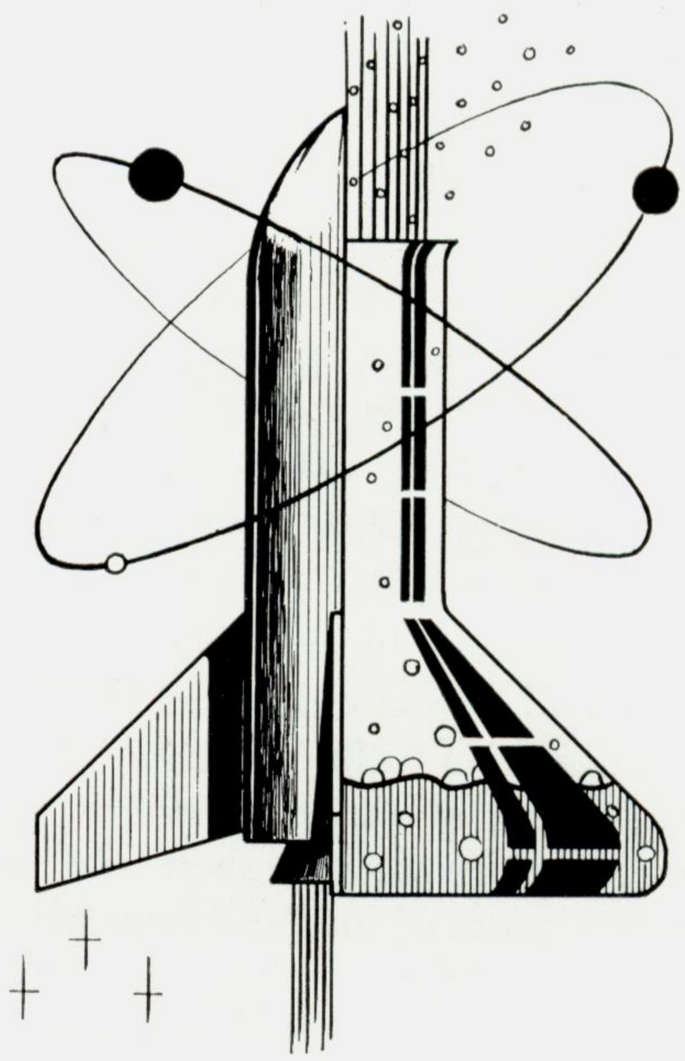


Figure 2: Adiabatic Wall Temperature versus airspeed at altitude of 35,000 feet.

Figure 2 shows a speed temperature curve obtained under specific conditions. While aircraft do not yet fly above Mach 3, missiles do, from Mach 3 for the *Nike Hercules* and *Talos* to Mach 10 and above for the *Thor, Atlas,* and *Titan.* Manned hypersonic crafts will eventually reach escape velocity of Mach 30 and above to become, in fact, space ships.

Concerning structural and skin materials for the "hot airplane", high temperature alloys are now available that will retain good strength at temperatures up to the 1200°F considered in the design of future fighters and bombers. An aircraft suitable for operation at 600°F, however, would weigh one and a half times as much as the same aluminum alloy aircraft. Consequently great efforts have to be devoted to discover lighter alloys. Of the heavier alloys already available for structural purposes the precipitation hardening semi-austenitic and austenitic stainless steels, and the hot work die steels, are gaining ground rapidly. These are readily fabricated in the annealed condition and hardened by heat-treatment at a temperature low enough to prevent excess scaling or distortion. They exhibit high impact strength at low temperature and good corrosion resistance. The dies steels, although existing previously, could be rolled only with difficulty, but recent technological advances in the rolling of metals now make it possible to roll even die steels. Of these, the 5% chromium steels are now proposed for aircraft operation range between −100 to +1000°F. They have far superior thermal stability, strength, and toughness than ultra-high steels at high temperature; they can be formed easily in the annealed condition and even fusion welded by the heliarc method or spot welded.

Another approach towards structural members for high temperature applications is the use of metallo-ceramics and cermets consisting of mechanical mixtures of metallic and refractory powders or fibres. One problem is the perfecting of coatings to resist oxidation. Molybdenum fibres covered with thorium oxide would withstand a temperature of at least 3000°F. The next few years will see this approach extended until a full spectrum of metal ceramics combinations is obtained. The ceramic parts of these



composite structures may be cermets, intermetallic compounds, graphite, oxides, carbides, borides, nitrides or other refractory substances.

But before these new structural materials can be used in aircraft production, characteristics such as productibility, structural reliability, uniformity, design properties, fabrication and process limitations have to be determined. Moreover, many factors which are unimportant at room temperature affect the selection of materials for high temperature applications. These are: sources and distribution of heat, method and rate of application of loads, total service time at each temperature and load condition,

variation of the material strength, modulus of elasticity, and coefficient of expansion with temperature. Attention must also be paid to differential expansion between components, thermal conductivity, surface emissivity and metallurgical stability of the alloy at high temperature. The material should also have a fatigue strength to tensile-strength ratio comparable to those of materials in present use, together with resistance to crack propagation, corrosion and high temperature oxidation. Applications for these new materials find place in combustion liners, blades, buckets, guide vanes, tail cones, and skin and structural members.

Besides the development of high strength high temperature alloys and the improvement in rolling techniques for these new alloys, the refinement of the metallic honeycomb structure is another development that is helping planes and missiles into the multiple-mach area. High temperature honeycomb structures can now be made up of relatively frail sections of stainless steel rolled to one-sixth the thickness of the human hair. They possess extraordinary strength to weight ratio plus outstanding rigidity.

Space Flight

The design of items for use under severe conditions calls for considerable ingenuity in the choice of materials. This is strikingly illustrated in the American scientific earth satellites "Vanguard" and "Explorer". The satellite consists of two hemispherical shells fastened to an inner support structure. Magnesium alloy was chosen as the constructional material because of its low density and high strength to weight ration at slightly elevated temperatures. The inner surface of the shell and supports are plated with layers of zinc, copper, silver and gold. The first three under layers are used to achieve an adherent layer of gold. The layer of gold is used to reduce the amount of radiation from the shell to the internal package.

The external surface is then covered with vacuum deposited coatings of chromium, silicon monoxide, aluminum, and lastly an outer layer of silicon monoxide. The chromium again is used because of its excellent adherence to substrates. The first layer of silicon monoxide prevents diffusion of chromium into the aluminum which gives the shell excellent reflectivity. The final layer of silicon monoxide controls the emissivity of the external surface. The above materials had to be chosen on the basis of thermal conductivity, density, and specific heat, to serve as a heat sink to absorb heat influx; of coefficient of expansion, thermal gradient and modulus of elasticity to minimize thermal stresses; and of emissivity to achieve proper balance between heat absorbed and heat radiated. Emissivity, however, is affected by surface color and roughness and will probably change if the satellite surface becomes eroded by meteoritic particles.

The Explorer's blunt nose cone is 12 inches long, 6 inches in diameter and of skin thickness 0.013 to 0.017 inches. It is shaped from a single square



sheet of material by a very recently developed spinning process called Floturning. Designed for a speed of 18,500 m.p.h., and weighing 13 ounces, this nose cone is made of stainless steel, chosen because of its high strength and resistance to temperature extremes even in thin sections. When in the earth shadow the Explorer radiates heat to the coldness of empty space, but when in the sunlight it absorbs heat at a terrific rate. The temperature differential is approximately 800°F, ranging from 150°F below zero on the cold side to 600°F on the sunny side. To keep the temperature fluctuation inside the satellite within the operational limits of the electronics, the stainless steel satellite is coated with equally spaced, ¼ inch wide, white aluminum oxide stripes, the percentage of surface covered being calculated to control temperatures by reflecting the proper amount of radiation. The temperature inside varies from 50 to 86°F.

Semiconductor Materials

The term semiconductor has become increasingly familiar during the last few years. Already, some semiconductor devices are in use in television sets, automobiles and radios, but so far the largest consumption has been in military equipment. Transis-

torized electronic equipment in fast aircraft contributed to a reduction in weight of the aircraft with a consequent increase in velocity. Infrared detectors are challenging radar as the best method of detecting enemy missiles, tanks, and gun emplacements. Other semiconductor materials are being applied to the conversion of solar and nuclear energy into electrical power.

The fields of application of these materials seem almost infinite. The photovoltaic effect where light is converted into electrical energy is observed in silicon, cadmium telluride, indium phosphide, gallium arsenide, and aluminum antimonide. Devices made with these materials can provide power for satellite instrumentation by transforming the sun's energy into electricity. This has already been proved and tested in high altitude rockets and in the Vanguard satellite. In satellites or spaceships such cells could not only furnish power for the instruments when exposed to the sun but also charge small batteries which would take over during the "night-time".

New Techniques for New and Better Materials

Coupled with the development of new materials is the absolutely essential development of new techniques for obtaining or processing these materials. For example, semiconductor materials could not have been produced without the development of the zone-refining and crystal growing techniques. Zone-refining permits the obtaining of ultra-pure materials containing less than one part impurity in a billion. Large single crystals of these materials can then be obtained by various crystal growing techniques. These crystals can then be cut into tiny pieces which will be used in various semiconductor devices.

Advances in rolling techniques including the use of diamond groove rolls have made possible the rolling of hard and even brittle materials. The rolling pressure is distributed more uniformly within the ingot than it is with flat rolls permitting more deformation without cracking.

Chemical milling is a new process for precision sculpturing of metal by chemical reaction. Its ability to produce odd-shaped parts and low cost has led to many practical engineering applications. One obvious advantage is that this milling method can be put to use on materials too hard to machine otherwise.

Another method of cold working extremely hard materials like super high strength steels, titanium alloys, and stainless steels is by the very recently developed method of explosive forming. This has been perfected by some of the main aircraft companies and manufacturers of explosives. The method consists in using the high potential energy of propellants and explosives to produce useful work such as shaping and perforating of metals. Steels of 280,000 psi tensile strength that cannot be perforated by any other method (ordinary punching presses will crack the material around the holes) can be punched satisfactorily by a high velocity punch actuated by the pressure of propellant gases. The most important application, however, is the forming and shaping of even complex shapes in high strength material.

Reactor Materials

The materials problems involved in atomic reactor design are tremendous. Internal heat generation in the structural materials, radiation-induced changes in mechanical properties, thermal shock, and strain cycling, and coolant-dissociation effects on corrosion and embrittlement, all require close attention. Materials having good thermal radiation and corrosion stability for reactor applications are the goal of today's research.

Fundamental work is required to study the effects of irradiation on solid state processes and to distinguish the effects caused by fast flux, exposure time, and irradiation temperature. Although it is known that neutron irradiation is equivalent to an increase in temperature on diffusion processes, much work remains to be done on the elucidation of metallurgical variables such as precipitate particle size in precipitation hardening alloys, possible resolution or homogenization, and other phenomena. Lubrication in the atomic pile remain a problem because of the breakdown of organic lubricants under irradiation. Inhibitors are being developed that will reduce these ionization effects. Another approach consists of the development of self-lubricating bearings able to carry high unit loads at elevated temperatures.

Radiation shielding materials for manned aircraft and rockets is a very pressing problem. A few effective materials have already been found for this purpose. Sheets a quarter inch thick of boron carbide dispersed into aluminum will provide neutron shielding power equivalent to 25 inches of concrete. Boron stainless steel and dispersions of lead into polyethylene will also afford protection against neutron radiation, the latter also acting as a gamma ray shield.

Other Materials

Plastics are already in use in the armament field for motors, nose cones, radomes, fins and fuselages. Improvements are required for plastics with greater rigidity and hot strength, cheaper fabrication costs, more uniformity in properties, and for better design for reinforced plastics structures and metal-clad plastic laminates.

The ceramics and the mixtures of metals and ceramics are producing a wealth of high temperature materials. Silicon carbide transistors can operate at temperatures up to 1400°C. Boron nitride is as hard as diamond and has good high-temperature oxidation resistance. Aluminum coated with lithium borosilicate, lithium chromate and lithium fluoride can be used at operating temperatures of 1000°F. Ceramic radomes can now be produced to tolerances of ± 0.001 inch.

Finally the newer or missile-age metals are put to use in dozens of new applications: germanium and silicon in rectifiers and transistors, gallium for heat transfer in atomic rockets, cesium in ion rockets, indium as neutron indicator for atomic rockets, thorium and uranium as nuclear fuel, zirconium as a low neutron absorber, beryllium as a neutron moderator, etc. The complete list would be too long to report here in detail.

Conclusions

The new requirements motivated by aircraft, missile and rocket developments emphasize the importance of new material concepts to attain suitable properties. Propulsion systems for aircraft and missile, the taming of the nuclear fusion reaction, and many other problems, have reached a state of development and complexity where progress is almost always limited by our knowledge or lack of available materials.

Numerous and difficult advances in material development have already been achieved. Future technical breakthroughs will require basic understanding coupled with ingenuity, initiative, perseverance, logic, uninhibited thinking, time and effort of magnitude far greater than ever before.

In fact one aspect of defence research is the high cost in skill and money involved. The tendency is to make joint efforts fully co-operative by integrating the services' research and development programmes and by co-ordinating these activities with those of non-service research establishments. Moreover, while most new materials and methods are being developed for nuclear, missile and other defence applications, they will eventually be of very great value to general manufacturing fields, and this in itself is a guarantee of an efficient return secured on the investment. Previous experience has shown that materials and techniques developed during emergency periods have proven to be essential to industry in peacetime.

It can now be foreseen that the major part of the research on materials in the future will be devoted to the control of atomic structure, i.e., to solid state physics. For it is only through the understanding of basic principles of the physics of metals that new materials will be created. In the past, understanding has generally followed invention, but in the future an increasing amount of developments will grow out of understanding of physical phenomena and this is the goal of research. In fact, metals research and device research today have become so intimately integrated that it is often impossible to distinguish between whether the new material has created the device or the new device given conception to a specific material. For this to happen it is essential that research on materials proceed with the pace and intensity of other sciences so that its function of providing materials for the products of modern thought may be fulfilled.

From an interview with Marshal K. A. Vershinin, Chief of the Soviet Air Force, Isaac Deutscher has written: "Marshal Vershinin makes a case for the rocket as against the bomber on the basis that the striking power of the rocket is far more reliable and that in the present state of technology there is no effective defense against it. However, when he lists the weapons that may be deployed against, say, New York and Chicago, he still finds use for the bomber alongside the submarine and the guided missile."

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Some Military Implications of Disengagement in Central Europe

CAPTAIN M. H. ELLIS

Captain Martin H. Ellis, C.D., R.C.N., who has now retired, was Military Advisor to the Canadian Delegation of the United Nations Disarmament Commission. His essay has been awarded an Honorable Mention.

CONSIDERABLE public interest has been aroused recently by the plan of the Polish Government, the Rapacki Plan, to create a de-nuclearized zone in central Europe. The avowed purpose of the Polish proposal is to achieve some relief of tension in that area in Europe where a clash of arms is most likely to occur. It is proposed here to examine the Rapacki Plan, together with other suggested methods of modifying the existing situation in central Europe, with a view to determining whether disengagement is a practicable or desirable military strategy for the Western Powers.

The Rapacki Plan appears to step from a proposal made by the Soviet Government before the Disarmament Sub-Committee of the United Nations on 18 March, 1957. A plan was outlined at that time for a reduction of forces in central Europe and for the establishment of "a zone of limitation and inspection of armaments". Its main features were that:

(a) Provision should be made for ceilings to the forces of the United States, United Kingdom, France and the Soviet Union stationed in the territory of other states in the zone.

(b) Stationing of atomic military formations or any form of atomic or hydrogen weapon in the zone be prohibited.

(c) States in the zone undertake to refrain from the use of force in settlement of differences.

(d) There should be joint inspection of armed forces and armaments in the zone.

(e) Pending an agreement on the zone, the four powers with forces in Germany reduce those forces by a figure to be determined by each of them at its own discretion. (In November, 1956, the Soviet Government had proposed a one-third reduction of all foreign forces in Germany.)

These Soviet proposals were rejected by the Western powers of the Sub-Committee (the United States, United Kingdom, France, and Canada) on the grounds that they dealt with European security rather than disarmament. Following this exchange, neither side reverted to specific consideration of disengagement in central Europe until the twelfth session of the General Assembly of the United Nations was convened in September, 1957. Then, in the course of a general debate on disarmament, M. Rapacki, Foreign Minister of the Polish People's Republic, presented the proposal for the establishment of a de-nuclearized area in central Europe which has since been generally known as the Rapacki Plan. The main points of the plan, as originally proposed and subsequently elaborated on 14 February, 1958, in notes to various governments, can be summarized as follows:

(a) The proposed zone should include the territory of Poland, Czechoslovakia, the German Democratic Republic, and the German Federal Republic. In this territory nuclear weapons would neither be manufactured nor stockpiled; the equipment and installations designed for their servicing would not be located there; the use of nuclear weapons against the territory of this zone would be prohibited.

(b) The United States, United Kingdom, France, and the Soviet Union would undertake not to maintain nuclear weapons in the armaments of their forces stationed in the proposed zone: not to maintain nor install any equipment designed for servicing nuclear weapons, including missile-launching equipment: not to transfer nuclear weapons or equipment to governments in the area: not to use nuclear weapons against the territory of the zone or against targets situated in the zone.

(c) Any other states with forces stationed in the zone would be bound by the same obligations.

(d) An effective system of control, comprising

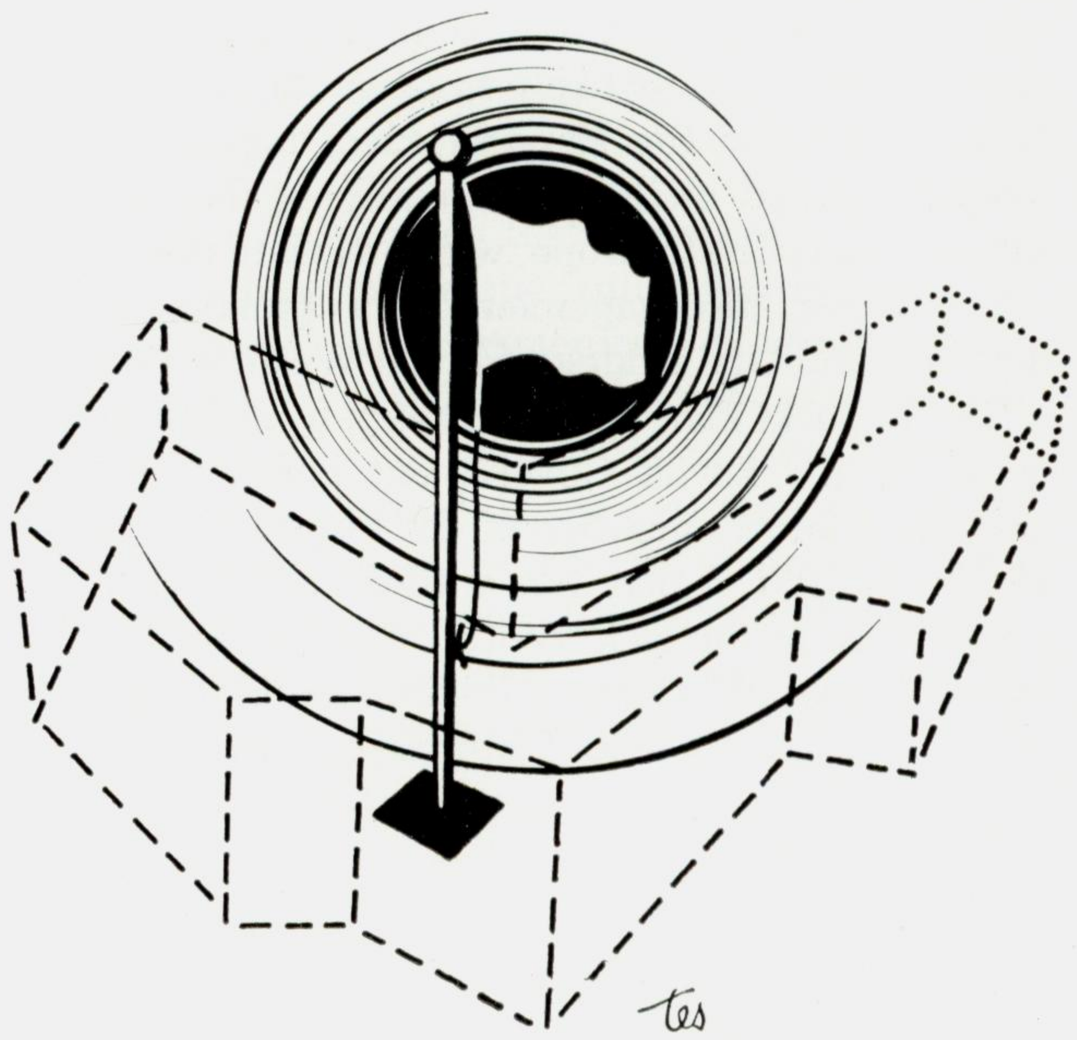
both ground and aerial inspection, would be established by the states concerned. Provision might be made for participation in the control system by representatives of states which do not belong to any military grouping in Europe.

National Reactions to the Rapacki Plan

The reaction of the Soviet Union to the Rapacki Plan was naturally favourable: not only was it inconceivable that a satellite country should advocate such a policy without previous consultation with the Soviet government, but also the plan was essentially a re-hash of the Soviet proposal of March, 1957. In the spate of correspondence loosed by Bulganin in the closing weeks of 1957 and early months of 1958 approval of the Rapacki Plan by Western governments was warmly advocated. In a press release endorsing the plan on 20 February, the Soviet government declared its willingness to assume the proposed obligations, if the governments of the United States, United Kingdom and France would do likewise. Again in *Pravda* of 5 March the more detailed elaboration of the plan was enthusiastically applauded and, for the first time, the Soviet Union declared its accord with the considerations on control in the zone and readiness to take part in the realization of a control system.

Reaction in the United States has not been enthusiastic. In an early press conference at which the question of the plan was raised Mr. Dulles pointed out that it was not a sound argument that the confrontation of two large groups of hostile forces in central Europe is necessarily a threat to peace. Since the establishment of NATO the most serious threats to peace had arisen elsewhere than in Europe. Again, in a press release of 19 February, the State Department, while recognizing that the Polish Government was taking an initiative which sought the relaxation of international tensions, pointed out that the Rapacki Plan had serious disadvantages from the standpoint of the security of the free world. It picked on two particular elements of the plan for criticism: the first was that the obligation not to use nuclear weapons against the territory of the zone or against targets situated in it could not be enforced and must, therefore, be dependent merely on the goodwill of powers possessing nuclear weapons. The second and major objection was that the proposal would tend to perpetuate the division of Germany, which made it automatically unacceptable to the United States.

There has been a notable 'rapprochement' of French and Western German thinking on the subject of European security over the past year. It is not surprising, therefore, to find that the reactions of France and of the German Federal Republic to the Rapacki Plan were very similar. Each country echoed the United States criticism that it would result in the continued political division of Germany and each asserted that the real aim of the plan was to draw the teeth of the NATO shield forces. At a press conference in Washington Herr Strauss, Defence Minister of the German Federal Republic, was asked for his attitude towards General Norstad's statement that it was essential to arm Western German forces with tactical nuclear weapons. Strauss commented that if SACEUR was recognized as being responsible for the military defence of Europe it would be impossible to deny him the means he considered necessary for defending Europe. Shortly



afterwards the Adenauer government, in the face of considerable opposition, announced its intention of arming its forces with tactical nuclear weapons. If it failed to do this, the Chancellor asserted, there would be a serious gap in the NATO defences which might eventually lead to the disintegration of the NATO alliance.

Public interest in, and even enthusiasm for, the Rapacki Plan was probably greater in the United Kingdom than anywhere else in the free world. Such an attitude is understandable in a country which knows that it would be one of the priority targets in a nuclear war and whose government has candidly admitted that the civilian population cannot be protected against nuclear attack. Nevertheless, the

London Times, which has been a leading advocate for the absolute necessity of easing international tensions and of making some progress in the disarmament field, concluded that the Rapacki Plan was militarily unacceptable at present and that creation of a satisfactory inspection system would pose an almost insoluble problem.

Military Criticism of the Rapacki Plan

Having looked at the proposals of the Rapacki Plan and at some of the national reactions to it, we might profitably consider in greater detail some of the military implications of the plan from the standpoint of the Western powers. The *London Times* in a leading article on 4 February pointed out three military problems connected with the plan; first, the difficulty of defining what constitutes a nuclear weapon; secondly, the difficulty of inspecting stockpiles of nuclear material because concealment is easy; thirdly, the situation created by carrying the plan to its logical conclusion which would result in forces remaining in the area being armed only with rifles or very small calibre artillery.

Taking the first of these points, it is indubitable that the definition of a nuclear weapon becomes increasingly difficult as families of smaller tactical weapons are created. The major problem lies in the fact that certain types of missile-launchers and artillery can be designed and have been designed to fire both nuclear and conventionally armed projectiles. If forces in the proposed zone were permitted to retain delivery systems adaptable to either conventional or nuclear projectiles, clandestine accumulation of nuclear stockpiles might occur. Both Soviet and NATO authorities have conceded that it is not difficult to conceal nuclear stockpiles in such a way as to defy detection by any practicable inspection system. This problem of definition of nuclear weapons forced the Polish Government in its memorandum of 14 February to include potential nuclear delivery systems as well as nuclear warheads, bombs and shells in its elaboration of the general nuclear prohibition. This brings us to the third point made by the *London Times* that, logically, in its final phase the Rapacki Plan results in two opposing forces of riflemen.

Would such a situation be militarily acceptable to the Western powers? NATO commanders have always been acutely conscious of the numerical inferiority of their forces in the face of the great conventional strength of the Warsaw Pact powers. Although NATO must always think chiefly in terms of defensive strategy and although a superiority in strength of more than three to one was considered a requirement for successful attack in World War II, nevertheless the NATO higher commanders have always insisted that, in order to discharge their missions effectively, their forces must be equipped with the most modern and most efficient weapons available. It is incontrovertible that the NATO shield forces would be seriously weakened if the forward elements of those forces in Germany were deprived of their close-range nuclear support weapons. Any plan proposing this must be extremely distasteful to the responsible military commanders. It can, of course, be pointed out in extenuation of such a proposal that the average distance from the demarcation line in Germany to the eastern frontier of the Netherlands, Belgium, or France is only two hundred miles, while the average distance from the demarcation line to the western frontier of the U.S.S.R. is more than twice as far; the NATO forces in Germany would, therefore, have their tactical nuclear support much closer to hand than the Soviet forces in the same area should an urgent need for them arise. However, it is unlikely that a mere difference in distances would allay the uneasiness of a United States general if he saw his troops being separated in any way from their close-range nuclear support. If political considerations were such as to lead to the adoption of the Rapacki Plan, a strong demand could be anticipated for a strategic withdrawal of United States and British troops from Germany to peripheral positions on the continent or possibly even to their homelands. Such a disengagement, apart from threatening the disintegration of NATO, would have the effect of creating a military vacuum in Western Germany. Nature proverbially abhors a vacuum and it is easy to imagine how this situation might be exploited by the Soviet government by every means short of actually goading the NATO powers to a point where they would unleash the full fury of the nuclear deterrent. The German Federal Republic, Denmark, the Netherlands, and Belgium would be subjected to increasing pressure to buy a hope of national survival at the cost of secession from NATO.

Reduction of Conventional Forces in Germany

If the Rapacki Plan for a de-nuclearized zone is so clearly disadvantageous to the NATO powers from a military standpoint, it remains to examine other suggested methods of disengagement in central Europe to see whether any of them would be more acceptable. Reverting, in the first place, to the Soviet proposal of March, 1957, for a zone of limitation and inspection of armaments, we note that,

pending agreement on the nuclear prohibitions and separable from them, the Soviet government advocated an all-round reduction of the forces in Germany belonging to the United States, United Kingdom, France, and Soviet Union. It was argued that this would result in definite relaxation of tensions in central Europe. It is noteworthy that similar suggestions have been made by Sir Anthony Eden at the Geneva Conference in 1955 and by Mr. Gaitskell, leader of the Labour Party of Great Britain, on several occasions. The United States government, however, opposes the reduction of conventional forces in the Germanies with the contention, quoted above, that the confrontation of hostile armed forces in central Europe is not necessarily a danger to peace. Presumably the American argument is that you are less likely to organize a raid on your neighbour's apple trees if you know that your neighbour and his family are sitting behind the hedge with loaded shotguns. History might tend to show that whenever two hostile armed camps have faced each other in Europe previously, an explosion has resulted: however, such an analysis of the present situation lies outside the scope of this article. What is pertinent is to examine whether a thinning out of the foreign forces now stationed in Germany would be militarily acceptable to the NATO powers.

The fourth edition of the North Atlantic Treaty Organization handbook, published in August, 1956, stated that NATO had about one hundred trained divisions (active and reserve) as against two hundred and fifty divisions of the Warsaw Pact powers. In aircraft strength, NATO'S six thousand were opposed by twenty thousand aircraft of the Soviet Union. It was not stated what proportions of these forces on either side were stationed in central Europe, but it is generally assumed that the Soviet Union and its satellites have a considerable preponderance of military strength in that area. Over the past year both sides have made unrelated reductions of their ground forces in the area: the Soviet Union has evacuated some thousands of troops from Eastern Germany with considerable fanfare; France has withdrawn divisions from Europe to deal with the situation in Algeria; the United Kingdom government has announced its intention of reducing the British Army of the Rhine from 77,000 in 1957 to 50,000 in 1959-60. With these unilateral reductions in progress, it would seem a logical and common sense course for each side to attempt to arrive at agreed reductions: at the least this might prevent the NATO forces from growing increasingly weaker vis-a-vis the conventional strength of the Soviet forces.

If confronted with such a proposal, SACEUR might point out that a thinning out of forces in Germany would present no problems for the Soviet government, which could withdraw troops either into Poland or just within the western frontier of the Soviet Union and hold them ready to reinforce their forward units at twenty-four or forty-eight hours notice. On the other hand, SACEUR himself would need every brigade and air group now in Germany in order to be able to snuff out any Soviet act of aggression at the outset. It would seem, however, that a planned reduction of forces might be acceptable and even advantageous to the Western powers, if, but only if, the NATO troops withdrawn from Germany could be maintained elsewhere in Europe in positions from which they could rapidly reinforce the forward areas in case of need. This requirement would narrow the choice of positions to Denmark, the Netherlands, Belgium and Eastern France. The Danish government has consistently refused to accept foreign forces into Denmark; Holland and Belgium are thickly populated and offer little territory suitable for the training of troops. This leaves only Eastern France as a possible area to which troops could be withdrawn. Apart from the geographical problem, it is patent that any large-scale re-deployment of NATO forces in Europe would create most expensive infra-structure and logistic problems. For this reason alone the United Kingdom government would almost certainly prefer to withdraw its forces across the channel, and there would probably be domestic pressure on the United States government to bring the displaced units home rather than finance their re-establishment elsewhere in Europe. The extent to which a thinning out of forces in Germany might decrease the likelihood of war would have to be weighed carefully against the geographical, military and financial disadvantages of re-deployment before any such proposal was accepted.

A Demilitarized Corridor

Reference has already been made to Sir Anthony Eden's proposal, made at Geneva in 1955, for reducing the NATO and Soviet forces in Germany and the countries neighbouring Germany. Linked with this proposal was a suggestion for the establishment of a demilitarized zone in central Europe; but this suggestion envisioned a reunited Germany and creation of the demilitarized zone along the eastern frontier of Germany. This idea of a demilitarized corridor, subject to adequate international inspection, has not since been revived by the NATO powers; possibly because there would be such strong German objec-

tions to a corridor based on the present demarcation line. From a purely military standpoint, the creation of a demilitarized corridor, seventy to one hundred miles wide and adequately patrolled by an international inspection service, might have certain advantages over any other disengagement plan. It would reduce the danger of an accidental border clash which might flare up into war; it would provide some safeguard against surprise attack by conventional forces; at the same time it would not necessitate large-scale re-deployment of NATO forces in Western Germany. It is doubtful, however, whether the slight easing of military tension which might thus be achieved would outweigh the political disadvantages of appearing to accept the status quo in the Germanies.

Conclusion

The idea of disengagement in central Europe must have an appeal for everybody who is in the least apprehensive about the present situation: but this brief examination of the problem appears to indicate that the nuclear disarmament proposed in the Rapacki Plan and disengagement achieved by the reduction of conventional forces are both militarily disadvantageous to the NATO powers. The Rapacki Plan is rejected because:

(a) It weakens the NATO shield forces.

(b) It might lead to the withdrawal of United States forces from Europe.

(c) There is no guarantee that nuclear weapons would not be used against targets in the zone.

(d) It is not possible to devise an inspection system capable of detecting hidden stockpiles of nuclear warheads.

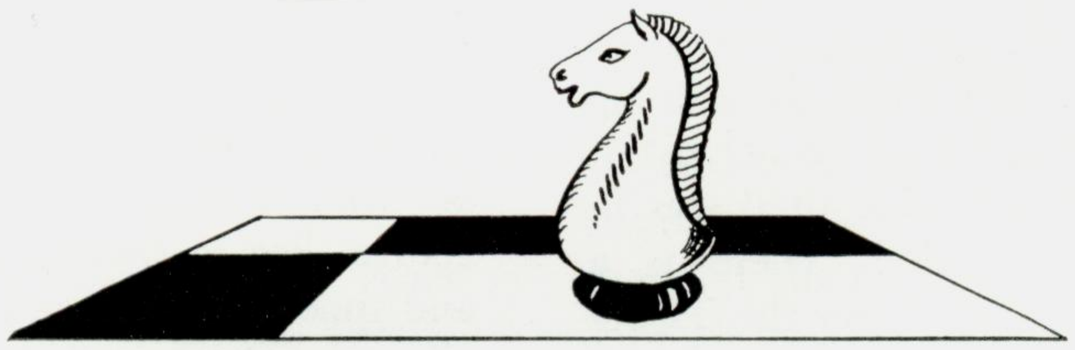
Conventional disengagement is disadvantageous because:

(a) NATO forces are already spread too thinly on the ground in Germany to be sure of nipping aggression in the bud.

(b) Re-deployment of thinned-out forces would be costly and geographically unsatisfactory, with the possible consequence that these troops would be withdrawn from continental Europe.

(c) The Soviet Union could concentrate a tremendous weight of conventional forces on its western frontier or in Poland, ready to take advantage of any situation which could be exploited by force of arms.

The creation of a fairly narrow, well-inspected, demilitarized corridor between the opposing forces has more military advantages than disadvantages; but this form of disengagement appears to be politically impossible until German re-unification can be achieved.



"The growth of scientific knowledge and practical experience are continuous processes, and at best fit uncomfortably into the tiny packages called development cycles. Problems of propulsion, guidance, re-entry and space medicine are no respectors of names like Thor, Atlas and Titan. These problems simply exist, tantalizing and frustrating the planners and engineers. They must be solved by whatever means and resources can be brought to bear on them."

— Major General Bernard A. Schriever, U.S.A.F.

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Air Power, Land Power, and Modern Weapons

SQUADRON LEADER N. W. EMMOTT

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AIR POWER has influenced land warfare for over forty years. Its prophets and its detractors have always held widely-differing views, and as in most other pursuits the pendulum of opinion has swung in dizzying arcs. It was air power that made possible the capture of Crete; in Korea, there are those to say the influence of air power, for what it cost, was far too little.

Today, in an era of comparative peace, we know how air power has influenced the land battle in the past. If history teaches anything, however, it is the way that air power was used in the past will not be the way it should be used in the future. Nevertheless, by looking at the history of land warfare and considering the new capabilities of modern aircraft and modern weapons, we may be able to deduce the shape that future warfare will take, and how air power should fit into the jigsaw.

It has been said that warfare between armies is a thing of the past, that everything will be over in one big bang. If this is true, of course, we need not bother with an army at all. However, there is no certainty that this happy result will be achieved; what is far more likely is an era of limited war in which mass destruction is avoided. There is a historical precedent for this, when after the Thirty Years' War no nation resorted to total war until Napoleon appeared on the scene. In any case, however, armies exist. The Second World War proved that land forces are crippled without adequate air support. Our armies will require air power, and we must therefore consider how best air forces should be used to provide it.

First of all, let us look into the future to see how a future war will probably be fought. The small wars since 1945 have all been strictly conventional, despite the existence of nuclear weapons. In most cases (the Israeli wars, for instance) the reason for this was simply that neither antagonist possessed any atomic hardware, while in others (Korea or Suez) the powers which did in fact have such weapons either considered they could attain their object without using them and incurring the world-wide revulsion of feeling that would follow, or did not wish to risk the world war which it was feared the use of atomic bombs might start.

Should a war begin between two antagonists, both armed with nuclear weapons, even that would very likely be limited. Whether it is limited or not, there are only two types of war possible between first-class nations; wars in which nuclear weapons are used, and wars in which they might be used. Even if both sides refrain from using them, the antagonists will be mightily afraid their opponents are waiting for an opening to do so, and will be forced to conduct themselves accordingly. This means more of the same remedy used to counter every increase in the power of missiles — dispersion. Failing to prescribe this medicine has always resulted in unnecessarily heavy losses, as Grant found in 1864 when he threw his Federals in Napoleonic lines against the Southern riflemen, as all concerned found in 1914-18 when they did the same thing, and earlier, as Pakenham did at New Orleans in 1815. Today, so small a concentration as half a battalion may invite an atomic bomb. Yet, paradoxically, battles cannot be won without concentration. The answer, of course, lies in speedy concentration for an assault and speedy dispersion after it. Time will simply not allow for the long build-up periods so common in the Second World War.

Wars, therefore, will be fought by small units, possibly down to company size, operating with a considerable degree of independence, and keeping themselves in readiness to concentrate or disperse for short, swift actions. This will be very much like guerilla warfare, with the proviso that these guerillas must be capable of striking with paralyzing power. To some extent this development was foreseen even in pre-atomic days by Major General J. F. C. Fuller, the great exponent of warfare on wheels and tracks, when he envisaged the swarms of "motorcycle guerillas" who operated with the German armoured columns in France in 1940. Furthermore, at intervals the enemy will win a round in the battle of wits, and our small units will find themselves assailed by

much superior forces. When this happens, they must be able to call up heavy support immediately. It is doubtful if the necessary support can be brought to bear fast enough and heavily enough through any agency other than air power.

The objection may be drawn that wars have been fought quite recently which did not follow this pattern at all; what about Korea? In Korea, however, the "gentlemen's agreement" in force ruled out nuclear weapons and interdiction beyond the Yalu. As a result, with the weapons in use much like those of the First World War, fighting returned to something very much in the 1914-18 style, with trenches, fixed lines of resistance, and reasonably safe rear areas all complete. We cannot count on this re-occurring.

To see how air power should be used to give the soldier the support he needs, let us look back into the history of warfare.

Soldiers can be divided into two categories—those who fight the battles, and those who help them. The actual fighters, despite the inclusion of signallers and their ilk into the arms rather than the services, for some centuries have formed the military trinity of infantry, cavalry and artillery. Of these, it is upon the infantry that the brunt of the fighting (and of the casualties) has fallen until it has earned the title of "Queen of Battles". The battle-honours of many a regiment commemorate the times when, with guns worn out and the tanks immobilized by swamps or minefields, the general has turned to the man in the cloth coat, carrying a hand-gun with a knife stuck on the end, to gain or save the day. As lately as in Korea it was unquestionably the infantryman who ruled the battlefield.

It was not, however, always so. For 700 years, beginning during the last agonies of the Roman Empire until the 100 Years War, the supreme soldier was the cavalryman — the mailed knight. Furthermore, the most feared armies the world has ever seen — the Mongols of Genghiz Khan and Tamerlane, neither of whom ever lost a battle — were exclusively cavalry. Yet the Roman legions at one end of the historical scale, and the Napoleonic legions at the other, were predominantly infantry.

Why should military supremacy shift back and forth? The reason is not far to see; the ruling arm is the one that is most formidable. Formidability, such variables as courage, morale, and training being equal, is predominantly a function of the weapons the soldier uses. The weapons can have only four characteristics: hitting-power, range, mobility and protection (or the other side of the medal — vulnerability). Weapons exert an irresistible influence on even the smallest military details, the colour, for instance, of a soldier's coat, which could be scarlet in the days of the musket, but which the rifle forced to be retailored to the colour of mud.

The Roman legionary was more formidable than the ancient horseman because, planted firmly on his sturdy legs, he had more hitting-power than a man sitting bareback on a horse who was wont to fall off if he tried to put his weight behind a blow. Then, about 600 B.C., some forgotten genius invented the stirrup and anchored the cavalryman so firmly in the saddle that only another horseman could knock him out of it. At one stroke, the cavalryman gained more hitting-power, because he could stand up in his stirrups to deliver a blow and because his sword or lance could be heavier than the foot soldier's, since the horse carried them for him; more protection, since not having to exhaust himself marching about in armour, he could wear a heavier coat of mail; more mobility, since a horse can run faster than a man; and more range, since he could carry a bigger spear. It is no wonder, therefore, that the mailed knight reduced the foot soldier to the status of a lackey for three-quarters of a millenium.

Infantry found the key to their prison in one of the four characteristics — range. Having no hope of achieving equality in hitting-power, they put their trust in missiles instead of shock weapons. When they learnt to pull the longbow to their ear instead of to their chest, they put enough force behind their arrows to penetrate armour, and the horseman found himself incapable of approaching close enough to the bowman to use his lance or sword before he was skewered by an arrow. Significantly, the Mongol cavalry armies depended far more on their bows than on their sabres and when at last they met Turkish archers they lost their first battles.

Firearms accentuated the power of infantry. Because nobody outside a Wild West show can hit anything from the back of a horse, the cavalryman was a poor shot and a good target. Whereas once the thundering lance-in-rest charge of the knight had been the ultimate expression of fighting power, by the 18th century cavalry were effective only against troops taken in the rear of the flank, against troops broken or in flight, or during rainstorms when the infantry muskets would not fire.

The "Great Divide" of cavalry power was crossed during the American Civil War, the first war fought predominantly with rifles. The main difference between a rifle and musket lies in the rifle's greatly superior effective range. The 10th century horseman was a big, vulnerable target who remained under enemy infantry fire for hundreds of yards

before he could retaliate, with the result that cavalry became incapable of taking part in battles pivoted upon assaults. Mars-la-Tour in 1870 proved this beyond cavil, when the German needle-guns tumbled the French curaissiers to ruin with a volley.

When the breach-loading rifle gave the infantryman the ability to fight effectively from a trench or while lying down (the muzzle-loader required its firer to stand up to reload) to range and hitting power the foot-soldier added protection. The cavalryman had superiority in only one of the four characteristics—mobility—and this was not enough.

Rifles or no rifles, a horse still had advantages, of course. It could carry more than a man, it could travel faster and farther, and it could bring a man into battle fresher and stronger. This fact gave rise to mounted infantry, which is really what nearly all horsemen became after 1860. The men who rode forth to raid communications attacked the wagon trains on horseback, sure enough, but if organized resistance offered they dismounted and set to work with rifles. However, since the conventional cavalry arms and appurtenances are not truly suitable for infantry work, cavalry became armed and trained more and more like infantry. The proof that he was not a cavalryman any more lay in the fact that it is the essence of cavalry to *fight mounted*; and after 1860 he used his horse only for transport. It took the horse-soldier 50 years to realize he was finished, but finished he was, except for some limited usefulness as a reconnoiterer or a mounted infantryman.

With the invention of gunpowder the third arm sprang up — artillery. Throughout the centuries it became increasingly important, not only in siege warfare but also in cooperation with infantry. Those commanders who had the greatest masses of men to draw on consistently made the greatest use of artillery; Napoleon, for instance, the generals of the First World War, and the Russians during the Second. Artillery, despite its power, however, is not an independent arm. It cannot hold ground, and it is relatively immobile. Moreover, the guns need protection which they can only get from infantry. Just as artillery added a third arm, aircraft added a third dimension. When should they best be used? To decide, we must consider the particular strengths of the air arm.

Aircraft have unrivalled mobility, almost unlimited range, and great hitting power. Since they cannot hide, however, and are inevitably rather fragile devices, they have negligible protection. Looking backwards, we can find another group of warriors who had exactly those characteristics — the Mongol horsemen, who wore only leather armour, relied on their bows, and used their mobility to out-manoeuvre the ponderous chivalry they faced. When Major-General J. F. C. Fuller made his forecast of how the Second World War should be fought, (the blueprint that the Germans used for their blitzkrieg), it was the Mongol horseman he used as his model.

Aircraft today should take a leaf from the same book. To begin with, airmen fight mounted, since their steeds cannot stand still, and thus they fill the first requirement for cavalry. To see how they fill the rest of the specification, let us consider how cavalry has fitted into the land-battle.

After the invention of firearms, cavalry were used for reconnaissance, for raids against enemy communications (preferably close enough to his front to cause him immediate and not distant anxiety) and attacks on routed, disorganized or demoralized troops, almost always from the flank or rear. All these tasks have been performed successfully by aircraft. Since the First World War, aircraft have all but monopolized reconnaissance; this is obvious, since they can range almost at will over the enemy's territory, regardless of ground defences and fixed lines. Likewise, their ability to attack communications — anywhere and anytime — enables them to carry out to perfection the role in which Jeb Stuart's or Sheridan's horsemen specialized. Indeed, interdiction of the battlefield is nothing more than attack upon communications writ large — and the Italian and Normandy campaigns proved how successful interdiction can be.

The soldier here will, however, put in a demurrer. Armies already have cavalry — the tanks, complete with cavalry names such as Lord Strathcona's Horse. As General Fuller said so early and so often, the answer to half an ounce of lead is half an inch of steel. When, in 1915 after uncounted obstacles had been overcome, the tank appeared on the scene, it seemed that cavalrymen riding steel horses had returned to the battlefield; the armoured knight had risen phoenix-like from his funeral pyre of gunpowder. This was, however, an illusion. First, tanks have so voracious an appetite for fuel that they cannot live on the country. Second, there are never very many tanks; an armoured division has 2,000 vehicles, but only 200 or so are actual fighting vehicles. Third, tanks are more restricted by terrain than horses. Fourth, tanks need a heavy investment in maintenance, and supply, which gives them a long and unwieldy administrative tail.

The standard fuel allowance for the tank without refuelling is between 75 and 100 miles, which gravely restricts their operational radius. They are

thus not a long-range but a short-range weapon.

When tanks go into action, they very seldom rely on shock-power; instead they rely on their guns. Furthermore, because aiming a gun from a tank is a difficult business, they usually stop to shoot, and quite often they dig themselves in to do that. It can be seen, therefore, that tanks very seldom operate as cavalry; instead, they are used as mobile artillery.

In the opening campaigns of the Second World War, it must be admitted the Germans succeeded in using armour as cavalry, at least for a while. When resistance stiffened, however, the tanks lost their seeming invincibility, and the wide ranging successes of the 1940 French campaign were not repeated; the tanks which broke out of the Normandy beachhead were stopped as soon as the Germans were able to establish a firm line of resistance. All the evidence points to the fact that the time-honoured role of cavalry cannot be filled adequately by the tank.

There are, of course, flaws in this picture, beautiful though it may appear through air-minded eyes. To begin with, in past wars tactical air warfare stops when darkness falls, or bad weather closes in. (To some extent it may be noted this disability afflicted cavalry too; Napoleon, for instance, lost all his heavy cavalry and most of his light horse when he tried to use it in the wintertime when snow hid the forage). To overcome this disadvantage more research must be undertaken to give aircraft the same all-weather, 24-hour capability close to the ground that they have in more rarefied air. Just as there are day-and-night fighters, there is a requirement for tactical aircraft which can seek out enemy supply convoys and lines through clouds or darkness. In the future, where the ability to concentrate with lightning rapidity, strike, and disperse equally fast before nuclear retaliation can be made, a few hours secure from air attack can be a gift from the gods. This has already been shown graphically by the German offensive in the Ardennes, prepared under cover of bad weather and the long winter nights.

The best aircraft for the job is, most likely, a two-seater fighter or light bomber with good radar, to enable it to distinguish roads and to provide terrain clearance and collision-warning, together with adequate automatic navigation aids.

Now, how about artillery? Can aircraft take over the traditional job of the gunners? To some extent they already have; in 1940 the Germans used their Stukas as flying artillery, and in the Pacific campaign air strikes played a prominent part in the softening-up bombardments of Japanese-held islands. As a rule, however, aircraft have not been over-successful in this field, because they are not accurate enough and not dependable enough. Indeed, it is standard army doctrine that air bombardment can be used only as a bonus in drawing up fire-plans, because bad weather can so easily ground aircraft.

However, a single aircraft armed with rockets can carry as big a punch as a battery of artillery, and when nuclear weapons are added to the sum there is virtually no limit to the destruction power it can possess. Moreover, an aircraft, because of its mobility, is a far more flexible weapon than a land-bound gun, has immensely longer range, and possesses the ability to attack targets from any direction. To write this enormous potential off simply as a bonus, desirable but not essential, is anything but good policy. Once again, of course, the answer is to increase the all-weather capability of tactical aviation. When aircraft can deliver their loads as accurately and with as much disregard of the weather as guns, land-air cooperation will be a reality, and aircraft will be able to be used to their full potential.

How do missiles fit into the picture? Partly, but by no means completely. Missiles completely lack the power to attack targets of opportunity; they cannot read or interpret ground signals unless the ground forces are equipped with immensely-complicated ground-control apparatus; and a few stray voltages running about in their electronic insides can lead them to attack their own masters. Moreover, tactical operations, especially those in support of troops, demand more than any other airborne task the exercise of judgment—a faculty with which machines cannot be equipped. During the foreseeable future, it will be the manned aircraft, not the missile, which will help the foot-soldier farthest along his road to victory.

However, the answer, as to so many other military disputes, may well lie in a compromise. Guided missiles may best be carried to the battle-zone aboard aircraft and controlled by their crews. The smaller guided missiles may be given some of the mobility they now lack by transferring them from place to place by cargo aircraft. Experience will undoubtedly show missiles and aircraft complement each other very well, rather than competing to the death.

Just as fighting aircraft are the cavalry of the future, slower, more vulnerable craft will supply the mounts for the next generation of mounted infantry. Helicopters and Short Take-Off and Landing aircraft will complement each other to give the infantryman the mobility he has always sought. There is nothing revolutionary in this; such organizations

as the U.S. Marines have made this their doctrine for half a decade now. This "vertical envelopment", like airborne trooping, is new in its means but not its ends; the emphasis is on the infantry work to be done after the aircraft lands, and not on the means of transport.

Since aircraft do the work of cavalry, combined with that of artillery, their capabilities should be exploited to the full when armies are divided into small units which require support at a moment's notice. And since this will very likely be the form of future war, provision of a force of tactical support aircraft will be essential to victory.

The comment can quite justly be made that nowhere has anti-aircraft fire been mentioned. It will exist, of course, and there is no doubt that the atomic flak shell will pose as great a problem for the airman as the atomic bomb will for the man on the ground. However, its threat can be countered by coming in very low, or very high; and aircraft are no more vulnerable to atomic attack than other vehicles. If ground-livery combat units can survive, so also can aircraft.

It follows also that modern land forces should increasingly consist of infantry in its various roles, with aircraft, and little else, supporting it. Such a force, in which mobility and hitting-power are combined with flexibility, should provide the best use of our resources.

In the battles of the future, if armies are to operate at all, air power, if not the key to success, will provide at least the combination to the lock. As the great campaigns of the Second World War proved, an army without air power is inevitably doomed, particularly in the advance. For a Canadian, this poses an unpalatable truth — our Canadian army, composed of regiments with fighting records second to none, because it is supported by nothing more than token air, is only a token force. The army, using Canadian resources only, is quite incapable of fighting effectively. To give our soldiers a chance to live up to their great reputation of the past, they should be provided with adequate air support.

To sum up, air-power used in direct support of land forces is best used as an enormously powerful form of cavalry. To find a guide for its best employment, our best historical precedent is the Golden Horde of Genghiz Khan. Our most urgent task is to give aircraft detailed for the job, a true 24-hour capability. Once this has been achieved, the airplane will remake land warfare as completely as it has already revolutionized warfare at sea.

"The alternatives for future activity become starkly simple: either outer space and the celestial bodies are an anarchic no man's world beyond any law, with nations contending for advantage and spreading their quarrels throughout the solar system, or they are in advance declared the common possession of mankind (assuming there are no Martians or Venusians with a prior claim) and, as such, are open only to joint exploration and development. If the second of these choices is to be made, it is obvious that it will have to be made very soon."

— Robert Bendiner.

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Coherency in Organization

WING COMMANDER J. G. WRIGHT

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IN ATTEMPTING to analyse the basic elements of organization, their effects and interaction, the one generic word to cover such a task seems to be "coherency", for this one word describes a state which is the end result of the interaction of a host of more elemental factors. Further, the degree of coherency of an organization provides an excellent general indication of the overall health of that corporate body. For a paper which purports to isolate and name some of these basic factors and suggest how organization can be improved by their application, then, coherency seems to be the most useful central concept around which the analysis can revolve.

The form of individual expression is art, but the form of organizational expression is order. The art form is free and is simply the individual's attempt to express himself through the medium of his choice; it need not be coherent and rarely is, and in fact very few may sense the substance of what is being imparted. The organizational form, however, is standardized and the individual must conform to it; its medium is the printed word, what is to be imparted must be clear to all and perfect coherency in all respects is the measure of its effectiveness as a form. In a word, art depends on variety, but organization depends on coherency.

Let us now examine the basic elements that affect coherency, that allow the organization to speak coherently, arrive at coherent decisions, and establish cohesion amongst the individual members that comprise its corporate body. To do this it will first be necessary to establish a vocabulary of basic terms, and then to study the mechanics of their interaction to measure their respective positive and negative contributions to overall coherency.

The Vocabulary of Coherency

If the subject of coherency is to be studied it is well that there should be coherency of expression. As the vocabulary of organization appears to be singularly deficient of clear-cut basic terminology, some thought should first be given to a medium of expression. The lack of specialist means of communication makes it difficult to express organizational ideas and concepts directly, and as a result an unnecessary amount of time must be spent in getting a point across to be sure that the essence of the presentation is being grasped. To be sure, one can discuss "morale" and "prestige", and "action" and "progress", but these are very vague terms and are not definitive in themselves. For example, what are the root sources of bad morale in terms of organization? Poor leadership? Slovenliness? These are aspects of personality, not of organization. To define the organizational causes and effects, one is required to delve into methods of expression so abstract that the listener is more apt to be led off on his own pattern of thought than to bear with that of the speaker. However, consider the specialist vocabulary of electronics, and the effectiveness of such a word as "tank". The use of this one word can describe not only a type of inductive-capacitance oscillatory circuit, but a whole concept of approach to a particular problem. So concise is the method of expression that to convey the phrase "Try a tank circuit" in non-specialist terms would probably require several pages.

If one is to establish specialized meanings for a word, it is perhaps better to choose a word not in common use, and one without clear-cut connotations to organizational practice. A general meaning should be conveyed from dictionary usage so that the scholar will not condemn the specialist use out of hand, and so that the layman will have some idea of what is meant, but the particular meaning should be entirely peculiar to the specialist use of the word. If one were to try to give more subtle meanings to such well established words as "sweet", "sour", "dilapidated", "asinine", and the like, the subtlety and specialist meaning would soon be lost. However, if words such as "contiguity", "conation", and "contumacy" are adapted to our purpose, a specialist definition can probably become useful as no strong image is brought to mind by the words in their normal sense. In this way definitions which may be somewhat arbitrary can be accepted without undue distaste. The reader should, therefore, not be too disturbed to find that, in some of the terms introduced, this text exceeds the dictionary in definition. It is, after all, simply a matter of semantics.

The Elements of Coherency

Continuity. Fortunately this first term used to describe an element of coherency is well known in organizational terminology. Continuity of policy and

action is well recognized as being essential to organizational coherency; however, in military organizations, the word has come to mean many things, so that the meaning of the word as used in this paper might usefully be explored.

Continuity, as used here, does not mean simply that a particular position is occupied without interruption. It means that policies remain stable in spite of staff rotation, and that there is a continuing support for these policies. It implies that there is an adequate system of files and that records of previous decisions are readily available, for continuity requires not only that there be records but that they come to the attention of the person continuing the particular action or policy. Without continuity of this sort, decisions will be based on individual effort rather than on the capability of the organization as a whole. As a result the voices that speak for the organization may fall into opposition, and its state of incoherence is made obvious to all who deal with it.

Contiguity. Contiguity refers to the completeness of the organization, and is a measure of its theoretical capability. It refers not only to the coverage of the organizational chart, but also to the extent that all relevant subjects are allocated to properly filled establishments. With good contiguity any matter that presents itself to the organization can be assigned for competent action without difficulty. If there is a lack of contiguity, the organization is unable to speak effectively on aspects having to do with the uncovered field of activity. However fluent its general expression of an activity may be, the lack of contiguity will leave gaps in the argument. When these areas are questioned, the lack of coherency in the organization becomes evident.

Cognition. Closely allied to contiguity, in its effect on the coherency of the output of the organization, is cognition. Cognition is simply the knowledge which is peculiar to the particular organization, and even more so, to the particular staff position. It might perhaps be expressed as job-knowledge. Certainly, it is quite distinct from service knowledge or even trade knowledge. If there is lack of continuity, the state of cognition may be very poor. The presence of permanent civilian staff should raise the level of cognition, but only if the importance of this factor is realized by the controlling military officers. If these officers are content to rest on their previously acquired knowledge, and fail to brief themselves on the needs of their present position, there will be a very low level of organizational cognition.

As this specialized and integrated knowledge is the foundation of all that goes out from the organization, it is obvious that lack of cognition, whether it be concerning staff procedures, methods of operation, or basic data, can but cause weakness in presentations on the part of the organization. As a result, these may well be unintelligible when examined by the experts of other organization with whom it is desired to communicate. The end result is a lack of coherency.

Conation. Conation is used to describe the sense of direction with which action is pursued, and implies that because of this sense of direction towards a goal, a clear sense of the priorities of related activities is held. Without conation, there is every danger that the means will become confused with the end. Procedures, for example, frequently become an end in themselves, to the extent that some vital action may be held back because the procedure is given a higher priority than the action. Conation will ensure that procedures are reviewed and modified as required to ensure the most efficient output of the most important items of action. This does not mean that there would be no firm procedures, nor that a change would be instigated for a low priority item at the expense of initiating a poor procedure for higher priority items. To reduce procedures to chaos would be to break the principle of continuity, and destroy coherency.

Thus, conation measures the common sense of the organization with respect to finding the optimum way of getting on with the job. Adequate conation ensures that the far-sighted view is taken, that maximum standardization of logistic items is achieved, that there is change when change is required, but that there is no change just for the sake of change. It is the force for equilibrium within the organization, and without equilibrium there can be no coherency.

Coagulation. Coagulation is the change from the fluid to the solid state. The fluid state is highly necessary in the early stages of action or in the formulation of policy, but coagulation into a solid state must take place rapidly or, to continue the analogy, the organization may well "bleed" to death. Excessive fluidity of position makes for an organization that is impossible to control, for it becomes impossible to pin down the facts of any matter, since what was held yesterday is looked at from a completely different viewpoint today.

Lack of coagulation is particularly noticeable in the development field. Here, the natural tendency of the project officer is to keep his project fluid, so that he may incorporate all the latest improvements. No sooner has a design been made, than ways are

found to improve it, and so coagulation never takes place.

Under such conditions, the output of the organization is confused. The non-engineering staff is forced to bring about a stabilization point and naturally it may not be sound from the engineering point of view. Thus the organization says one thing today, but is forced by physical facts to change its stand tomorrow. Taking advantage of change of decision, the engineering staff may try to incorporate improvements, and so ad infinitum. As a result the output from the organization is incoherent, and successive attempts must be made before some stable position can be established. The analogy to stammering, or to oscillation in a servo-mechanism, is apparent.

Convergency. Convergency used in the organizational sense, refers to the capability of an organization to converge upon a decision. It may appear to be similar to the process of coagulation, but in reality is quite different. Certainly, coagulation must take place at the various staff positions before convergency upon a decision can be achieved, but whereas coagulation implies a firm solid position, convergency implies a narrowing down, a process of selection, a process of weighing various considerations and a process of refinement of opinion and judgment.

Without coagulation, conation and continuity, the decision making processes of an organization may degenerate into movement along parallel paths without convergency, as each staff pursues its own particular goal. In the military organization, these separate goals may be military requirements, technical compatibility, international standardization, minimum cost, utilization of Canadian labour and so on. Amongst these there may well be serious incompatibilities, which may not be discovered until final action is required. Then a very rapid convergency may be attempted. It is very likely not to be achieved, for if the staff had not achieved a natural convergency it can be taken that there is also a want of understanding of the underlying basic points and friction may develop. This can rapidly lead to divergency, with each staff independently trying to force its position by direct access to authoritative bodies. The obvious result is arbitrary decision. That is to say a cut-off is forced, without any real convergency within the organization. Again, coherency suffers.

Contumacy. Contumacy is a cancer within an organization. Translated directly from Latin it means "a swelling against", and in this paper it is used to connote a swelling against authority. It does not show itself as insubordination, which is a quite different thing. Insubordination is open and is easily dealt with, but contumacy bores from within, and hides itself from the detection of those in control.

Contumacy shows itself as an almost unconscious tendency for one part of the staff at the working level, to buck other parts at the same level. This obduracy is usually supported by argument, but careful analysis shows the argument to be rationalization rather than application of logic. Unless this tendency is watched for most carefully, and stamped out as soon as it shows itself, it can spread rapidly through a great part of the organization, with the result that support for any action can fly completely to pieces.

It will be seen that contumacy is also quite different from common back-biting, which again is quite easy to spot and deal with. Contumacy is less obvious, and it should be stressed again that it is an aspect of the subconscious which causes co-operation to be withheld when it should be forthcoming. Neither is it caused by innate selfishness; it is simply that strange hidden force which causes a man to resist giving his consent or his assistance. The British phrase, "bloody mindedness", covers the condition fairly well.

It is contumacy that causes an officer to say that there is no transport, when in fact there is; or that he is too busy to deal with some particular matter, when in fact he could quite easily if he chose; or to say that a specification cannot possibly be altered to take some unforeseen factor into account; or that a requirement cannot be relaxed to permit some simplification in the design. Multiplied by a hundred, it can separate an organization into as many unintegrated cells each able to see no further than its own nose. As a result organizational coherency and efficiency falls to the extent that action takes far longer and involves far more people than it should.

Concession. Concession, of course, is almost the opposite of contumacy. It greases the wheels of organization. If, as a task progresses, concession is made all along the way of points which can readily be conceded in the broader interest, the convergency factor is greatly increased, and effective and well based decisions can be reached very quickly. As a result, the output from the organization is strong and coherent. For this reason, the strength of the concession factor tells a great deal about the strength of the organization and about its capability to move quickly.

Procession. Procession, in this usage, refers to the efficient procession of work through an organization. If there is continuity, cognition and contiguity, it will be processed rapidly and move through clearly defined channels. If not, it will process as through a labyrinth, and action will be confused and ineffective. As a result, drastic and ill-considered action may have to be taken to clear the matter, thus greatly weakening the coherence of the organization.

Conception. The process of conception is of fundamental importance to an organization, for without it the organization stagnates and loses its sense of purpose. Unfortunately, to arrive at a concept is something of an art, and requires a certain amount of individualism, and the person with this type of ability is frequently unable to accept organizational discipline. Thus, there is a tendency on the part of organizations to purge themselves of this extremely essential element. Fortunately, however, a very few such individuals only are required to season the organization.



A concept should not be confused with a compulsion. The latter may be as destructive as the former is constructive. It is compulsion, not concept, that drives the ambitious man; that makes him strive to improve his position, not the strength of the organization; that drives him into professional groupings and power cliques, rather than into an integrated pattern of organization. The man who evolves concepts must be objective to a degree if his concepts are to bear fruit, and he must have sufficient vision to recognize both the hidden advantages and disadvantages of his proposals. Conception simplifies and improves, and enables others to see a task more clearly, or to cope with it more simply or more economically. Without this process of conception, methods simply evolve and complication increases without end.

The jet engine well illustrates the power of conception. Without that factor, organization would have progressed only by calling for larger and more pistons, bigger and better spark plugs, and fuels of increased complexity. Whittle's concept cut across this process of endless extrapolation, and brought into being not simply an increment in power, but a whole new order of flight. This is the power of conception, that it raises not by an increment, but by an order of magnitude. In itself it does not contribute directly to coherency, but absence of conception encourages complexity and thus incoherency.

Control. Finally, we come to the matter of control. It is to a certain extent outside the scope of coherency, for there can be complete coherency without overall control, just as there can be a well trained team of horses going forward without a driver. But such a state of coherency depending entirely on organizational forms cannot stand up under stress, nor can it progress beyond the routine. Which is to say that it can administer to its own needs, but cannot speak coherently on any new issue.

As control is the purpose for which coherency exists, and vice versa, it is affected by all the other factors mentioned. Contumacy is the great enemy of control; without contiguity, control breaks down; without conception it is fruitless and to no purposes; without conation it is pointless; without continuity it cannot exist; without convergency it produces no result; without coagulation it exhausts itself; and without cognition it has no real effect.

The Mechanics of Coherency

Having examined some of the basic elements of coherency, and having given them labels for greater fluency of expression, it is now fitting that we make use of this vocabulary for analysis and synthesis, so that the vocabulary may acquire reality and some linkage with basic organizational usage, and by this means permit the examination of the concept of coherency from another aspect.

It has been shown that continuity is essential to coherency, and also that it is one of the most difficult factors to provide in a military organization. It has also been shown that the greatest disrupting factor, namely rotation of personnel, can never be entirely eliminated in such an organization. Thus other aspects of continuity must be recognized and en-

hanced if coherency is to be retained. In the military organization, continuity stems mainly from adequate promulgation and filing of those comparatively few main points of policy from which a great deal of subsequent action derives. This, in turn, requires that there be adequate cognition and conation. In their own turn these derive from continuity, so that if any of these elements is weak, a vicious circle can easily be formed.

If continuity of policy is to be maintained in the face of personnel rotation, then not only must the basic policy itself be clearly and succinctly stated, but the main steps in its formation, and the logic leading to its final declaration, must also be readily available. This requires that these main points of convergency and decision be set aside in special policy files; that there exist an adequate machinery of control to ensure that such files are maintained, and that they do, in fact, both state and support the policy they set forth. To support this properly, it is essential that the main counter arguments be carefully set down, together with the reasons why it was decided to override these objections; if this is not done, they may bring about a reversal of the policy at a later date for want of realization that they had been considered before. This omission is one of the causes of faulty continuity, and one of the major forces working against coherency.

If these statements of policy are buried in the mass of data which surrounds their formulation, succeeding staff officers will have neither the incentive nor the time to get to the core of the matter when the policy is questioned. They will find it easier to follow their personal idiosyncrasies, and to reinterpret the basic situation according to their own experience, and in the light of the data directly available to them. As the former varies greatly from person to person, and the latter can easily bear the imprint of pressure groups or personalities, inconsistency of policy is almost bound to occur as the rule rather than the exception in such circumstances. Further, it will not be possible to retain administrative control over the situation, for the officer in the staff position at the working level will always be able to overwhelm the officer in the administrative control position with detail supporting the situation as he sees it. In the absence of properly constituted policy files, there will be no means of bringing forward the necessary detail to support the policy. Thus, the administrative officer will be fundamentally unable to convince the specialist as to the wisdom of existing policy; or, what is perhaps worse, may stubbornly refuse to sanction a change in policy when, in fact, a changed situation justifies it.

To establish such files requires not only cognition (job-knowledge), and conation (sense of purpose), but also a high degree of convergency in the decision making apparatus, for lacking this, it becomes impossible to state the support for the policy succinctly. In fact, without this essential element, there is every reason to expect that the policy may not have been based upon completed contiguous staff work, and efficient procession, but rather may represent a temporary domination of the policy making apparatus by some strong personality. The continuity of policy as established, whether or not it is inherently sound, is not likely to be effective.

Again, if any of these basic factors is weak, or is not represented in the policy files, an easy entrance for the factor of contumacy is provided. This strange facet of organizational psychology, it will be remembered, shows itself as a subconscious resentment of authority; policy is the epitome of authority. There is always a tendency to criticize the work of preceding staff, and often this occurs without due process of logic or benefit of information, because of the strange workings of contumacy. To prevent this effect, or to stop it if it does occur, requires not only clear-cut statements of policy, but also that they be reached at the apex of a convergent series of decisions from contiguous sections of the staffs concerned. For, should convergency and contiguity be poor, and decision precipitate, the several factors of contumacy, cognition, and conation will all work against continuity and coherency.

Coherency also depends upon proper procession during any one era of policy formation, or flow of action. In general, the formal structure of organization provides for adequate procession, since excess attention is usually given to establishing this structure. Thus, formal channels are well defined. However, although the path for action may be well charted, the procession of responsibility is often extremely uneven. As a result, the location of responsibility for some aspect of action is at times almost impossible to determine. To find the elements of this defect in coherency, it is necessary to examine the infrastructure of committees which usually spread the responsibility for major points of decision within the formal structure of an organization.

The function of committees is to bring the advice of several sections of the organization to bear at a particular stage of policy formation or action. If the principles of procession are observed, the proper role of the committee can be established and main-

tained without difficulty, thus preserving continuity and coherency. However, committees often tend to become permanent, or semi-permanent, and to have permanent heads. This can completely upset any logical procession of responsibility, for the responsibility now is not transferred through the various staffs in parallel with the procession of action. Thus, the condition of split responsibility arises, and, in fact, may become split again and again, as different committees come to bear on the subject in hand.

Under such conditions of split responsibility and split control, an orderly process of convergency cannot take place, for divergency can take place as soon as the matter is referred to some permanent committee. Thus, instead of procession and convergency towards logical decision by senior officers based on points of major policy, these decisions will take place in a specialist atmosphere in which the senior officers cannot be expected to function effectively. As a result, their role will be that of arbitrer and referee, rather than that of gathering together the final threads of logic and determining the final balance of priority of the main organizational considerations. It is also evident, that under such a pattern of action, contumacy can become rampant and uncontrollable.

To ensure procession of responsibility, it is essential that control of the committee rest with the organization head who is responsible at the point of procession of action. Thus, committee structure should be flexible. If it should become rigid, with the memberships more or less permanent in nature, then at least the chair should be taken by the director responsible in the chain of procession. Thus, the committee will simply provide advice to the responsible staff position plus a certain amount of liaison; and the decision or recommendation of the committee will be neither from its majority or its permanent chairman but from the staff officer concerned.

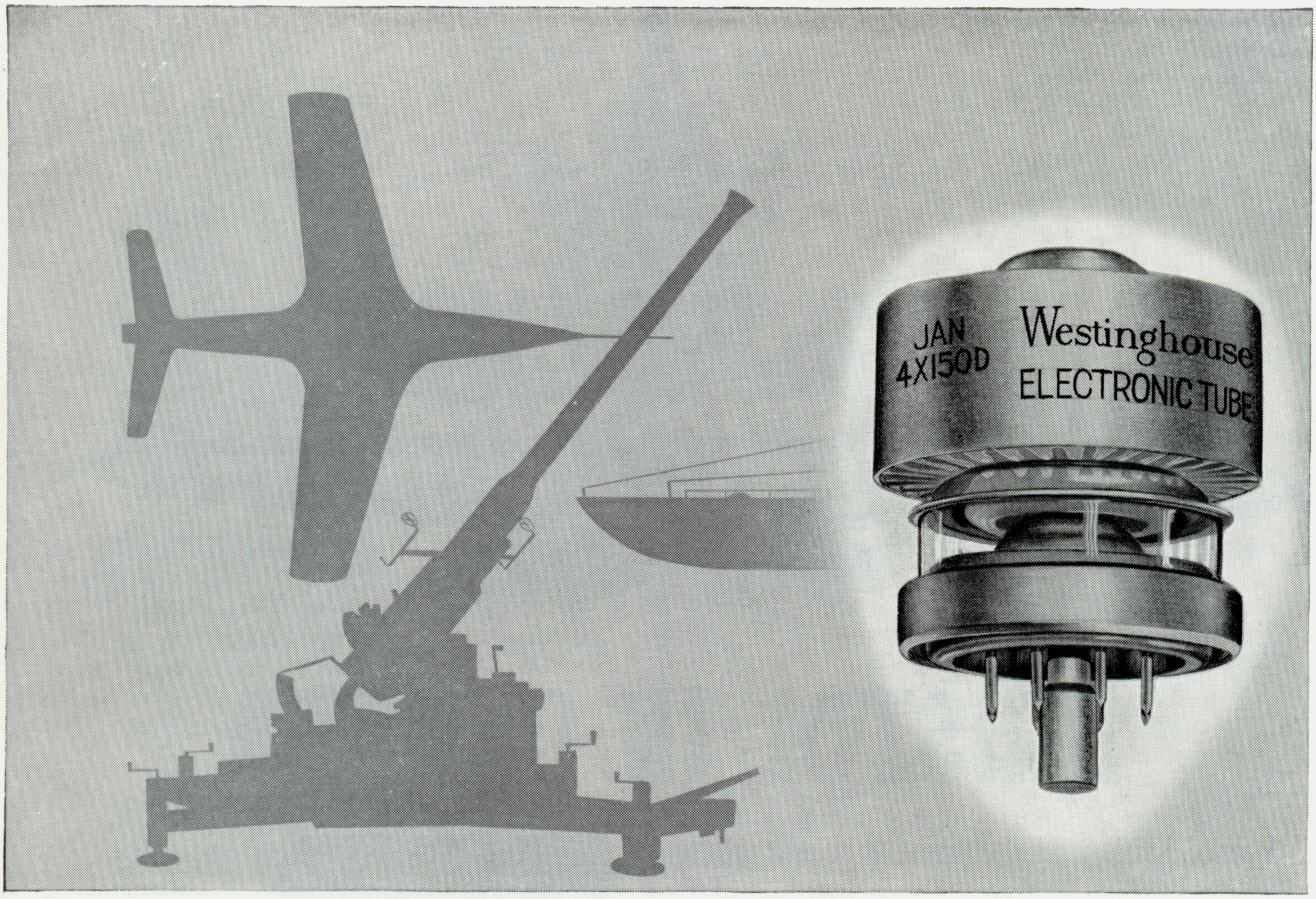
By such a procession of responsibility, convergency and coherency are assured and responsibility is clearly fixed. For example, suppose a committee is called to advise at the time that the basic operational requirement is being processed. Here the technical members will advise concerning the impact of technical considerations, and suggest how the requirement might be shaped for most effective implementation, but the chairman will be a member of the requirements staff and may with reason either accept or ignore such advice. In processing the action, however, he should summarize those considerations which led to his decision. Having so done, the responsibility should now process with the action.

As the action processes, say, to the technical staff, the same committee may be called together again, with the chair now being held by the responsible member of the technical staff. Now as the matter converges towards action, physical considerations become paramount. The chairman must preserve continuity, however, and thus cannot from contumacy take arbitrary action — the clear realization of his undeniable responsibility further discourages any unwise action. However, he may set forth new factors to the committee, and ascertain the interplay of these factors with the user requirements, and then make the technical decision that he thinks is called for. His objectivity will be guaranteed by his responsibility, for the decision will be recorded against his name for all time. Such clear-cut procession of responsibility further adds to the strength and coherence of an organization, as it allows early detection of those who are fundamentally unable to assume successfully such a weight of responsibility because of their lack of conation or their inability to overcome contumacy.

Conclusion

This paper has attempted to state and demonstrate some of the basic elements of coherency, to show that they can be brought forth, given names with specialist meanings and connotations, and can be used to show the over-riding importance of coherency to an organization. According to the argument presented, and its elaboration, "coherency" can be used as a generic term to call to mind the basic elements that comprise it. As each of these basic elements carries further meanings and connotations, and has a definitive name given it, a general medium for organizational analysis and synthesis can be envisioned by a study of this quality defined under the general term, "coherency".

This is obviously a very large subject, and, therefore, what has been set forth here is little more than introductory thought along lines sufficiently unorthodox, it is hoped, to stimulate further thought by others. As this paper is an effort at provocation of a new subject rather than the summation of an old one, it must be realized that a certain exaggeration of effect can be permitted to achieve the desired provocation. This being the case, it should not be concluded that the use of coherency in organization as a criterion of its state of being, hinges on the successful implantation of the vocabulary of coherency set forth here. The reader should rather look to its mechanics and to his own further thoughts on the subject.



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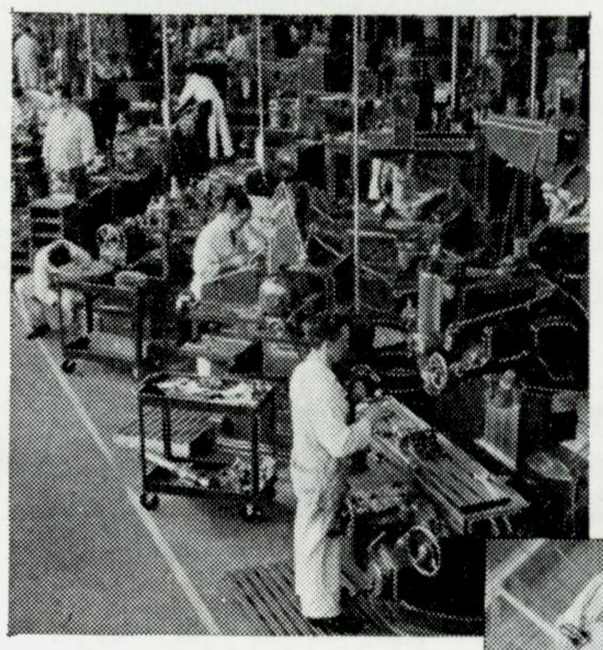
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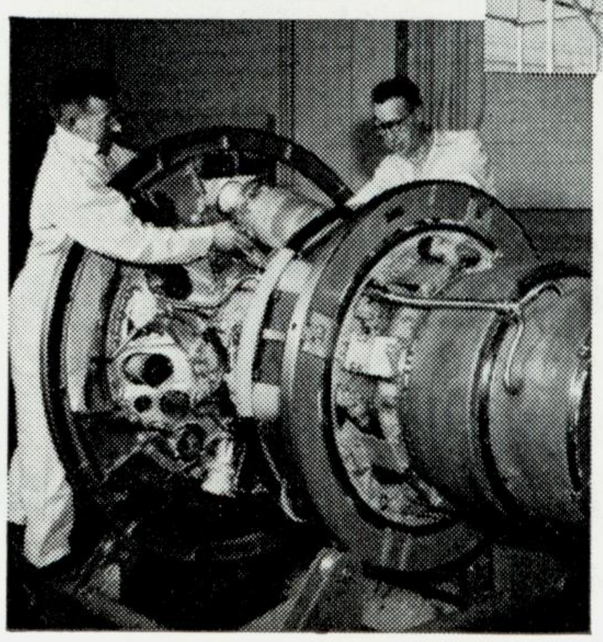
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Book Reviews

STRATEGY AND COMPROMISE

By Samuel Eliot Morison (120p., Little Brown, Boston, Mass., $3.50)

Reviewed by AIR COMMODORE K. L. B. HODSON

"STRATEGY AND COMPROMISE" has been developed from two lectures given by the author, Samuel Eliot Morison, to University audiences. Consequently, the book is short, simply written and easily understandable. It sets forth, devoid of detail and substantiating argument, the United States' contributions to strategy in World War II.

These contributions are stated at the very beginning as, first, a share in the major strategic decision to 'beat Hilter first' arrived at in March 1941 prior to U.S. entry into the War; second, U.S. contributions to the strategy in the European theatre and particularly with regard to the invasion of the Continent; third, the strategy of the war against Japan which was almost completely American.

"Strategy" in the title refers, of course, to the author's analysis of the reasoning which led to allied decisions as to how to win the War. The "Compromise" refers to the wide differences of opinion between Americans and British as to how the War in Europe should be fought. These differences of opinion were slowly resolved and the final outcome was in effect a compromise which, in the author's view, was a happy one.

The word 'happy' is indeed the underlying theme of the book. This tone can be sensed throughout the writing but jumps forth in the final paragraph in which the sentiment is expressed that a successful alliance of the United States and the British Commonwealth is the greatest, if not the only, guarantee of peace in the World today. This theme constrains the author to explain sympathetically the opposing views held by United States and British leaders at both the political and the military levels. This ability to give both sides of the story without noticeable prejudice is a marked characteristic of the book. As a result the author is able to explain the strategy of the Western allies in an overall, comprehensive sense. Many such books have an individual or a national viewpoint to justify which can normally only be done at the expense of those people who were not in agreement with the author. Whether "Strategy and Compromise" profits from objectivity or is a prey to rationalization is open to discussion. On balance it would appear to be a fair accounting of the proposals and counter-proposals which led finally to the allied strategy of the last Great War.

The course of World War II has already been followed in a number of works by well known authors ranging from Churchill to Bryant. For the most part, these histories are voluminous and carefully documented. While invaluable for intensive study and proper understanding, nevertheless the very nature of their detailed presentation makes it difficult to retain in a single picture the essential elements of allied strategy during this period. The principal advantage of "Strategy and Compromise" is that it gives nothing but these essentials and, as a result, permits a quick grasp of the main issues. As a consequence, the reading of this book would provide useful preparation for serious study of World War II.

In achieving the advantages of simplified explanation, the author is forced to make generalized and unsubstantiated statements with which the reader should not pause to argue if he is going to run quickly through the book and gain the reward of a quick understanding. Airmen, for example, would certainly be prone to dispute the statement that carriers can indeed approach within flight distance of enemy territory on which significant fighter forces are based. Substantiation of this type of conclusion should be sought in the more detailed histories which are available.

For the Canadian reader, the chapters on the War

in the Pacific are particularly interesting. These make up one half of the book; another gesture of fair play. The War in Europe has received much more attention in this country, for obvious reasons, and the Canadian student of military history has some prejudices to overcome in forming his judgments. Insofar as concerns the Pacific, however, he can read more or less dispassionately of the competing interests of MacArthur and Nimitz. Once again, important elements of two plans were combined in another compromise strategy. But a more interesting aspect was the manner in which the U.S. Joint Chiefs of Staff were able to make a sudden major change of objectives to profit from an unexpected victory in the later stages of the campaign. This decision, incidentally, was made during the Quebec Conference but owed nothing to Canadian hospitality. The lesson of flexibility demonstrated on that occasion was made possible by the favourable logistics situation which prevailed by mid-1944 in the U.S. Pacific organization. Peacetime planners know only too well that emphasis on economy results in a corresponding lack of flexibility.

Finally, there is a pointer for the airman. "Strategy and Compromise" shows the allied bomber campaigns against Germany, the maritime air forces' assault on the U-boat, and the B29 strikes against Japan as no more than contributing elements in much bigger campaigns. The author's effort to avoid bias is sufficiently successful to suggest that this assessment of the air force contribution may be in proper perspective; not in terms of what could have been done with air power but of the degree to which consideration was actually given to air power in Chiefs of Staff plans. The conclusion might be that the airman should avoid examining the strategy of World War II solely from the cockpit of his aircraft if he is to be prepared to face up to the impact of new weapons, the successful application of which will require one single, concentrated effort.

DEFENCE AND THE ENGLISH-SPEAKING ROLE

By Norman Angell (116p., Pall Mall, London, $2.50)

Reviewed by AIR COMMODORE K. L. B. HODSON

"DEFENCE and the English-Speaking Role" is a masterly analysis of the confusion and irrationalism that has featured Western thought. The author, clearing away some of the wishful thinking, prepares a firm base on which to build his concept of the structure required for world peace; namely a system of world authority based on liberal principles. Such a structure can only be erected with extreme care and patience. Unity of the English-speaking countries should have been the first stage. How this first stage has never materialized is given considerable attention. How fateful have been the consequences of the inability to complete successfully this first step is clearly shown.

It is a hopeful sign to find more and more authors dwelling on the responsibilities of democracy as opposed to the privileges. In this book, Norman Angell shows how in the past the narrow, selfish views of the Western nations have contributed to our present plight. "To make of unqualified sovereignty, independence, self-determination the highest political aim is to render the nations of the non-communist world, whether in Europe, Asia or Africa, incapable of effective defence, putting them at the mercy of the communist power". Nations like citizens must place the overall interests of the community ahead of individual desires if they are to survive. Such a simple truth and so hard to follow!

The staff college graduate who has promised himself to continue his serious reading will find in this little book, several sign-posts to guide him. One of the more attractive sign-posts is Anglo-American relations which, of course, should have constituted the nub of English-speaking unity. Unfortunately, these relations have been more often than not featured by lack of co-operation if not by downright antipathy which, tragically enough, was "due not to any real opposition of interest but to emotional antagonisms rooted on both sides in bad history, worse journalism and unscrupulous demagogy". This is a case where bad history can make good reading if tackled in the spirit of objective fact-finding. How the early relations of Britain and the U.S. which, contrary to popular belief, were featured by considerable mutual admiration, gradually worsened has been a major factor in the deterioration of Western influence. This unfortunate trend would provide a profitable line of study both as a means of understanding present day developments and as a contribution to overcoming the misunderstandings which, more than the Atlantic, tend to separate these two nations.

Another sign-post points to education, a current topic. The author feels that the democracies could expect help from changes in their educational sys-

tems. Here, the operating word is "changes", for the present generation is the most educated generation that has ever existed. But the education is not balanced. The advances scored in technology have not been matched by political and social development. The world which has produced the bomb has not been capable of developing a world order for its control. The social and political consciousness required to produce such an order begins with education. The author points to what he considers to be some of the inadequacies of present educational systems and gives some suggestions for a different approach. References are made to current views of educationalists who are equally dissatisfied with the present system and their remarks might tempt the graduate to read further in this field.

This is a small book but the ideas are large. The chapters on Anglo-American relations and education have been singled out because they are clearly defined areas, convenient for further exploration. But many other vital subjects are developed: the relationship of peace and defence; what we are to defend and how this should be done; the validity of the deterrent concept and the effects of the introduction of the "clean" bomb. These are topical issues and dangerous ones. "Defence and the English-Speaking Role" makes a valuable contribution to their understanding.

DEMOCRACY IN WESTERN GERMANY

By Richard Hiscocks (Oxford, 1957, $6.00)

WEST GERMAN LEADERSHIP AND FOREIGN POLICY

Edited by Speier and Davison (A Rand Corporation Study; Row, Peterson, 1957)

Reviewed by WILLSON WOODSIDE

THE Germans, what they do, why they do it and how it will affect us, have been a constant concern to Canadians for a full generation. For myself it seems, as indeed it is, a long, long time since I first encountered "the German question" face-to-face. The coincidence could hardly have been neater: Hitler was about to come to power and I was about to become a journalist.

It was the desperate year of 1932, at the bottom of the Depression, and the desperate choice of fascism or communism was put to millions of peaceful Germans by brown-shirted and red-shirted storm troopers who fought nightly for control of the streets. I heard Hitler in the Berlin *Sportpalast* and Thaelmann, the Communist leader, in the Munich *Zirkuskrone*. I witnessed the presidential election in which Hindenburg was returned, and a general election in which the Nazis triumphed over 37 other parties, under the baleful system of proportional representation.

Since then we have had the Hitler era; a war which carried German troops to the Channel and the Volga; and the collapse, partition, and occupation of Germany. Finally there has been the establishment in the Western part of that country of a prosperous, democratic society, and the basic theme of the two books under review is, rather naturally, *how reliable is this development?*

Judging from nearly a decade's experience with it, the Germans have devised a much sounder constitution than that of the Weimar Republic; and there is far less opposition today to republican institutions, not to say treasonable activity against them. Weimar was faced from the beginning with very large segments of the population, on the Left and the Right, Communists and Monarchists, who refused to accept the republic. Later the Nazis assailed it. Probably at no time in its 13 years did Weimar have the support of a majority of the people. Not only politicians but teachers, professors, and judges were free to condemn it and inculcate disloyalty to it.

The situation is very different in the Federal Republic. Due to German experiences in Russia during the war and the experience of having the Russians in Germany since the war, Communist strength is almost negligible in Western Germany. On the Right, monarchy is a dim memory, and only twelve to fifteen per cent of the voters consistently tell the public opinion interviewers that they would vote for "a man like Hitler" if they had a chance. Thus, only about one German in six is aligned against the republic today.

It is not proved yet, as the authors of both books note, whether the Germans can develop a healthy democracy which will withstand the strains and shocks of serious economic or political crisis. But Hiscocks stresses the many excellent features of the new constitution which have promoted stability of government while ensuring democratic freedom, such as the "constructive vote of confidence" (which

the French may now copy) requiring parliament to agree on a new chancellor before throwing out the old one, and the power of dissolution which the government can hold over an irresponsible assembly.

There is also the method of election of the president, through a council of some 900 federal and state electors, instead of by popular vote; the federal system itself which has produced a surprising and gratifying number of first-rate political figures on the provincial or *Land* level; and the provision by which sovereignty can be transferred to international bodies such as a United Europe.

Then there is, of course, the electoral law by which half of the members of the Bundestag are elected by direct vote and represent constituencies, as in Britain or Canada, while the other half of the seats are apportioned according to the popular vote, of which a party must have at least five per cent to be represented in the Bundestag.

This electoral law eliminated the Communists from parliament in the 1953 election and the Refugee Party in the 1957 election. The demise of the Refugee Party is an important event and underlines a point which neither of these studies makes in as many words: that refugees from lost territories who are gradually absorbed into the homeland are a very different factor both in domestic and international politics from brethren suffering under a foreign yoke in an *irridenta.* Stalin knew what he was about when he drove the Germans before him out of the eastern territories of the Reich.

To make any judgment on the development of democracy and the trend of foreign policy in the Federal Republic without carefully considering the role of Konrad Adenauer would be nonsense. The question is how much weight to give this single, dominant figure. Our authors have no doubt that his consistent pro-Western policy, his efforts towards reconciliation with France, and his commitment to the European idea gained his government concessions in the occupation statutes which another leader might not have obtained. No doubt also, many people in the West have come to think of Germany in Adenauer's image, as they formerly thought of it in Hitler's.

Hiscocks believed when he closed his book half a year or more before the last election, that the era of "chancellor democracy" was coming to an end. The turning-point, he thought, was the debate over the Volunteer's Bill in 1956, which saw the legislature taking up the challenge of the Chancellor's imperious methods for the first time, asserting its constitutional rights, and forcing a revision of the government's proposal. But he doubted the wisdom of the Social Democrats in coming down flatly against conscription, and suspected them of a political opportunism which was far from justified by the outcome of the subsequent general election.

Adenauer is now sometimes referred to as "the new Iron Chancellor" or "the greatest German since Bismarck". W. Phillips Davison, in his contribution on "Trends in West German Public Opinion" in the Rand Corporation study, cites a public opinion poll taken in 1954 which asked which was the greater statesman, Adenauer or Hitler. Almost fifty per cent said Adenauer, only fourteen per cent Hitler. But when they asked, Adenauer or Bismarck?, the choice was five to one for the original Iron Chancellor.

Clearly that admiration of the great qualities of Bismarck, which Hiscocks believes to have been a sinister influence on the Germans, bringing them to accept his cynical, amoral pursuit of political ends, has not yet run its course. All of the writers represented here find, indeed, that many old German failings still persist. Hiscocks is by no means blind to them, but the Rand Corporation studies, as their origin might suggest, take a rather more skeptical line. These "field" studies, each based on a great many interviews by a competent researcher, date from 1953-55 and presumably are made available to the public now because their immediate use in guiding official U.S. policy has been achieved.

Hiscocks' general attitude is well displayed in his comment that, while the old German habit of refusing to take responsibility for their own actions and troubles is the most repellent feature of postwar Germany, there is a small minority which has faced up to German guilt. "These people belong to the salt of the earth, and their counterparts in every country are in a small minority . . . In them and their followers lies the hope for Germany's future contribution to the world."

Hiscocks, an Oxford man who is now Professor of International Relations at the University of Manitoba, and who has spent years in Germany at several critical periods of her recent history, has written a wise and humane book. Two of the studies in the other volume, those by S. L. Wahrhaftig and H. J. Kellerman, approach Hiscocks' in breadth of view. The others are devoted to narrower fields. J. H. Herz, describing the Political Views of the German Civil Service, says that the top officials today are mostly "better Germans", while the lower down you go the more Nazi remnants you find. Otto Kirchheimer, writing of the German Trade Unions, tells how the loosening of the old grip of Marxist dogma

has made it possible to bring the Christian unions within the German Trade Union Federation.

Outlining the Politics of German Business, G. A. Almond demonstrates that business does not dominate the country, has consistently supported Adenauer's foreign policy, and has joined in many European organizations. It might prefer to support the Free Democratic Party, but realizes that it would not then have so much influence. Finally, W. P. Davison, in his studies of Mass Media and Trends in Public Opinion, finds that only one German newspaper in twelve supports a political party and that, for all the "German miracle", the best paper in the German language is still the Swiss *Neue Zuercher Zeitung*. The most he will concede of the ten-year trend in public opinion in West Germany is that it is "mildly encouraging".

However the German story comes out, the last ten years have shown a remarkable development. How quickly, and almost smoothly, it moves along when you read it over at a sitting! The major criticism which I scribbled into the margins of these two volumes, was that the authors did not give the fearsome figure of Stalin or the stirring experience of the Berlin Airlift sufficient credit for shoving the Germans our way.

LOST STATESMAN – THE STRANGE STORY OF PIERRE MENDÉS-FRANCE

By Alexander Werth (428p., Abelard-Schuman, New York and London, 1959, $5.95)

Reviewed by WING COMMANDER J. GELLNER

THIS reviewer read Alexander Werth's story of Pierre Mendés-France in May 1958. By that time unfortunate, dissension-torn France had had 25 governments in the 153 months since the liberation of Paris. During only seven-and-a-half of these months, one twentieth of the existence of the Fourth Republic, had Mendés-France been its Prime Minister. Apart from that, he had been Finance Minister for a short time in the very beginning, and Minister without Portfolio for about four months in Guy Mollet's government in 1956. Not much of a record in a country in which leading politicians can boast of having been premiers three or four times, or cabinet ministers in 15 successive governments. Not much to earn the appellation of "statesman". Not much to deserve, in his lifetime and at the age of 50, to be made the subject of a biography compiled by the leading writer on contemporary France.

Yet Mendés-France's achievement cannot be measured by the length of time during which he has borne responsibility for the destinies of his country. His position in French political life is unique. French politics have (perhaps too unkindly) been called, "the shabby shuffling of a greasy pack of cards". Mendés-France has refused to shuffle. Instead, he has driven with courage, frankness, and vigour toward a clearly designed goal. He did this in a manner which gave Churchill "an impression of French leadership which he had not sustained since the days of Clemenceau". Moreover, where De Gaulle chose to be "a noble anachronism . . . like a cold wind of French greatness, blowing from very high and very far", Mendés-France tried to exercise leadership in the given milieu of French parliamentary institutions and with the feeble tools accorded to French governments, a much more difficult and much less rewarding task than that of being a living symbol, a sage divorced from the rough and tumble of everyday politics.

Alexander Werth is at his best when he describes these unbelievable 31 days during which Mendés-France made his supreme effort to undo all at once the sins of past mis-management of France's foreign policy. In Geneva, with nary a trump in his hand, he succeeded in cutting away the terrible liability that was Indochina, and extricating the sorely pressed French forces, while saving what could be saved of French assets and without surrendering the whole country to the Communists. He had set himself 30 days to liquidate a war, through which successive French governments had wearily wobbled for eight years at a cost of more than a billion dollars a year, and he managed to get terms far better than could have been expected after the debacle of Dien Bien Phu. The Geneva Agreements were signed on the night of July 20th. On July 19th, the Brussels conference was opened in which Mendés-France was seeking an alternative to EDC (which he and the majority of Frenchmen – and of other Western Europeans – rejected) as a method of re-arming Germany and tieing it to NATO. The result was the Paris Agreements, which bear Mendés-France's signature and which today are the basis of West Germany's armed alliance with the West. On July 31st, Mendés-France went to Tunis to replace with a generous, realistic, and sincere

new course the bankrupt Tunisian policy of the past, the working through stooges, the piecemeal concessions, the periodic application of force. What a month!

It is a tragedy that it was also during the premiership of Mendés-France, the man who might have brought on a political arrangement in North Africa beneficial to French and Arabs alike, that the present Algerian revolt broke out. It looks, in fact, as if the wire-pullers of revolution against the "colonial powers" had launched the assault at that time fearing that if they waited any longer, an equitable settlement would knock the props from under them. The French National Assembly had backed Mendés-France's policy on Indochina, Germany, Tunisia. It had let him make the first steps toward economic reform. But when the Algerian crisis came up for debate, it dismissed him.

"Lost Statesman" is a worthy companion piece to Alexander Werth's magnificent "France 1940-1955". It is not as scholarly as the latter, nor does it have its firm structure, but, for that, "Lost Statesman" has all the picturesqueness and the human interest of a first-class biography. It gives a crystal-clear picture of contemporary France, of a great country and of a great people afflicted by an inexplicable political lethargy, a kind of political sleeping sickness. Mendés-France seemed to have the right antidote in his hand. It is unfortunate that he was not allowed to finish the treatment.

THE ADMINISTRATIVE PROCESS

By Robert H. Roy (223p., The John Hopkins Press, Baltimore, 1958, $6.25)

Reviewed by GROUP CAPTAIN F. R. SHARP

"THE ADMINISTRATIVE PROCESS" is a readable and thought provoking book, liberally sprinkled with examples which the Air Force reader will be able to associate with his everyday experiences. Robert H. Roy draws on his experiences as Dean of Engineering at John Hopkins University, as a business manager, and as an arbitrator in labour disputes to present an analysis of the process of administration.

Throughout the book the author stresses the importance to effective management of a thorough understanding of human nature. In fact he makes the point that administrative problems, and the solutions to them, are very largely determined by existing social mores. If this is true, administrators who wish for the good old days are wishing in vain; existing conditions must be recognized and decisions must be consonant with them. This thought has many Air Force applications, of which our concepts of discipline and authority are probably the most important. Perhaps present social mores will not permit us the tight military discipline which was suitable 25 years ago, or the concentration of authority in the hands of a few which was acceptable to the average serviceman of the pre-war days.

The chapter on delegation of authority has such widespread application to Air Force situations that it might well be required reading for all officers faced with solving this delicate problem. It is pointed out that while need and custom influence the amount of authority delegated, the individual superior still determines to a large extent the amount of freedom of action accorded his subordinates. The author believes that organizations suffer because superiors delegate less authority, less responsibility and less freedom than they should for optimum results. He gives many reasons for this apparent lack of delegation, of which the most pertinent to a military administrative situation is probably the fear of a subordinate's error for which the superior might be held responsible.

One characteristic of the executive who fails to delegate is his eternal busyness and his great devotion to routine trivia. One might argue that, provided the executive is able to accomplish his work and not hold up decisions, there is no harm in him delving into detail. However, as the author points out, insufficient delegation blocks subordinate development. The armed services go to great lengths to develop executives by rotation of employment and by training through formal and informal courses. It is a debatable point whether this effort will pay the expected dividends unless similar effort is devoted to ensure that subordinates are given enough authority to learn from the experience of making decisions. A final point made by the author concerning delegation of authority is most pertinent to Air Force administration: "In the environment of administration, rules covering all possible contingencies are impossible to state. Attempts to write such rules will not only fail in their purpose but will violate equity and stultify delegation as well. A framework of rules within which subordinates are free to decide for themselves will serve the ends of sound delegation". Those of us who are concerned with drafting

orders and regulations might do well to remember this factor.

Dean Roy makes some very pertinent observations concerning the nature of staff work. While it is probably true that military services have a better understanding of this function than do business organizations, the author is able to make some observations which will help the military as well as business understand better the requirements of staff work. Particularly useful are his remarks on the relationship between line and staff officers. While conventionally the staff officer provides an advisory service to the line organization, these conventions, as Dean Roy points out, are usually violated. The staff tends to become functional and its pronouncements are accepted as orders and not advice, yet the staff expert who encroaches on the line by virtue of his rank and expertness has the same effect as the line superior who clutches all decision-making to himself. "Both, to the degree that they transgress, reduce the subordinate executive to the role of relay". How often has one heard a command or group headquarters referred to as a "post office"! The author makes the point that the staff officer, if he grows into habits of operating the enterprise, even though his operating tendencies are confined to his expert knowledge, diminishes his value as an advisor to his superiors.

Dean Roy also deals with such subjects as morale, communications, organization, and decision-making. All in all this book makes extremely interesting and worthwhile reading.

OTHER BOOKS RECEIVED

The limitations of space prevented inclusion of a review on these books received from publishers:

The Computor and the Brain. By John von Neumann. New Haven, Yale University Press, 1958, 82p., $3.75.

The French Political System. By Maurice Duverger. Chicago, The University of Chicago Press, 1958, 227p., $4.00.

My Zeppelins. By Hugo Eckener. London, Putnam and Co., 1958, 216p.

A United Nations Peace Force. By William R. Frye. New York, Oceana Publications, 1957, 225p., $3.75.

World Peace through World Law. By Grenville Clark and Louis B. Sohn. Cambridge, Harvard University Press, 1958, 540p., $9.00. (Published in Canada by S. J. Reginald Saunders, Toronto.)

Power and Diplomacy. By Dean Acheson. Cambridge, Harvard University Press, 1958, 137p., $3.75. (Published in Canada by S. J. Reginald Saunders, Toronto.)

The Kingdom of Jordan. By Raphael Patai. Princeton, Princeton University Press, 1958, 315p., $5.75. (Published in Canada by S. J. Reginald Saunders, Toronto.)

Our Nuclear Future. By Edward Teller and Albert L. Latter. New York, Criterion Books, 1958, 184p., $4.00. (Published in Canada by S. J. Reginald Saunders, Toronto.)

Communication, Organization, and Science. By Jerome Rothstein. Indian Hills, Colorado, The Falcon's Wing Press, 1958, 110p.

Fall Out: Radiation Hazards from Nuclear Explosions. Edited by A. Pirie. London, MacGibbon and Kee, 1958, 176p.

SAC: The Strategic Air Command. By Richard G. Hubler. New York, Duell, Sloan, and Pearce, 1958, 280p., $5.25.

One Man's Window. By Denis Barnham. London, William Kimber, 1956, 201p., $3.75.

Sputnik Into Space. By M. Vassiliev and V. V. Dobronravov. London, Souvenir Press, 1958, 147p., $3.25.

U.S. Air Power. By S. T. Moore. New York, Greenberg, 1958, 196p.

Authority. Edited by C. J. Friedrich, Cambridge, Mass., Harvard University Press, 1958, 234p., $6.50. (Published in Canada by S. J. Reginald Saunders.)

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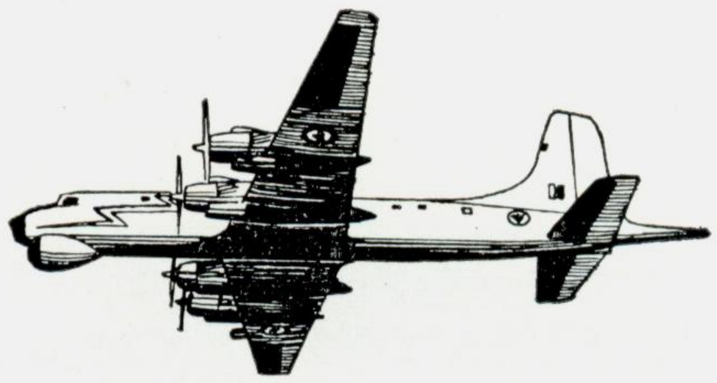
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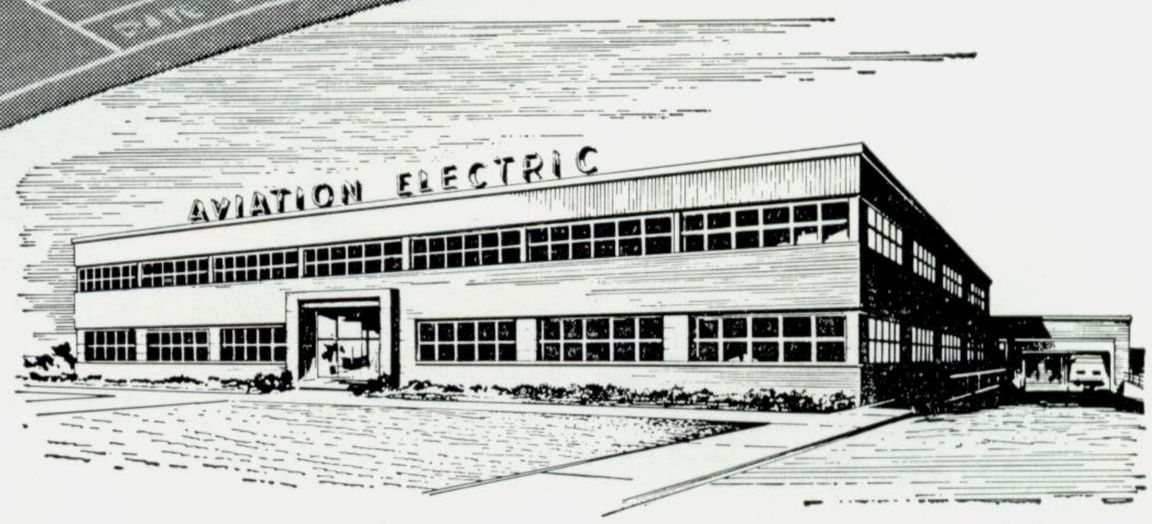
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Course 22's Year



Valedictory

". . . It is the education which gives a man a clear conscious view of his own opinions and judgments, a truth in developing them, an eloquence in expressing them, and a force in urging them."

— John Henry Newman.

The ceremonies of graduation over, the students disperse and the staff regroup. The twenty-second course at R.C.A.F. Staff College has passed into academic history. This is the time for reflection and resolution. The achievements and shortcomings of the year pass in review: for some, opportunities have been lost forever; for others, lessons have been learned which will be the cornerstones of future striving.

Summing up the benefits of the course should be a personal and private exercise of recall. Here were gathered officers from three nations and five services, each with a background distinct from all others, each with abilities unmatched by his fellows. The impact of the group upon the individuals was an education in itself; the impact of individuals on the group was likewise broadening — sometimes.

To know Canada better than before; to study the role of the R.C.A.F. in co-operation with other services; to understand Canada's position in the affairs of the world with emphasis on the military aspect; to review modern military history and the principles of war; and to revitalize one's habits of thinking, through self-improvement in the use of language: these were some of the stated objectives of the College. Lectures, visits, discussions, written and oral exercises, topical reading, and impersonal research were the main avenues of approach towards the objectives. The College could only assign, assess, and assist through constructive criticism. The rest was up to us.

We have been withdrawn from ordinary responsibilities for an academic year. These ten privileged months represent a considerable investment by our respective services, and the return on that investment is our new responsibility. Training is a preliminary only, not an end. Therefore the profit we show will depend on the persistence with which we utilize our newly acquired habits of study, thought, and expression. In putting the course behind us, let us keep its purpose before us.

As the mark of a college is the quality of its graduates, so each succeeding class imparts something of itself, which is received into the character and tradition of the college. Whether for good or ill, but let us hope for good, Course Twenty-two has made its contribution.

— Wing Commander R. A. B. Ellis.



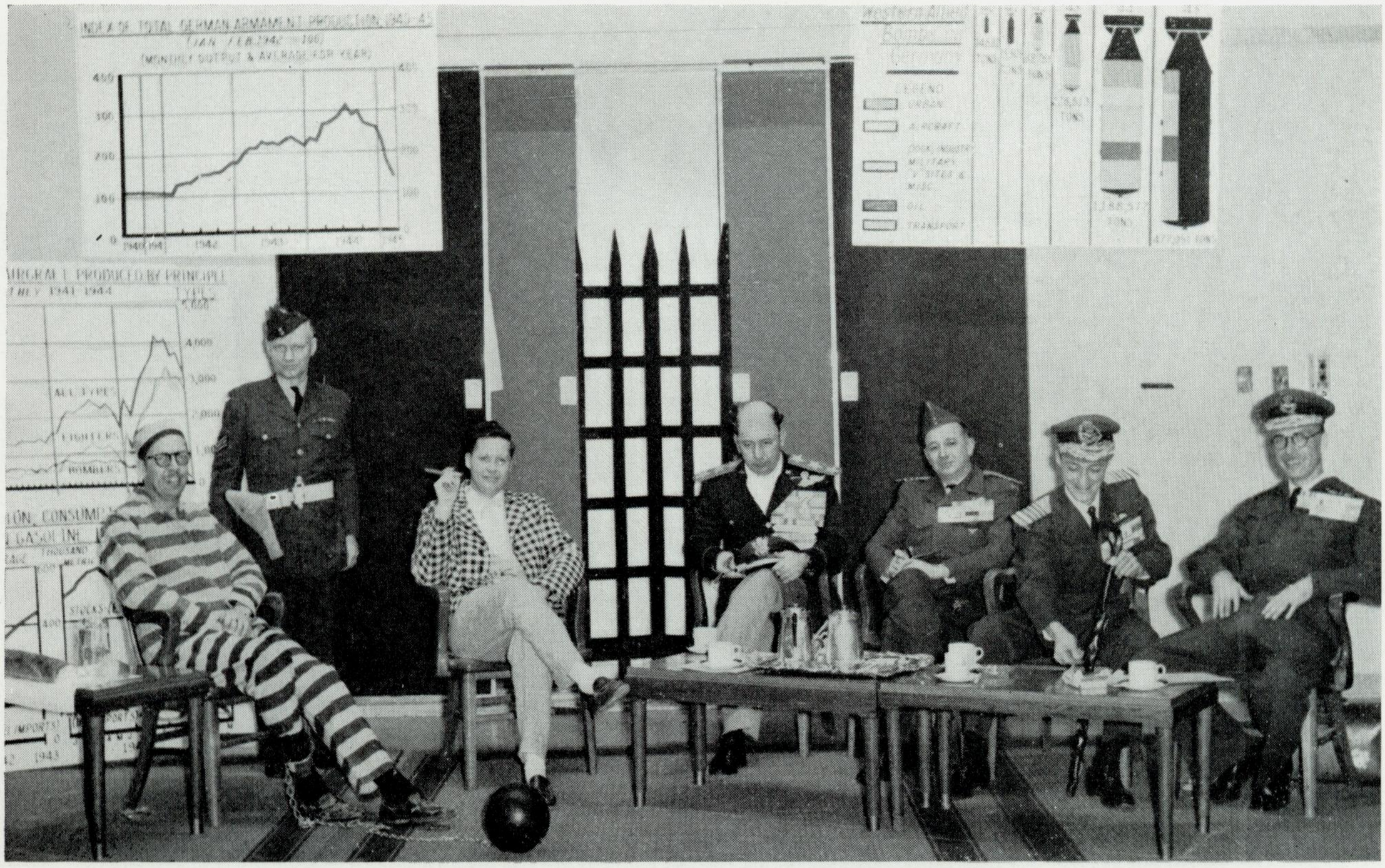
AFTER WE BECAME ACQUAINTED



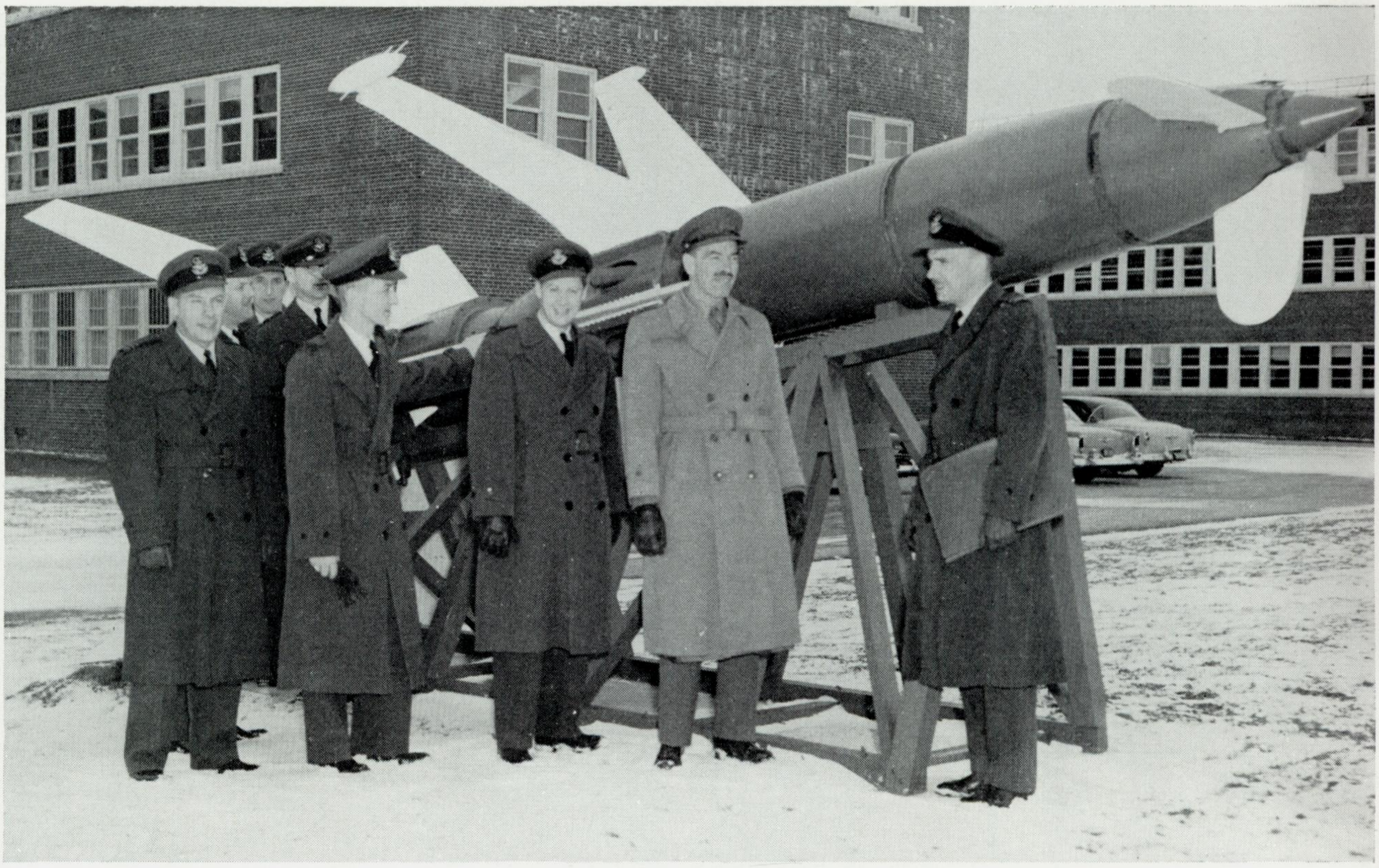
WE GOT DOWN TO DEALING WITH PROBLEMS,



DEFENDING OUR SOLUTIONS,



AND STUDYING THE ART OF WAR.



WE INCREASED OUR KNOWLEDGE OF THE AIR FORCE,



OTHER SERVICES,



AND THE MARVELS OF SCIENCE AND INDUSTRY.



AND BY PULLING TOGETHER,



WE CEMENTED RELATIONSHIPS WITH OUR ALLIES.



THERE WAS TIME FOR RELAXATION,



MEDICATION,



AND FINALLY, CELEBRATION.

Biographies – Course 22

These officers were members of Course 22.
Their average length of service is seventeen years.



Lieutenant Commander W. H. I. Atkinson, D.S.C., C.D.

Bill Atkinson was born in Minnedosa, Manitoba, in 1923. He received his education there and in Winnipeg. After graduating from the Daniel McIntyre Collegiate Institute he joined the Royal Navy in 1942. On receiving Fleet Air Arm pilot's wings he served in the Far East with the R.N. At the end of the war Bill returned to Canada and transferred to the R.C.N. Since then he has commanded an Anti-Submarine squadron embarked on H.M.C.S. Magnificent and acted as Naval Assistant to the Commandant at the Canadian Joint Air Training Centre. Bill and his wife, Val, with their four children, have moved to Halifax where he is now serving in the Destroyer H.M.C.S. Nootka.



Squadron Leader R. M. Bauman

Ron Bauman was born in Olds, Alberta, in 1921, and attended high school in Calgary. He joined the R.C.A.F. in 1940 as an aero-engine mechanic and remustered to air-crew as a pilot in September, 1942. After serving overseas in 1944 and 1945 he returned to Canada and was released. He was employed in civilian flying until November, 1948, when he rejoined the Service. Since then Ron has been employed in ferry-flight operations and experimental and development flying with Central Experimental and Proving Establishment. (He attended the U.S.A.F. Test Pilot School in 1952.) Ron is married to the former Muriel W. Alexander of St. Thomas. They and their two sons are now living in Ottawa where Ron is with the Directorate of Flight Safety at Air Force Headquarters.



Squadron Leader D. A. Bell, C.D.

Don Bell was born in Halifax, Nova Scotia. He joined the R.C.A.F. in 1941 as a Radar Mechanic and served almost continuously with the R.A.F. as a Radar Mechanic and Radar Officer until late in 1945. Following the war, Don graduated from the University of Toronto (B.A.Sc.), and re-enrolled in the R.C.A.F. in 1948. Before coming to the Staff College he served with the Systems Engineering Group at Air Force Headquarters, which was engaged with the Mid-Canada Line Project. He is married to the former Elizabeth Hungerford, of Huntsville, Ontario, and they have four children. Don's present assignment is with NORAD Headquarters, Colorado Springs.



Squadron Leader Russell M. F. Bowdery, C.D.

Russ Bowdery, 40, was born in Camberley, Surrey, England. The family emigrated to Canada in 1921 and Russ was raised and educated in Vancouver, B.C. He joined the Royal Canadian Air Force in 1939 and flew Liberators on operations in India and Ceylon. After the war Russ served at Western Air Command Headquarters and at Training Command Headquarters, Trenton, and later as Deputy Officer Commanding Flying at the Air Observer School, Winnipeg. Before he came to the R.C.A.F. Staff College, he spent three years at the Canadian Joint Staff in London, England, as Staff Officer Personnel. He and his wife, Mildred, returned to Trenton at the conclusion of the course.

Squadron Leader H. T. Brown, R.A.F.



"Bill" Brown is a transplanted Canadian who was born in Wainwright, Alberta, in 1922. He was educated at Biggar and at the University of Saskatchewan. Bill joined the R.C.A.F. in 1941 and completed one tour of operations with Bomber Command. After completing one year at the University of Saskatchewan he joined the R.A.F. in 1947 and was employed in Bomber and Flying Training Commands. Prior to coming to the Staff College, he spent two years at the Air Ministry in the Directorate of Flying Training. Bill, his wife and their two children have returned to the United Kingdom and are now stationed at the Royal Air Force College, Cranwell, where Bill commands No. 2 Advanced Squadron.

Wing Commander O. C. Brown, C.D.



Orv Brown, 36, comes from Prince Albert, Saskatchewan. He graduated from high school in 1940 and shortly afterwards joined the R.C.A.F. as a pilot. During the Second World War he was with a bomber-reconnaissance squadron on the East Coast of Canada. Afterwards he served as a transport pilot and completed two tours of duty with Central Experimental and Proving Establishment. Before he came to the Staff College he was employed in the Operational Requirements sub-division at Air Force Headquarters. On graduation he was transferred to Air Defence Command to join an all-weather squadron. Orv married the former Jean Richard of Halifax in 1944. They have one son and four daughters.

Squadron Leader R. G. Christie, C.D.



Bob Christie, although a native of Vancouver, B.C., was brought up in Florida. In 1942, while attending Cornell University in New York, he joined the R.C.A.F. and spent the war years as a flying instructor. In 1951 he graduated from the U.S.A.F. Experimental Test Pilots School and afterwards became Chief Test Pilot at Central Experimental and Proving Establishment. Before coming to the Staff College, Bob was Detachment Commander at the Air Armament Evaluation Detachment, Cold Lake. He is married to the former Jacqueline Rose, of Chapleau, Ontario, and they have two sons. He is now at Air Force Headquarters in the Directorate of Air Defence Operations.

Squadron Leader J. T. Dalton, C.D.



Terry Dalton, 36, was born in Newcastle, New Brunswick. He joined the R.C.A.F. in 1943, after a short period in the Army, and served until release in September 1945. Terry re-entered the University of New Brunswick and graduated with a B.Sc. in Electrical Engineering in 1946. He re-enlisted in the R.C.A.F. in 1947. Terry has held several flying appointments, was on the staff of Air Radio Officer School, Clinton, and was Resident Staff Officer with the University of New Brunswick Squadron. Before he joined Course 22 he was at Training Command Headquarters in Postings and Careers. Terry married Dorothy Martin in 1946 and they have five sons. He is now on the staff of 2 Air Observer School at Winnipeg.

Squadron Leader W. S. Day, D.F.C., C.D.



Bill Day was born in Aylesford, N.S., in 1921. He joined the R.C.A.F. in 1940 and, after training as a pilot, instructed at Brandon, Man. He went overseas in 1942 and completed a tour of operations in Bomber Command. Later he was a flight commander at an Operational Training Unit and on 436 (T) Squadron. His post-war assignments have included a tour with 414 Photo Squadron and duty at A.M.C.J.S. London. Before coming to Staff College Bill was Chief Operations Staff Officer at R.C.A.F. Station Greenwood; at present he is in the Directorate of Air Operations at A.F.H.Q. In 1946 Bill married the former Audrey Adams, of Leamington Spa, England. They have three children.



Wing Commander J. A. G. Diack, C.D.

Jim Diack was born in 1920 at Brooklyn, N.Y. Educated at Vancouver and Toronto he received a B.A.Sc. degree from the University of Toronto in 1943, and joined the R.C.A.F. as an aeronautical engineer upon graduation. Post graduate studies at the California Institute of Technology led to a M.Sc. degree in 1947. Before he came to the Staff College he was on the technical staff of Tactical Air Command Headquarters in Edmonton. Married in 1945, Jim and his wife, Peggy, have two boys and three girls. Jim's Staff College experience is now being applied in the Directorate of Aircraft Engineering at Air Force Headquarters.



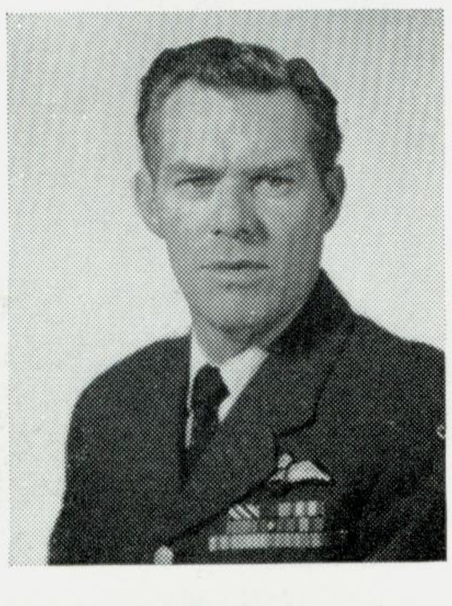
Squadron Leader M. F. Doyle, C.D.

Mike Doyle was born in Montreal in 1924 and was educated at Bishops College School, Lennoxville, and McGill University. He joined the R.C.A.F. in 1942 and completed a tour of operations on fighters in 2nd T.A.F. His postwar career has included a tour on a Vampire and Sabre squadron and assorted staff duties. In 1946 he was married to Ann Grant, of Hayling Island, England, and they are now the parents of four children. Mike was posted from the Staff College to flying duties with an all-weather squadron.



Wing Commander R. A. B. Ellis, C.D.

"Rab" Ellis, 38, is the son of Dr. and Mrs. R. W. Ellis, of Westport, Ontario. He received his education in Ontario, and prior to joining the R.C.A.F. in 1941 he was a bandmaster, teaching school bands in Ormstown and Huntingdon, Quebec. He was a flying instructor throughout the war, and left the Service in 1946. Later the same year he rejoined the R.C.A.F. and served in both flying and staff appointments in Training Command until 1954, when he was transferred to all-weather operations. His wife is the former Flo Ann MacDonald, of Glengarry; they have two children. Rab's present assignment is at the Air Ministry in London, England.



Squadron Leader F. W. Evans, D.F.C., C.D.

Fred Evans, 38, was born and educated in Saint John, New Brunswick. During the Second World War, Fred flew "Spitfires" on operations with 421 Squadron. Since the war he has had various flying appointments, including duty with the R.A.F. and the U.S.A.F. While with the U.S.A.F. he was attached to a Sabre Squadron on operations in Korea. Since then he has held staff appointments at 1 Air Division Headquarters and at A.F.H.Q. It was from this latter post that he came to the Staff College. Fred is married to the former Claire Dunlop, of Ottawa. They and their two children are now living in Colorado Springs, where Fred is on the staff of NORAD.



Squadron Leader A. W. Fisher, C.D.

Art Fisher was born in 1918 in Saskatchewan and attained his matriculation there. He enlisted in the R.C.A.F. as an airframe mechanic in 1938. In 1942 he remustered to aircrew and became a pilot. Most of Art's flying career has been associated with Training Command; he has served on the staffs of Flying Instructors School, Instrument School, and Central Flying School. Before he came to Staff College, Art was in Europe; he commanded Sabre Squadrons in England, Germany and France. At present he is on the staff of the Officers Postings and Careers Branch in Training Command Headquarters. Art and his wife, Terry, have three children, a son and two daughters.



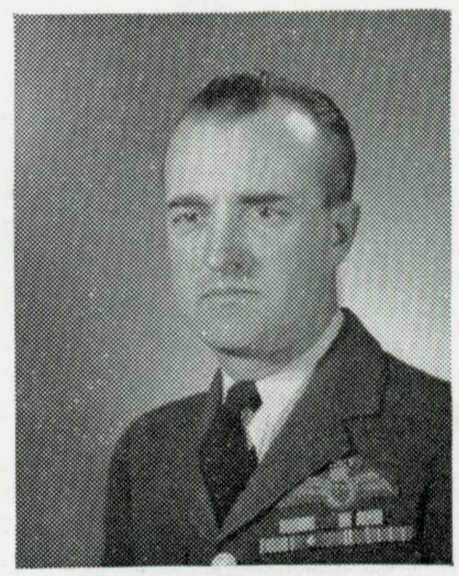
Squadron Leader H. A. Foster, C.D.

Al Foster was born in Frankford, Ontario, in 1918. He joined the R.C.A.F. at Trenton in 1937 and has been a member of the R.C.A.F.'s logistic organization for over 21 years. During the Second World War he served in Toronto, Montreal, Calgary and in Germany. After the war he was on exchange duty at Tinker Air Force Base, Oklahoma City, for two years. He came to Staff College from Air Materiel Command where he was employed as Staff Officer Logistics Data for six years. He is married to Rosanne Laflamme, of Montreal. They have three daughters. Al is the Chief Supply Officer at 7 Supply Depot, Namao, Alberta.



Squadron Leader J. E. Goldsmith, D.F.C., A.F.C., C.D.

Johnny Goldsmith was born in 1922 in Halifax, Nova Scotia. He joined the Canadian Army shortly after the outbreak of the war and transferred to the R.C.A.F. in February 1942. His wartime experience consisted of two tours of operations with the Pathfinder Force of the R.A.F. and service with Coastal Command until the end of the war. Since then he has served four years with 413 Photo Squadron and spent a tour of duty with the U.S.A.F. in Hawaii. For three years before his arrival at the Staff College he filled the position of Chief Instructor at Manning Depot at St. Jean, Quebec. He married Margery Doane, of Boston, Mass., in 1945 and they have two sons. After graduating from Staff College he was transferred to Air Defence Command to join an all-weather squadron.



Squadron Leader A. M. Halkett, D.F.M., C.D.

"Porky" Halkett, a native of Peace River, Alberta, was born in 1922. He joined the R.C.A.F. in 1941 and went overseas after training as a pilot. Porky completed two tours of operations in Bomber Command before returning to Canada in 1945. Since then he has served mostly in Training Command, except for a two-year tour on exchange with R.A.F. Bomber Command. While in Training Command he instructed at Centralia, Central Flying School, Trenton, and latterly was a staff officer in the Air Training branch. He married Hilda Dumbleton, of Banbury, England; they have two daughters. S/L Halkett was transferred from the Staff College to Maritime Command, and he will be joining a Maritime squadron.



Squadron Leader C. E. L. Hare, D.F.C., A.F.C., C.D.

Chris was born in Montreal in 1922. He moved to Toronto in 1927 and joined the R.C.A.F. in June, 1940. After training as a pilot he flew Wellington aircraft in Bomber Command and in the Middle East, but he was shot down and captured in North Africa during the summer of 1942. Chris escaped one year later, and completed a second tour of operations with an R.A.F. Lancaster Squadron. From 1946 until 1953 he held a number of staff and operational positions in R.C.A.F. Air Transport Command and R.A.F. Transport Command. Before attending the Staff College, he was Chief Administrative Officer at Bagotville. He is now completing conversion training prior to joining a CF100 Squadron. In 1946 Chris married the former Gwendolyn Holgate, of London, England.



Squadron Leader H. T. Heaslip, A.F.C., C.D.

Bob Heaslip was born at Uxbridge, Ontario, and educated at Oshawa, where his parents still live. He joined the R.C.A.F. at Toronto in 1941 and, after training as a pilot, served on the West Coast on communication and transport duties. In 1947 he became one of the R.C.A.F.'s first helicopter pilots and served as helicopter instructor at the Light Aircraft School at Rivers, Manitoba. Before coming to the Staff College Bob was Commanding Officer of 108 Communications Flight, which was engaged in the helicopter airlift during the construction of the Mid-Canada Line. He married Jean Campbell in 1947, and they now have two sons. Bob is remaining at the College as a member of the Directing Staff.



Squadron Leader J. Howarth, C.D.

John Howarth was born near Drumheller, Alberta, in 1920. He joined the R.C.A.F. in 1940, trained as a pilot, and went overseas to the United Kingdom where he flew on operations with Fighter Command until May, 1943. After service in Gibraltar, North Africa, and Italy he spent a year instructing at a gunnery school in Egypt. In 1945 he attended University of British Columbia, but a year later he rejoined the R.C.A.F. In 1952 he was selected for duties with the R.A.F. Before he joined Course 22 he was Operations Officer at Station Uplands. His wife is the former Frances Burchall; they have four daughters. The Howarth family is now in Vancouver where John is a member of the Air Staff at 5 Air Division Headquarters.



Wing Commander W. E. Johnston, C.D.

Johnny Johnston was born in Souris, Manitoba in 1917. After completing his schooling in Souris in 1935 he worked for some years with the Coca Cola Co. in Winnipeg. He joined the R.C.A.F. as a radio technician in 1941 and obtained his commission as a radar officer in September of that year. He was attached to the R.A.F. for the remainder of the war and served with Coastal and Transport Commands in the U.K. He returned from overseas in November 1945 and since then he has been on the telecommunications staffs at 6 Repair Depot, Clinton, Air Defence Command Headquarters, and Air Force Headquarters. Johnny, his wife Rita, and their two daughters have returned to Ottawa where he is again employed at Air Force Headquarters.



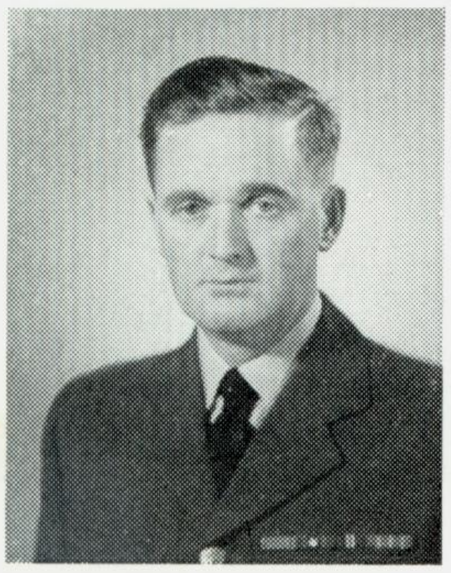
Squadron Leader N. A. Keene, D.F.C., C.D.

Norm Keene was born in Macleod, Alberta, in 1920, and received his schooling in White Rock, B.C., and Blaine, Washington, U.S.A. He joined the R.C.A.F. in September, 1940, and completed two tours of fighter operations in the European Theatre. His post-war appointments have included duties at Churchill and with 408 Photo Squadron and the Auxiliary Support Wing at Montreal. Before coming to the Staff College he worked in the Directorate of Airmen's Postings and Careers at Air Force Headquarters. Norm and his wife, Gloria, and their four daughters have now moved to Quebec, where Norm has taken up his new appointment with Central Experimental Proving Establishment, Canadian Armament Research and Development Establishment, Val Cartier.



Squadron Leader J. R. Low, C.D.

Reed Low was born in Ottawa where he graduated from Glebe Collegiate Institute in 1935. He joined the R.C.A.F. the same year and was commissioned as a supply officer early in the war. During the war he served at Air Force Headquarters and spent a year as liaison officer at the Aviation Supply Office, United States Navy, Philadelphia. After several years in Montreal, Toronto, and Edmonton he completed a second assignment in the U.S.A., this time on exchange with the U.S.A.F. at Dayton, Ohio. He arrived at Staff College from Air Materiel Command Headquarters in Rockcliffe. Reed and his wife, the former Ethel Flinn, of Ottawa, have a son and daughter. Reed is on the staff at Air Defence Command Headquarters.



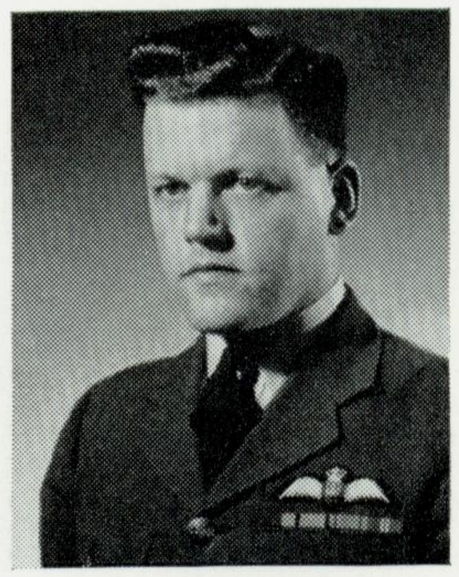
Wing Commander W. C. Maclean, C.D.

Bill Maclean, 42, was born in Truro, and educated in Halifax and Dartmouth, N.S. He enlisted in the R.C.A.F. in 1936 as a Wireless Operator Mechanic. During the war he served as a technical (communications) N.C.O. and officer — he was commissioned in 1941 — in coastal and fighter squadrons. Later, following a period on the staffs of wireless schools in Canada, he held posts in 6 (R.C.A.F.) Bomber Group and in Germany. After the war he held a number of positions in R.C.A.F. communications in Canada and U.K. He and his wife, the former Kathleen Wilcox, of Dartmouth, have two children, a son and a daughter. Bill is now head of one of the branches in the Directorate of Communications at Air Force Headquarters.



Squadron Leader H. M. MacLeod, C.D.

Hal MacLeod was born in Sydney, N.S. in 1922. During most of his wartime service he was with 38 Group of the R.A.F. and flew Stirlings on clandestine and airborne operations. Following the war he served with 435 and 405 Squadrons and was Resident Staff Officer at Queen's University. Hal came to Staff College from Maritime Air Command Headquarters and is now in the Directorate of Postings and Careers at Air Force Headquarters. He and his wife Doris, also of Sydney, have three daughters.



Squadron Leader G. J. Macrae, R.A.F.

Graham Macrae was born in Wandsworth, England, in 1924 and attended Willesden Junior Technical College. In 1939 he became an R.A.F. apprentice and served for a short time as an airframe fitter before becoming a flight engineer in Bomber Command. Shot down in August 1943, he was a prisoner until the end of the war. After the war he held several flying appointments in Transport Command and completed pilot training in 1950-51. Prior to joining Course 22 he was Officer Commanding the R.A.F. Detachment in Maralinga, South Australia. Graham, with his wife Helen and their three children, has returned to England to take over command of Bomber Command Communication Squadron.



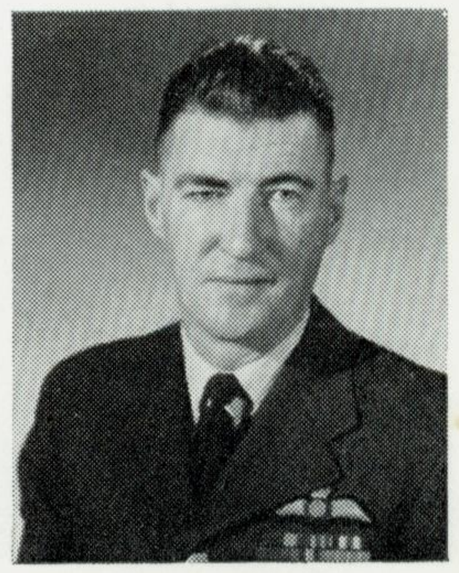
Wing Commander J. E. McClure, D.F.C., C.D.

John McClure, 37, and a native of London, Ontario, joined the R.C.A.F. in 1940 and went overseas in 1941. He completed an operational tour with the Westland "Whirli-bombers" of 137 and 263 Fighter Squadrons. Shortly after returning to Canada, in 1944, he was appointed aid-de-camp to the Governor-General, the Earl of Athlone. The next assignment was to A.F.H.Q. and this was followed by a two-year stint at 1 I.F.S., Centralia. Before coming to the Staff College John was in the organization branches at AMC HQ and 1 Air Division HQ. He and his wife, the former Lucille Baker of Detroit, have a son and a daughter. John has been transferred to Air Defence Command to join an all-weather fighter squadron.



Wing Commander H. M. Miller, C.D.

Hugh Miller, 38, comes from Champion, Alberta, where he was raised and educated. He enlisted in the R.C.A.F. in January, 1941 as a Wireless Operator Air Gunner. During the Second World War he served with a bomber reconnaissance squadron on the west coast of Canada and with a transport squadron on the east coast. Before coming to the Staff College, Hugh was Radio Leader of 407 Maritime Patrol Squadron at Comox, British Columbia. He married Mildred Patterson, of Vancouver, in 1943. Hugh and his family are now in Goose Bay where he is Chief Administrative Officer.



Wing Commander R. J. Mitchell, C.D.

Bob Mitchell was born in 1918 in Calgary and was raised and received most of his education in Prince Albert, Saskatchewan. He joined the R.C.A.F. as an observer in 1940. He served with Coastal Reconnaissance squadrons on the west coast of Canada until 1944, at which time he was posted to R.A.F. Transport Command. He returned to Canada in 1946 and has held a variety of appointments in Training Command. Before coming to the Staff College he was with the U.S.A.F. at Mather Air Force Base, California, as Chief Navigation Instructor of the Senior Navigator Technical Specialists Course. Bob and his wife, the former Catherine Gray, and their two children, are now in Ottawa, where Bob is with the Directorate of Air Defence Operations at Air Force Headquarters.



Squadron Leader E. F. Monkman, C.D.

Born in Toronto in 1918, Fred Monkman completed his formal education in that city before joining the R.C.A.F. in 1940. During the war, he served as an accountant in Training Command and Eastern Air Command. Since 1946, Fred has held staff appointments at Air Force Headquarters and at Allied Forces Central European Headquarters, and before coming to the Staff College was Senior Accountant Officer at R.C.A.F. Station Gimli. Fred and his wife, Isabel, and their two children have moved to Ottawa where he is filling an appointment in the Comptroller Division at Air Force Headquarters.



Major B. N. Mullen, U.S.A.F.

"Moon" Mullen was born in Illinois, raised in Pennsylvania, and educated at the University of Oklahoma. He entered the U.S.A.F. in 1942 and served in India and China with the 1st Tactical Communications Group supporting the B-29s of the 20th Bomber Command. Later, he was a unit commander and staff officer with the Airways and Air Communications Service in Germany, Italy, Korea and Japan. His last assignment before coming to the Staff College was as a Communications and Electronics Staff Officer with Headquarters, 9th Air Force of the Tactical Air Command. Married since 1946, Moon and his wife Vivian have two boys. Moon is now filling an exchange position in Telecommunications at Air Defence Command Headquarters, St. Hubert, Quebec.



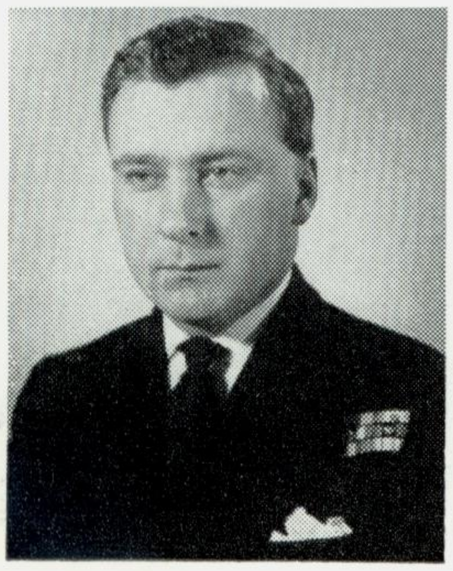
Squadron Leader O. G. Nelson, A.F.C., C.D.

Grant Nelson was educated in St. Thomas, Ontario, and at the University of Michigan. He joined the R.C.A.F. in 1941, and after a tour of operations with 413 Coastal Squadron in Ceylon, he returned to the United Kingdom for employment on the staff of Overseas Headquarters, London. After the war he spent six years with rescue and maritime squadrons at Greenwood, N.S., as Operations Officer and Pilot Leader. Grant has also been Resident Staff Officer at the University of Western Ontario, and was with the International Truce Commission in Indo-China. He is married to the former Esther Martin, of London, England, and they have one son. Grant is now at Air Force Headquarters.



Major W. M. Oxley, C.D.

Bill Oxley was born in Toronto in 1915, and received his early education there before going on to the Royal Military College at Kingston. He graduated from R.M.C. in 1936, and returned to civilian life and militia service until the outbreak of the Second World War. During the war he served with the Royal Canadian Corps of Signals, and since then has held various appointments, which included duty in Ottawa, Saskatoon, and Kingston, and a year with the International Truce Commission in Indo-China. Just before going to the Canadian Army Staff College in 1949, Bill married Phyllis Bates, of Ottawa and Grand'-Mère, P.Q., and they have one son. They are now in Ottawa, where Bill will be serving with the Canadian Army Operational Research Establishment at Army Headquarters.



Lieutenant Commander J. L. Panabaker, C.D. — R.C.N.

Jack Panabaker was born in Detroit, Michigan, in 1924, and while attending school in Windsor, Ontario, he joined the R.C.N.V.R. in 1942. He has served in destroyers and frigates and his career has included duty with Atlantic and Russian convoys. After the war he transferred to the R.C.N. and was on loan to the Royal Navy on the Mediterranean Station. Before joining Course 22 he was Commanding Officer of the Minesweeper *H.M.C.S. Resolute,* and afterwards Staff Officer Mine Warfare at Naval Headquarters. Jack is married to the former Mary Ellen Brick, of Windsor, Ontario. They have five children — all girls. Jack is now at Naval Headquarters, Ottawa, in the Directorate of Personnel (Officers).

Squadron Leader D. R. Pearce, D.F.M., C.D.



Born in Edmonton in 1920, Doug Pearce completed his formal education in that city before joining the R.C.A.F. in 1941. Transferred overseas during that year, he completed two operational tours as a radio officer with Bomber Command; the second tour was with 617 Squadron, R.A.F., of dam busting fame. After the war Doug served with R.C.A.F. Air Transport Command, and on exchange with R.A.F. Transport Command. During this time he was awarded the Queen's Commendation. Doug's last appointment before coming to the Staff College was Chief Instructor at the Air Observer School at Winnipeg. He is now the Executive Assistant to the A.O.C., Training Command. Doug married Frances McNeill, of Edmonton, in 1947 and they have three children.

Wing Commander W. S. Pearce, C.D.



Wayne Pearce was born in 1915 in Sandford Dene, Saskatchewan. He joined 111 Squadron, R.C.A.F. (Auxiliary) in 1935 as a photographer and went on active duty with the squadron at the outbreak of war. He was commissioned in 1942 and in 1944 he was posted overseas where he commanded 6 Mobile Field Photo Section. After the war he returned to Canada as Officer Commanding the School of Photography, R.C.A.F. Station, Rockcliffe. Later he served at Air Force Headquarters and Central Experimental and Proving Establishment. He married Marguerite Ironside, of Vancouver, in 1939, and they have two daughters. Wayne is now serving in the Directorate of Instrument Equipment Engineering at Air Force Headquarters.

Wing Commander C. F. Phripp, D.F.C.



Frank was born in Toronto in 1917, graduated from the University of Toronto in 1941 with a Bachelor of Applied Science degree, and joined the R.C.A.F. in 1942. After training as a pilot in Canada Frank joined 576 Squadron (R.A.F.) and completed a tour of operations on Lancaster bombers. After the war he obtained masters degrees in Aeronautical Engineering and in Mathematics at the University of Michigan. He married Ruth Reynolds in 1942 and they have three children. Before coming to the Staff College Frank served in AFHQ in the Directorate of Armament Engineering; he is now in California at work on guided missiles.

Squadron Leader R. E. Ratcliffe, D.F.C., C.D.



Ted Ratcliffe was born in Kingston, Ontario, where he attended Queen's University before joining the R.C.A.F. in 1941. After being trained as an observer he served throughout the war with Bomber Command. Afterwards he flew with T.C.A. as a navigator on the newly-formed Trans-Atlantic Service, but rejoined the Air Force in 1948 and continued transport flying with 426 Squadron. A graduate of the Specialist Navigation Course, Ted served at 2 Air Navigation School, Winnipeg, and in the Plans Branch at 1 Air Division H.Q. before coming to the College. He is now in the Operational Requirements Branch at Air Force Headquarters. Ted and his wife Kay have two boys.

Squadron Leader R. S. Reid, C.D.



Bob Reid, 38, was born and educated in Toronto and was with the Canadian Bank of Commerce before he joined the R.C.A.F. in 1940. He trained as a navigator and completed a tour of operations with R.A.F. Bomber Command. After the war he returned to the bank but joined the R.C.A.F. again in 1946. His last three appointments prior to attending Staff College were at 1 Air Division H.Q., Recruiting Unit Ottawa, and 426 Transport Squadron Lachine. He is married to the former Letitia Nisbet, of Glasgow, Scotland, and has two daughters. Bob is now Chief Operations Officer at R.C.A.F. Station Beaver Bank, N.S.



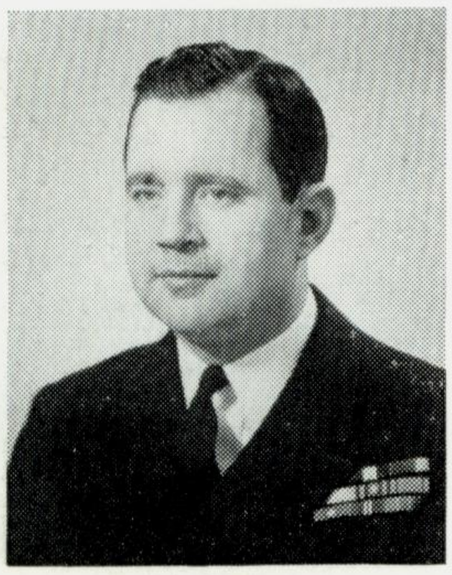
Major W. H. Scott, C.D.

Bill was born in Toronto in 1916 and educated at Assumption College and the University of Western Ontario. Before the war he was employed by the Chrysler Corporation, but in 1939 he joined the Essex Scottish and went to England in August 1940. Two years later Bill was taken prisoner at Dieppe and in 1945 was released from Colditz Castle. After a year with his old firm, he returned to the Army and has served with the North Nova Scotia Highlanders in Germany and the Black Watch in Canada. In October 1945 he married Charmian Sansom in Kingston, Ontario. Bill, Char and their two children have returned to Kingston where Bill is G.S.O. 2 at the Canadian Army Staff College.



Lieutenant-Colonel W. P. Segura — U.S.A.F.

Wiltz Segura was born in New Iberia, La., and attended Louisiana State University. During the war he flew fighters in China with General Chennault's forces. (He was credited with four confirmed kills and two probables). He was shot down twice by ground fire but escaped to complete his tour. After the Second World War he was assigned to Air Materiel Command. In 1952, after a Spanish language course, he became a technical advisor to the Venezuelan Air Force. Before coming to the Staff College he, his wife Joy and their three children were stationed at Bunker Hill Air Force Base, Indiana, where Wiltz was a Group Commander in a Fighter Bomber Wing. He is now in the 834 Air Division at England Air Force Base, Louisiana.



Commander D. J. Sheppard, D.S.C., C.D., R.C.N.

Don Sheppard, 34, was born and educated in Toronto and joined the Royal Navy from high school in December, 1941. After basic naval training in England he was qualified as a fighter pilot by the United States Navy. On the completion of his flying training he served in the aircraft carrier *H.M.S. "Victorious"* in the Home Fleet, Eastern Fleet, and Pacific Fleet. Since the war he has served in a number of air, sea and administrative appointments, the last of which was executive officer of *H.M.C.S. "Iroquois"*. He is married to the former Gwen Falls, of St. Thomas, and they have three daughters. Don is now stationed at Naval Headquarters, Ottawa.



Commander C. G. Smith, R.C.N.

Chris Smith was born in 1920 at Victoria, B.C. He was educated in that city and entered the R.C.N. in 1939. During the Second World War he saw service in the Norwegian campaign, Mediterranean and Indian Ocean convoys, North Atlantic convoy escort, and Channel operations during the Normandy invasion. Post war duties have included flying with the Fleet Air Arm of the Royal Navy, sea service in Korea, and Commanding Officer of *H.M.C.S. "Fortune"* and Senior Officer of 2nd Canadian Minesweeping Squadron on the West Coast. Chris and his wife, Margaret, with their two children, have moved to Halifax where he has been appointed to the staff of the Flag Officer Atlantic Coast.



Wing Commander M. C. Smith, D.F.C., C.D.

Maurice Smith was born at Wiarton, Ontario, in 1921, and educated in Toronto. He enrolled in the R.C.A.F. during November, 1940, trained as an Observer, and flew on operations with Bomber Command in the United Kingdom. The majority of Smitty's post-war experience has been in personnel work; before attending Staff College he was in the Officers' Careers Branch of the Directorate of Postings and Careers at Air Force Headquarters. He is married to the former Iris Beauchamp, of Toronto, and they have two sons. Smitty is now at 1 Air Division Headquarters, Metz, where he holds the position of Staff Officer Plans and Organization.

Squadron Leader H. J. Tennant, C.D.



Jim Tennant, 36, a native of Brandon, Manitoba, joined the R.C.A.F. in 1940 and departed for England a year later. He spent four and a half years overseas, and completed an operational tour on all-weather fighters. After the war Jim studied at the University of Manitoba and obtained a B.A. He rejoined the R.C.A.F. in 1946 and since that time has been active in the manning field, having spent three years as Commanding Officer of the Recruiting Unit at Regina and four years as a Branch Head in the Directorate of Personnel Manning at Air Force Headquarters. Jim married Mary Robertson, of Brandon, in 1947; they have three daughters. Jim will be spending the next few years as Chief Operations Officer at Senneterre.

Wing Commander C. E. F. Underwood



Clyde Underwood, 38, was born and educated in Winnipeg, Manitoba. He joined the R.C.A.F. in 1941, and served as a pilot in the R.A.F. Coastal Command. Released in 1945, he was accepted in the interim force a year later. While on leave without pay, Clyde earned a civil engineering degree from the University of British Columbia. Since the Second World War he has been engaged in construction engineering duties which included a two-year tour as Associate Professor of Civil Engineering at the Royal Military College of Canada. Clyde, his wife Mary, and two children are at present in Ottawa where he is in the Construction Engineering sub-division of Air Force Headquarters.

Wing Commander M. G. Utas, D.F.C., C.D.



Gus Utas was born in Chipman, Alberta, in 1923 and educated in Lacombe, Alberta. He joined the R.C.A.F. in 1941 and served overseas with Bomber Command and Training Command. His immediate post-war years were spent in various appointments in Northwest Air Command, and there followed tours of duty in the Personnel Branch at Air Defence Command Headquarters and 1 Air Division. His job before joining Course 22 was with 404 (Maritime Patrol) Squadron, Greenwood. Gus was married in 1948 to Shirley MacKintosh, of Edmonton, and they have one son. Gus is now attending a course at the University of Western Ontario.

Squadron Leader G. W. Webb, D.F.C., C.D.



Gordon Webb was born in Hamilton, Ontario, in 1923 and joined the R.C.A.F. in March 1942. His wartime experience included two tours of operations with the Pathfinder Force of Bomber Command. After the war he spent a year at McMaster University in Hamilton before rejoining the R.C.A.F. in 1946. Since the war his career has included a spell in Alaska with a U.S.A.F. B-29 Polar Reconnaissance Squadron, duties with 426 and 412 Squadrons, and an exchange transfer with the U.S.A.F. Military Air Transport Service. Gord is married to the former Audrey Bassett, of Montreal and Ottawa, and they have one son. The Webbs are now in Ottawa and Gordon is with the Directorate of Transport Operations at Air Force Headquarters.

Squadron Leader J. A. White, D.F.C., C.D.



Tony White was born in Vancouver in 1925. After receiving part of his early schooling in the United Kingdom, he returned to British Columbia to complete his senior matriculation. Tony joined the R.C.A.F. in 1942, and after a tour of operations with Bomber Command returned to Canada and became a specialist in navigation. Before becoming a member of Course 22, Tony was Officer Commanding the Observer's Standards Flight at Central Flying School. With his wife, Ellenor, and two sons, Tony is now at Thorney Island on the south coast of England on an exchange transfer with the R.A.F.



Squadron Leader G. C. Whittington, C.D.

Cam Whittington was born at South River, Ontario, in 1921, and was educated at Eagle Lake Public School and South River High School. He joined the R.C.A.F. in July, 1941, and was trained as a wireless air gunner. During the war he flew with R.A.F. Ferry Command at Montreal and Nassau, Bahamas, then with the R.A.F. Transport Command in the United Kingdom. Since the war, Cam has served in 426 Transport Squadron and in Training Command. His job before coming to the Staff College was Staff Officer Training at Air Transport Command Headquarters. Cam is now Military Secretary in the Cabinet Secretariat, Ottawa. He is married to the former Martha Egry, of Montreal, and they have three daughters.



Wing Commander R. C. Wilson, C.D.

Roger was born in Toronto in 1915, attended North Toronto Collegiate, and worked as a civilian pilot before joining the R.C.A.F. in 1940. After a period of instructing he became a fighter pilot with 421 Squadron. He married Angela Marsden in Edinburgh in 1944 and they have two sons. Since the war Roger has served on exchange duties in England, as Officer Commanding 1 Fighter Operational Training Unit and as a staff officer with Air Materiel Command. He is now Commanding Officer at R.C.A.F. Station Beaver Bank, Nova Scotia.



Wing Commander Jerauld G. Wright, D.F.C., C.D.

Jerry Wright was born in Liverpool, Nova Scotia, in 1917 and was educated at the local Academy. His two operational tours were spent on flying boats, and after this he went to the Test and Development Wing of the Empire Air Navigation School. Returning to Canada in 1946 he spent a few months at the Test and Development Establishment at Rockcliffe and was then transferred to the Air Navigation School at Summerside. In 1949 he was transferred to A.F.H.Q., where he was responsible for the development of several well-known systems, including the R Theta Computer and the Air Navigation and Tactical Control (ANTAC) System for the Argus. Jerry, his wife Elma and their two boys and two girls now live on the east coast where Jerry is at the Naval Research Establishment.



Wing Commander D. B. Wurtele, C.D.

Douglas Wurtele was born in Croydon, England in 1919. He joined the R.C.A.F. in 1939 on graduation from the Royal Military College at Kingston. He was a flying instructor from 1940 until 1942, then was posted overseas to fighter operations with 412 Squadron. Since the war Doug has attended the University of Toronto where he obtained his B.A.Sc., and London University where he received his masters degree. Just before coming to the Staff College he was at the Central Experimental and Proving Establishment in Ottawa. Doug, his wife Julie and their daughter are now at Metz, where Doug is at 1 Air Division Headquarters.



Squadron Leader J. K. Young, C.D.

Jake Young was born at Winnipeg in 1916. He left the University of Manitoba after three years and joined the R.C.A.F. as an airman in 1937. He was commissioned as an armament officer in 1941 and served until 1943 at training schools in Canada and at Overseas Headquarters in London, England. Toward the end of the Second World War he remustered to aircrew and was in one of the last pilot courses. In 1952, Jake went to the U.S.A.F. Institute of Technology at Dayton, Ohio, and returned to A.F.H.Q. in 1955 with a B.Sc. in Electrical Engineering and a M.Sc. in Aeronautical Engineering. In 1940, in Regina, he married Winnifred Hunter, of Vancouver. They have three children. Jake is stationed at Air Force Headquarters.

Reminiscing



THIRD WAR COURSE — 27 Mar. 44 - 2 June 44

Visit of H.E. The Earl of Athlone, Governor General of Canada and the A.O.C. No. 1 T.C. 29 Mar. 44 with the Commandant, Directing Staff and Third War Course of the Royal Canadian Air Force Staff College.

Front Row — S/L W. B. Woods, DFC, W/C R. K. Fraser, G/C S. N. F. Chant, G/C E. W. Kenrick, Colonel Willus O'Connor, G/C R. M. McKay, His Excellency, A/C G. E. Wait, A. V. M. A. T. M. Cowley, G/C R. F. Davenport, Lt. Col. J. G. Stewart, G/C G. H. Sellers, AFC, S/L A. A. Harcourt-Vernon, S/L H. A. S. Molyneux, DFC, S/L P. Leith, DFC. **Middle Row** — W/C R. F. Gross, S/L A. W. Gilmour, W/C D. E. Galloway, W/C G. A. Folkins, AFC, S/L J. R. Farquharson, W/C G. Dever, W/C L. O. Cooper, W/C H. G. M. Colpitts, A/Maj. R. J. P. Keswick, W/C A. M. Cameron, AFC, S/L R. H. Burroughs, W/C S. R. Burbank, S/L E. C. Briese, W/C S. E. Bourne, W/C R. D. P. Blagrave, W/C B. C. Andrew. **Back Row** — W/C E. M. Williams, AFC, W/C S. Volk, W/C R. D. Turner, W/C S. A. Sprange, A/Maj. R. F. Sails, S/L L. A. Porteous, S/L G. B. Mulligan, S/L W. B. Millar, S/L G. E. McMurtrie, W/C D. R. McCallum, S/L J. B. F. McAra, W/C H. H. Langford, S/L A. G. Hobbs, S/L J. F. Heard.



FOURTH WAR COURSE — 19 June - 26 August 1944

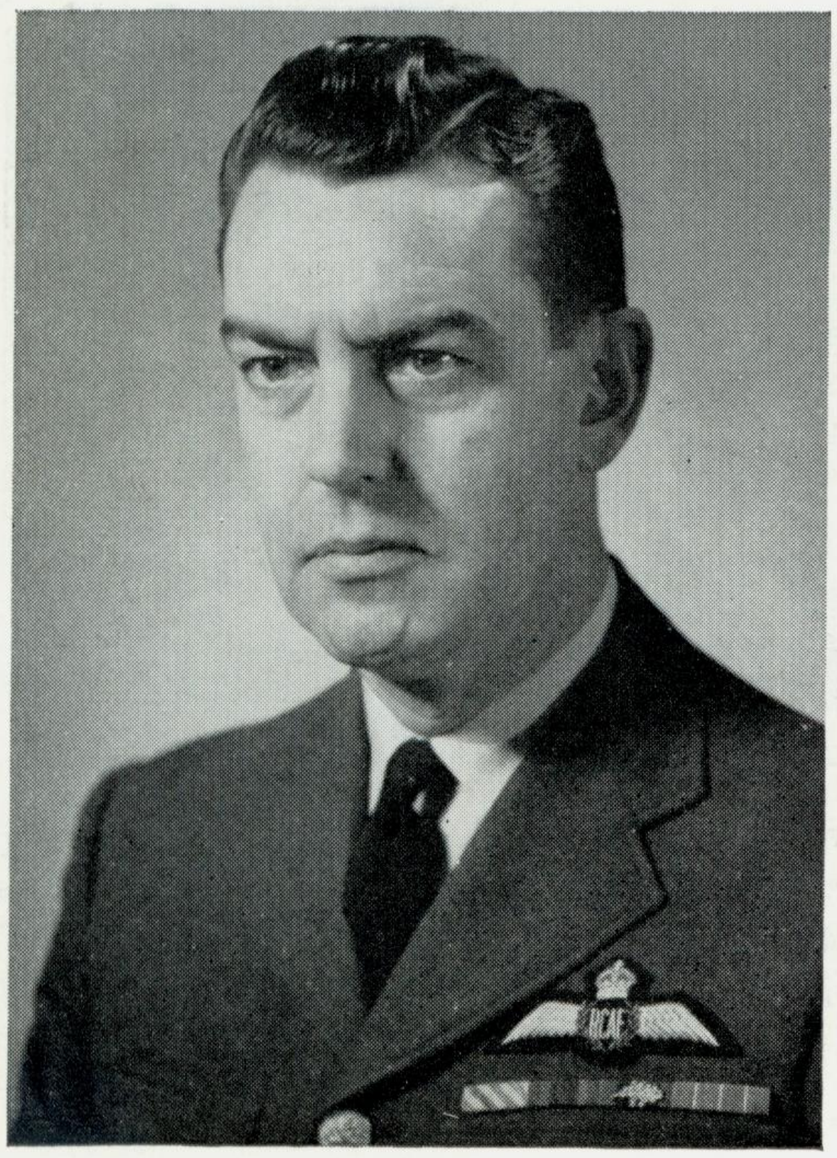
Front Row — Maj. A. A. Corey, S/L J. R. Welsh, Capt. W. A. Mullock, W/C L. O. Cooper, W/C R. E. Morrow, W/C R. K. Fraser, G/C R. M. McKay, A/C G. E. Wait, G/C E. W. Kenrick, Lt-Col. J. G. Stewart, W/C G. H. Elms, S/L W. B. Millar, S/L T. Harcourt-Vernon, Lt-Col. W. R. Fysh, Lt-Col. W. S. Calverley. **Middle Row** — S/L E. A. Alexander, S/L W. F. Duthie, S/L C. J. W. Taylor, W/C A. Walmesley, S/L T. H. Christie, S/L T. M. Scarffe, S/L J. S. Howden, S/L J. B. Sparling, S/L D. J. Brooker, S/L E. L. Neal, S/L J. H. Ross, S/L A. L. Delahaye, W/C B. E. Christmas, W/C H. Bryant. **Back Row** — W/C H. M. Kennedy, S/L R. Milne, W/C J. L. Berven, S/L E. D. Wilson, S/L J. H. Hollies, S/L L. H. Pilling, W/C C. L. Ingles, S/L W. M. Doherty, S/L R. R. Livermore, S/L A. M. Kennedy, S/L J. E. Elwin, S/L S. R. Miller.

Biographies – Departing Staff



Air Commodore F. W. Ball, D.F.C., C.D.

Frank Ball, 42, was born in Brandon, Manitoba. After graduation from McMaster University, Hamilton, Ontario, he joined the R.C.A.F. in July 1938. During the Second World War he served at various flying schools across Canada and was Deputy Director of Air Training at Air Force Headquarters prior to going overseas in March 1944. While overseas, Air Commodore Ball flew on operations with 427 Bomber Squadron in the R.C.A.F.'s No. 6 Group, and was later appointed Commanding Officer of 415 Squadron, with which unit he completed his tour of operations. Since the war he has held many senior appointments being Director of Air Operations at Air Force Headquarters, and Commanding Officer of R.C.A.F. Stations Aylmer, Ontario, and Goose Bay, Labrador. He has attended the U.S.A.F. Air War College and the National Defence College at Kingston, Ontario. He came to the Staff College in July 1955, and has been Director of Studies until his present assignment in Allied Air Forces Central Europe Headquarters at Fontainebleau, France. Married to the former Athol Crozier, of Belleville, Air Commodore Ball has three children.



Group Captain H. R. Studer, A.F.C., C.D.

Bert Studer was born in Callander, Ontario, in September 1915 and completed his early education at Capreol, Ontario. He joined the R.C.A.F. in 1940 and received his pilot's wings in March the following year. During the Second World War he served mainly in the field of flying instruction and filled such posts as Staff Officer (Flying) at Central Flying School, Trenton, and Chief Flying Instructor at Uplands, Centralia and Deseronto. After the war G/C Studer commanded the Communications Flight at Trenton and later became Officer Commanding Central Flying School. In October 1947 he attended the R.C.A.F. Staff College, and on completion of the course was transferred to the staff of the Directorate of Postings and Careers at Air Force Headquarters. Following a four-year period of service at Air Force Headquarters, he moved to the Pentagon in Washington, U.S.A., as a member of the Tri-Nation Air Standardization Committee. In 1955 he returned to the R.C.A.F. Staff College as a member of the Directing Staff. He leaves the College to take up his new appointment as Commanding Officer, R.C.A.F. Station Gimli. Bert married the former Margaret Harte in 1945 and they have two children.

Wing Commander John Gellner, D.F.C., C.D.



John Gellner was born in 1907 in Trieste. In 1930 John graduated from Masaryk University of Brno, Czechoslovakia, with the degree of Doctor of Law. Following Hitler's seizure of Czechoslovakia John was imprisoned for a short time (he was a reserve infantry officer in the Czech Army) and he reacted by escaping from Czechoslovakia to the United States. Afterwards he came to Canada and, in April 1940, joined the R.C.A.F. During the war Wing Commander Gellner saw action with Bomber Command. When the war ended he decided to make Canada his home. Since then he has been Assistant Judge Advocate General, has served in the Intelligence Branch at Ottawa, and as Chief Administrative Officer at 3 Fighter Wing, Germany. He has established an international reputation as a writer and lecturer on military and political affairs; he has contributed articles and reviews to this and the two preceding issues of the Journal. Wing Commander Gellner graduated from the Staff College with Course 14, and for the last three years has been a member of the Directing Staff. Now, after more than eighteen years of service, he has retired from the R.C.A.F. The Gellners will live permanently in Toronto, where John will work as a free-lance writer and lecturer.

Squadron Leader D. G. Bell-Irving, C.D.



Gordon Bell-Irving was brought up in Vancouver and educated there and at Royal Military College, Kingston. After training as a pilot and serving as a flying instructor, he joined a night interdiction squadron early in 1944 and flew Mosquitoes from bases in the south of England. He was mentioned in dispatches in connection with this work. Following the war he served with the regular force support sections of 400 (Fighter) Squadron, Toronto, and 2442 Aircraft Control and Warning Unit, Vancouver. He was also on the staff at 12 Group Headquarters, Vancouver, and Air Defence Command Headquarters, St. Hubert. He became a student at the Staff College in 1954, and after completing the course, joined the Directing Staff. One of his duties at the College has been the editing of this Journal. Gordon is married to the former Mary McDonald, of Banff and Ottawa, and they have three children. The Bell-Irvings have moved to Ottawa where Gordon is with the Directorate of Joint and Combined Planning at Air Force Headquarters.

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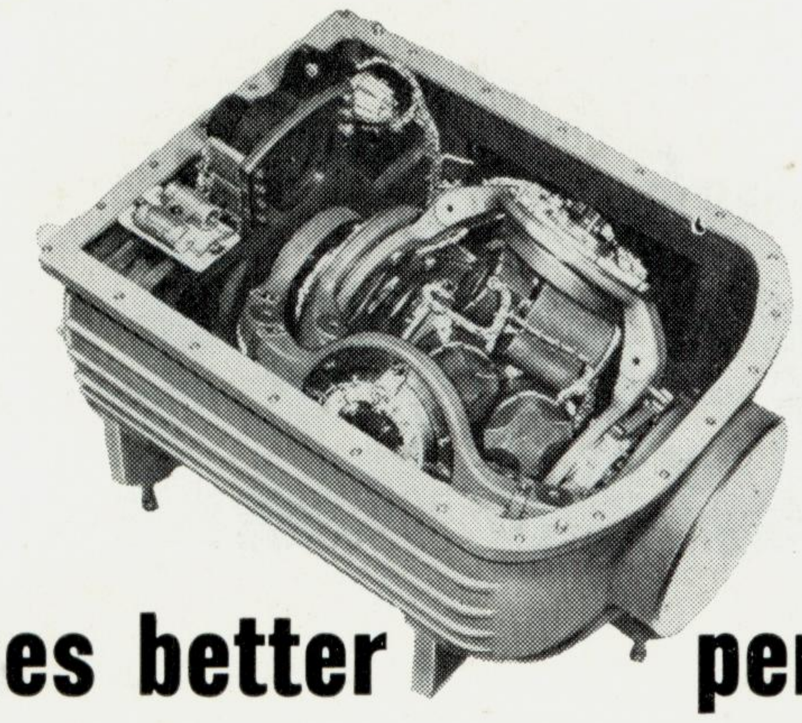
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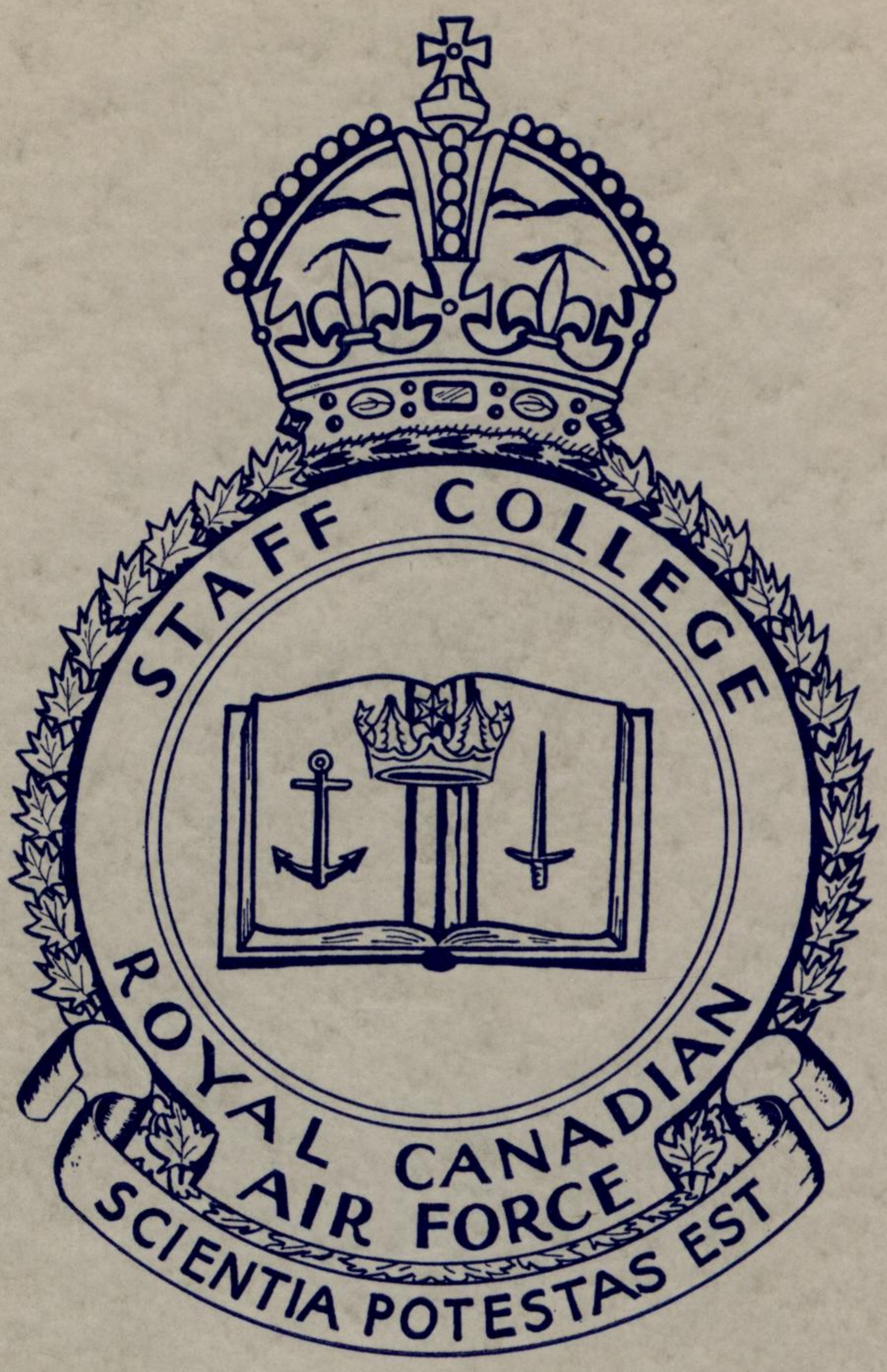
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