

RESTRICTED

COMMAND AND STAFF TRAINING INSTITUTE BANGLADESH AIR FORCE



Junior Command and Staff Course

AIR POWER MODULE

EMPLOYMENT OF AIR POWER

January - 2012

RESTRICTED

EMPLOYMENT OF AIR POWER**TABLE OF CONTENTS**

<u>Ser No</u>	<u>Topic</u>	<u>Page No</u>
1.	War and the Nation	1-3
2.	Principles of War	4-7
3.	Air Power and its Characteristics	8-17
4.	Air Power Operational Hierarchy	18-21
5.	Air Power Command and Control	22-28
6.	Counter Air Campaign	29-38
7.	Anti Surface Force Campaign	39-47
8.	The Strategic Air Offensive Campaign	48-52
9.	Combat Support Air Operations	53-64
10.	Ground Combat Support Activities	65-74
11.	Military Doctrine	75-82
12.	Applying the Doctrine	83-92
13.	Electronic Warfare	93-98
14.	Information Warfare	99-108
15.	Psychological Operations	109-114
16.	Nuclear Biological and Chemical Warfare	115-118
17.	Unconventional Warfare	119-122
18.	Aerial Munitions	123-135

Ref :

A. 00.03.2600.017.26.026.11.003/83A dt 24 Jan 12.

TOPIC-1

WAR AND THE NATION

1. **General.** War is the continuation of policy by other means; its sole purpose is to achieve political objectives. Bangladesh pursues purely defensive policies, which seek to preserve national and international security and stability. However, it cannot be assumed that all nations endorse similar principles or see military power as a purely defensive instrument. Even the most peace-loving nations need to understand war if they are to play their part in preserving international peace and stability.

2. **The Nature of War.** War has certain essential characteristics. The recognition and intelligent exploitation of these characteristics are fundamental to the successful use of armed force in support of political objectives. The characteristics are as follow:

a. **War is an Instrument of Policy.** Success in war is not measured by the number of casualties inflicted or the amount of territory occupied but by the achievement of political objectives. Therefore, the character of the political objectives shapes military goals, the scope and intensity of military operations.

b. **War is an Act of Violence.** War is distinguished from the other instruments of policy by its use of organized violence. The use of violence injects elements of emotion and improbability into war, and this can undermine reason on both sides and impede the pursuit of a purely rational course of action. Recognizing this is essential if the damaging effects of war are to be minimized.

c. **War is the Province of Uncertainty.** Man wages war, and human frailties and irrationality make the course and outcome of war uncertain and unpredictable. The fog of war - when combined with danger, friction and physical stress - can make apparently simple operations unexpectedly difficult. Fog and friction are always present in war, but their effects can be mitigated by sound doctrine, leadership and training.

d. **War is of the People.** Groups of people wage war is affected by group passions cohesion and war, and the conduct of determination. A significant war effort cannot be sustained by a democratic state in the face of public hostility or indifference.

e. **Leadership is Crucial in War.** Man is the central element in war, and leadership is the critical factor in shaping human effort. Leadership inspires and persuades men and women to help a commander achieve his objectives in spite of adversity and danger. Leadership is an exercise of character far more than it is an application of management skill.

3. **Spectrum of Conflict.** Within the spectrum of conflict, three distinct types of warfare can be defined e.g. nuclear, non-nuclear and insurgent:

a. **Nuclear Warfare.** Nuclear warfare is defined as any conflict which involves the employment of nuclear weapons. The enormous destructive capacity of nuclear weapons, the inherent danger of escalation, the very limited experience of nuclear warfare and the long-lasting effects of nuclear radiation all mean that nuclear warfare has a completely different character from warfare in which nuclear weapons are not used. Their use changes the nature of a conflict and can have far reaching implications for all parties.

b. **Non-nuclear Warfare.** Non-nuclear warfare is defined as any conflict between national states or multi-national groups of states which does not involve the use of nuclear weapons. Non-nuclear warfare can encompass the use of both conventional and bio-chemical weapons by the antagonist states. However, the use of bio-chemical weapons - now banned under international law - would inevitably mark a major escalation in the intensity of any conventional conflict.

c. **Insurgent Warfare.** Insurgent warfare embraces all forms of organized and politically-motivated armed violence within a state. It is often loosely controlled, and it can have factional or international political aims. Each situation is unique but the range of conflict can include the following:

(1) **Civil Disturbance.** Civil disturbance encompasses group acts of violence and disorder which are prejudicial to public law and order.

(2) **Revolutionary War.** Revolutionary war generally aims to overthrow the state and its social system through a series of phases: preparatory moves, guerilla activity and near-conventional military operations.

4. **Defence Policy.** The purpose of military action is to prosecute national defence policy. Defence policy defines the aims selected by a government to deter, contain or defeat threats to its interests or security, or to the interests or security of its allies.

5. **The Levels of War.** Planning for armed conflict takes place at a range of levels. Modern military theory identifies four such levels of war: grand-strategic, military-strategic, operational and tactical.

a. **The Grand Strategic Level of War.** Grand strategy is the application of national resources to achieve defence policy objectives. Grand strategy is concerned with the overall conduct of the war, and it involves economic, industrial, political and military components.

b. **The Military-strategic Level of War.** The military component of grand strategy is termed military strategy. Military strategy is the art and science of developing and employing military forces to achieve grand-strategic objectives. Military strategy is developed by the Chiefs of Staff (COS) under the direction of national political leaders.

c. **The Operational Level of War.** The operational level of war is concerned with the direction of military resources to achieve military strategic aims. It is the level of war at which major campaigns and operations are planned. Operational art – i.e. the control of military activities at the operational level of war - links military strategy to tactics. It does this by establishing operational objectives, initiating actions and applying resources within individual theatres of war.

d. **The Tactical Level of War.** The tactical level of war involves the direction of military resources to achieve operational objectives. Tactics is the art of deploying sea, land and air forces, when confronting the enemy. The tactical level of war is the level at which forces are deployed ready for battle, should this be required. However, it should be noted that battle - defined as the act of fighting - may not be needed to achieve a satisfactory tactical result, let alone in a satisfactory operational military strategic or grand strategic result.

TOPIC-2**PRINCIPLES OF WAR****Introduction**

1. The growing complexity of modern warfare has led some students to take a fresh look at the principles that have traditionally guided military strategists in war. It has long been a favourite occupation of military theorists to distil from the great mass of military experience a simple list of principles of war to guide commanders. Usually they have derived such principles from a study of campaigns of the great captains of history. As far back as 400 BC Sun-tzu, a Chinese general, set forth 13 principles. The stress varies from list to list. For example, the followers and interpreters of the 19th century theorist Carl von Clausewitz believed that the batter was all and that defeat of the enemy's armed forces was the correct objective and path to victory. Supporters of "the strategy of indirect approach," on the other hand, sought victory by indirect methods. Though there is no complete agreement on the number of principles, most lists include the following; the objective, the offensive (unity of command), mass (concentration), economy of force, manoeuvre, surprise, security, and simplicity. The British have added one called administration the Soviets, another, translated as annihilation Despite debate over their precise number and meaning, the principles of war are widely taught, and most military students accept them as basic concepts. A comparison of principles of war used by various nations is given in table 1.

United States	Great Britain and Australia	Soviet Union	France	People's Republic of China
				Political mobilization
Objective	Selection and Maintenance of the aim	Advance and concentration		Selection and Maintenance of the aim
Offensive	Offensive action	Offensive		Offensive action
Mass	Concentration of force	Concentration	Concentration of efforts	Concentration of force
Economy of force	Economy of force	Economy of force		
Manoeuvre	Flexibility	Manoeuvre and initiative		Initiative or flexibility
Unity of command	Cooperation	Combined arms		Coordination
Security	Security	Adequate reserves		Security
Surprise	Surprise	Surprise and deception	Surprise	Surprise
Simplicity				
	Maintenance of Morale	Morale		Morale
		Annihilation		
	Administration			
			Liberty of action	Freedom of action
				Mobility

Table 1 : Comparison of the Principle of War

2. The debate over principles was renewed with the arrival of the nuclear era. Some theorists argued that the new weapons had destroyed whatever value the principles once had; others contended that the principles were as valid as ever. Defenders pointed out that each age must make its own applications of the "fundamental truths" of strategy. Opponents argued that there can be no set rules for the art; the so-called principles must by no means be interpreted as pat formulas for victory to be followed blindly and rigidly; the only sound guide in war and strategy is flexibility.

The Principles

3. Whatsoever, the principles of war are the most fundamental form of doctrine, and they represent the basic guiding elements of warfare. They are not separate and distinctive items from which a commander selects when employing his forces, nor are they a checklist. They are inter-related and interacting elements designed to provide a better understanding of warfare. The principles of war recognised by the United Kingdom (and are accepted in BAF) are set out in the following paragraphs:

a. **Selection and Maintenance of the Aim.** In the conduct of war, and therefore in all military activities, it is essential to select and define the aims with absolute clarity before operations start. The ultimate aim may be, absolute (e.g. the overthrow of a hostile government), or more limited (e.g. the recovery of occupied territory). Once the aim is decided, all efforts must be bent on its attainment until a changed situation calls for a re-appreciation and consequently for a new aim. Every plan of action, on whatever level, must be tested by the extent to which it contributes to the attainment of the military aim at the next highest level of command and ultimately to the overall military and hence political aim. Thus governments must be quite clear about their military objectives and commanders at all levels must know exactly what they are required to achieve, must make that quite clear to their appropriate subordinates, and must not be led into expenditure of effort which does not contribute directly or indirectly to the attainment of their aim.

b. **Maintenance of Morale.** Success in all forms of war depends more on morale than on material qualities. Morale is a mental state, but it is very sensitive to material conditions. It is based on a clear understanding of the aim, on training and on discipline and is immediately responsive to good leadership. It is adversely affected by inferior or inefficient equipment. It also depends to a marked degree on sound administration and success in battle is the best stimulant of morale.

c. **Offensive Action.** Offensive action is the chief means open to a commander to influence the outcome of a campaign or operation, and almost no military operation can be brought to a successful conclusion without it. Many defensive actions may have to be fought, but ultimately success must depend on the offensive use of available forces. Offensive action embodies a state of mind which brings the determination to gain and hold the initiative: it helps to create confidence and to establish a moral ascendancy over the enemy. In warfare the aim must be to wrest the initiative from the enemy, and to take offensive action at the earliest possible moment. Offensive action is needed not only to achieve victory, but also to avert defeat. As Napoleon pointed out, "He who remains in his trenches will be beaten".

d. **Concentration of Force.** To achieve success in war it is essential to concentrate superior force against the enemy at the decisive time and place. Concentration does not necessarily imply massing forces in one place, but rather disposing them so as to be able to deliver the decisive blow, or to counter an enemy threat, whenever and wherever required.

Concentration of sufficient force to achieve what is the decisive or most important task at the time is perhaps the cardinal principle in the employment of armed forces in war. This may well entail the use of all force available. It may be said that the art of war is to decide the aim, and then decide the tasks needed to achieve that aim, and then to concentrate the required forces into those tasks until the aim is attained.

e. **Economy of Effort.** The corollary of concentration of force is economy of effort. It is, impossible to be strong everywhere, and if decisive strength is to be concentrated at the critical time and place there must be no wasteful expenditure of effort where it cannot significantly affect the issue. In the narrower sense economy of effort implies the correct use of weapon systems, a sound distribution of forces and a careful balance in the allocation of tasks with the object of achieving an effective concentration at the decisive time and place.

f. **Security.** A degree of security by physical protection and information denial is essential to all military operations. Security should enable friendly forces to achieve their objectives despite the enemy's interference. Active measures include the defence of bases and entry points. The principles of concentration of force, economy of effort and security are all closely inter-related.

g. **Surprise.** Surprise is the most powerful influence in war, and its morale effect is very great. Commanders at all levels must endeavour to surprise the enemy while safeguarding their own forces against surprise action. Surprise action can achieve results out of all proportion to the effort expended; indeed, in some operations, particularly when other factors are unfavourable, surprise may be essential to success. Surprise can be achieved strategically, operationally, tactically or by exploiting new technologies, material or techniques. Its elements are secrecy, concealment, deception, originality, audacity and speed.

h. **Flexibility.** Although the aim may not alter, a commander may be required to exercise judgement and flexibility and modify his plans to meet changing circumstances, take advantage of fleeting chances or shift a point of emphasis. Flexibility demands trust, good training, organisation, discipline, staff work and above all that flexibility of mind and rapidity of decision on the part of commanders and their subordinates which ensures that time is not wasted. It also calls for a degree of mobility which ensures that redeployments can be adopted rapidly and economically. This poses an inherent danger air power is a particularly flexible instrument of military force but care must be exercised in diverting it for tasks not directly linked to the main aim. Although diversions may be necessary in crisis, all demands should be critically examined in the light of the overall strategic situation before diversionary tasks are undertaken. Unless this examination is unbiased, air power may be frittered away in secondary tasks with consequent prejudice to the overall aim.

j. **Cooperation.** Cooperation is based on team spirit and entails co-ordination of all activities to achieve the maximum combined effort from the whole. It is a Means of attaining concentration of force with economy of effort in pursuance of the aim. Above all, goodwill and desire to co-operate are essential at all levels, not only within any one Service, but also between the separate national Services and between allies. Only by full cooperation between the Services can the right balance of forces be achieved and joint Service plans are made to provide effective defence.

k. **Administration.** Sound administration is the pre-requisite for success in any operation. Logistic considerations are often the deciding factor in assessing the feasibility and influencing the outcome of an operation. A clear appreciation of logistic constraints is as important to a commander as his ability to make a sound estimate of the operational situation. No tactical plan can succeed without administrative support commensurate with the aim of the operation it follows at a commander must have a degree of control over the administrative plan proportionate to the degree of his responsibility for the operation. Scarce resources must be controlled at a high level. Administrative arrangements must be designed to give the commander the maximum freedom of action in executing the plan. Every administrative organisation must be as simple as possible. The operational commander must have a clear understanding of the administrative factors which may affect his activities. He must control the administrative plan which supports his operational plan.

Reference:

1. AP 3000 (2nd Edition)
2. DSCSC Précis

TOPIC-3

AIR POWER AND ITS CHARACTERISTICS

Introduction

1. Anybody come across the word 'Air power' for the first time it gives a very basic and a common impression of a Fighter Aircraft flying at high speed and firing missiles on enemy targets. It probably was the first power projection of mankind since the beginning of the history of human being when they threw stones or spears for hunting animal either for the purpose of saving own selves from those vicious animals or for having them as food. It may be taken as the simplest example of 'Air Power'. But why should it be called 'Air Power'? It has always been difficult to define the concept of air power. From the birth of aviation to the development of independent air forces, many have seen air power as an all-embracing concept. For example, Marshal of the Royal Air Force Sir John Slessor argued that "air power is a compound of Air Forces and all those things on which Air Forces directly or indirectly depend, such as a flourishing aircraft industry and civilian aviation, a good meteorological service, secure fuel supplies and so on." Today, the British definition of air power is:

"The ability to project military force in air or space by or from a platform or missile operating above the surface of the earth. Air platforms are defined as any aircraft, helicopter or unmanned air vehicle."

2. The means of exercising air power are many and include any system which can be used to wage warfare in the air for example, manned and unmanned aircraft (fixed and rotary wing), guided missile, balloons and space vehicles. This definition does not exclude civilian elements such as contractor support, particularly to sustain air operations.

Air Power Defining Characteristics

3. Air is very different environments in which to fight and operate from either land or sea. Consequently, air forces have different characteristics from land and sea forces. The military advantages of elevation include enhanced observation and perspective of the battle space. In addition to joint utility, air power platforms, sensors and systems are capable of independent, distinct action to attack an opponent's defined centre of gravity with strategic effect. Historically, the characteristics of air power have been described as either strengths or limitations. Recent experience of conflict suggests that the relative importance of air power characteristics will vary depending on the circumstances. A range of factors which govern the effective employment of air power will apply to a greater or lesser extent, determined by the strategic context, operational campaign plan and tactical scenario.

The Strengths of Air Power

4. Air power has the unique ability to exploit the third dimension above the surface of the Earth. As a result air vehicles are faster and have greater reach than naval ships or land vehicles. Thus, height, speed and reach must be considered as the primary strengths of air power. However, height, speed and reach act together synergistically to produce additional strengths which are listed below and which merit examination.

a. **Height.** The ability of aircraft to operate over a spectrum of heights gives them the ability to observe and dominate activities on the surface and below the sea. It allows direct fire to be used against all of the enemy's forces, whether or not they are in the front line, and it permits manoeuvre in three -rather than just two- dimensions, an important factor in survivability.

b. **Speed.** The speed of aircraft allows rapid projection of military power; greater speed allows missions to be completed in shorter times and a larger number of tasks to be completed within a given period. At the tactical level, high speed reduces the time that aircraft are exposed to hostile fire and thus can increase their survivability in battle.

c. **Reach.** 70% of the world is covered by water, 30% by land and 100% by air; as a result air power possesses unrivalled reach. Aircraft can project military power over great distances in any direction unimpeded by surface features such as mountain barriers or water expanses. Air power reach has been greatly extended in recent years through the use of air-to-air refueling. Reach is important not only for striking at distant targets and reaching isolated locations, but also for circumventing potential restrictions (e.g. by routing flights around a country which has refused over flight clearance).

d. **Ubiquity.** Within a given level of resources, air power- thanks to its height, speed and reach- can counter or pose simultaneous threats across a far wider geographical area than is possible with surface systems.

e. **Flexibility.** Aircraft can perform a wide variety of actions, produce a wide range of effects and be adapted with comparative ease to meet changing circumstances and situations. For example, the Tornado GR1A can be used for reconnaissance, air-to-surface attack and air-to-air self-defence. It can therefore carry out more than one role during a single mission and be re tasked in the air if necessary. Similarly, larger aircraft such as the Hercules can be used for surveillance and air-to-air refueling as well as its primary role of air transport.

f. **Responsiveness.** Speed and reach make air power uniquely responsive. It can be used to counter or pose simultaneous threats across a far wider geographical area than is possible with surface systems. Air power can be deployed rapidly into distant theatres to provide visible and timely support for an ally or to act as a deterrent to aggression. For closer threats, it can be used to project military

power rapidly, direct from its peacetime bases. The responsiveness of Air power is as important in crisis management as it is in conflict.

g. **Concentration.** Speed, reach and flexibility allow air power to concentrate military force - in any of its many forms - in time and space, when and where required. The moral and physical effects of such a concentration capability are often crucial to achieving operational success.

Limitations

5. Air power has inherent limitations as well as strengths, namely impermanence, limited payloads and fragility. Like the strengths of air power these are relative rather than absolute and need to be understood in that context:

a. **Impermanence.** Aircraft cannot stay airborne indefinitely. Although air-to-air refueling plan greatly extend the range and endurance of aircraft, no means have yet been found to re-arm, re-crew or service an aircraft in flight. To that extent, air power is an impermanent form of military force; the effects it creates tend to be transient and to sustain those effects, operations have to be repeated. In certain circumstances, the impermanence of airpower can be an advantage. For example, it can help to avoid the potential military and political liabilities which can arise from an extended presence in a foreign country.

b. **Limited Payloads.** The payloads that can be carried by aircraft are far more limited than those that can be carried by ships or by land vehicles. Thus, aircraft are most cost effective when they are used for tasks which give high-value pay-offs. This applies equally to combat and combat support tasks, such as, for example, transportation. While relatively small payloads that can be carried are a disadvantage, they can in part be compensated for by the high sortie rate conferred by an aircraft's speed and by the lethality and precision of modern air-to-surface munitions. Moreover, a small payload deployed quickly may be of far more value in a critical situation than one many times its size which is deployed later. It is important to note that payload limitations are common to all systems which exploit the third dimension. They are particularly marked in all missiles with small aerofoil lifting sections.

c. **Fragility.** Because air vehicles are by their nature highly stressed and have to be as light as practicable, they carry little or no armour protection. Hence, relatively low levels of battle damage can have catastrophic effects, a fact which tends to limit the extent to which it is sensible to risk exposing aircraft to enemy fire. However, it is important to distinguish between fragility and vulnerability. While aircraft are less robust than land vehicles or ships, this is in large part offset by the ability of aircraft to exploit speed and height, which increases the enemy's targeting difficulties.

Other Considerations

6. In addition to the strengths and limitations discussed above, air power also possesses certain other important and well-known characteristics, which also affect the air power contribution to defence and security. Here are the examples as follows:

a. **Cost.** High-technology equipment inevitably costs more than simple equipment, and as military aircraft tend to be at the cutting edge of technology, they can be costly. Similarly, aircrew training can also be very expensive. But these costs are less related to air power per se as a form of military force, than to the level of air power capability desired and the increase in capability they provide over older/obsolete systems often permits a reduction in the numbers of platforms required. A modern highly-capable fighter-bomber aircraft will typically cost in the region of \$15m to \$20m. Less capable aircraft can be purchased for the same price as a main battle tank, while macro light aircraft cost about the same as a car. For certain tasks, a highly capable aircraft is essential, but for others a far less costly solution may suffice. Similarly, training costs are closely related to the complexity of the aircraft that the aircrew are required to fly.

b. **Dependency on Bases.** All forms of modern military power depend on base support. Armies in the field need depots to support them and navies need harbour facilities. However, air power is often seen to be more obviously dependent on its bases than are either land power or sea power. Helicopters and some fixed-wing aircraft can take-off and land vertically, but most aircraft need runways. And all aircraft need a high level of base support if they are to operate at their maximum sortie rate. If this base support is vulnerable to attack, then base-dependency can be a source of potential weakness. However, if the bases are difficult to find or difficult to close, then the converse applies. In these circumstances, the unique ability of air forces to fight directly from their peacetime bases enormously simplifies logistics and expedites the delivery of ordnance from the factory or depot onto the enemy.

c. **Sensitivity to Light and Weather.** Air power is sometimes perceived as being far more sensitive to weather and light conditions than are other forms of military force. Bad weather can certainly create difficulties with take-offs and landings, navigation and target acquisition. But the operations of all types of forces are affected by weather and light conditions. In very high sea states, ships cannot fight and sometimes cannot even leave harbour. Similarly, the mud caused by torrential rain can bog down armies, while intense heat can be a major handicap to carrying out large-scale land force operations. Moreover, in recent years the impact of weather and light on air power operations has changed markedly. Thanks to the rapid advance of technology, many combat aircraft are now able to operate in all light conditions, and many of these can also operate in all weather conditions. In the Gulf War, the weather (the worst in the region since records were kept) did indeed prove to be a limiting factor, but it merely slowed down certain types of operations. Overall, night was not a limiting factor for the attackers; indeed the converse was true and most sorties flown deep into Iraq were made under the cover of darkness.

Indeed, the concealment offered by darkness and bad weather is increasingly turning to the advantage of air power, as more advanced all-weather navigation and targeting aids are developed and deployed.

d. **Sensitivity to Technology.** Air power tends to be more sensitive to technological change than sea power or land power. Air power is a product of technology, and technological advances inevitably affect air power development. Experience has shown that even relatively small technological innovations can have major impact on air power effectiveness. The offensive capabilities of air power could be inhibited by, say, advances in surface to air defence technology. But equally, they could be enhanced enormously by developments in "low observables" technology (that is, "stealth"). The nature of the balance will always depend on the overall direction and rate of technological development.

The Applications of Air Power

7. The distinct and specific characteristics of air power lead in turn to distinct and specific applications. Growing effectiveness has tended progressively to widen air power applications, and air power today can offer decision makers an unprecedented wide range of options to prosecute defence and security policy. Such options begin long before the shooting starts and make air power as important an instrument for preserving peace and managing crises, as it is for waging war.

8. **Preserving Peace.** Air power can be used to help preserve and strengthen international security, both by promoting good international relations and by providing reassurance to nations that they are not under threat of attack.

a. **Promoting International Relations.** When disaster strikes in whatever form; floods, famines, typhoons, volcanoes, plagues or earthquakes; speed of response is vital, and the speed of air power helps it to play a key part in alleviating suffering. Military transport aircraft are uniquely capable of delivering rapid relief during the critical early stages of natural disasters. They have rugged construction, are designed to deliver loads into rough field strips, and can operate autonomously with the minimum of ground equipment. Their crews are trained and prepared to deal with the difficult conditions associated with natural disasters. For example, in the Ethiopian famine of 1984/5, the starving communities isolated in the Ethiopian high lands could only be supplied from the air. Similarly, during the Bangladesh cyclone disaster of 1991, the broad extent but relatively shallow depth of the flooding meant that aircraft were by far the best means of bringing relief to the survivors. The potential security benefits of such high-visibility operations are obvious: they generate a spirit of goodwill, help to remove suspicion, alleviate grievances and thus promote stability and security.

b. **Providing Reassurance.** Air power can also be used to help avert threats to peace, both real and imagined. By exploiting the third dimension for surveillance purposes, it can provide assurance that a potential antagonist is not about to attack. It can, in addition, be used to verify arms control agreements and

play an important part in furthering confidence and security building measures. While satellite surveillance systems offer expanding contributions, the capabilities, flexibility and unpredictability of airborne systems continue to make a unique contribution in this field. Aerial inspection provisions form a key part of the verification regimes of the Conventional Armed Forces in Europe Treaty of 1990 and the Vienna Document 92 on Confidence and Security Building Measures. The Open Skies agreement which allows surveillance aircraft to roam freely over the territories of signatory states and the information thereby gathered to be shared - will play an important role in fostering security and stability in Europe.

9. **Managing International Crises.** While air power can make a useful contribution to preserving peace, it can play a major part in managing crises too. In times of increasing international tension, the unique ability to generate and project military power rapidly, over long distances unimpeded by surface features makes airpower an ideal instrument for international crisis management. Air power has a wide variety of important crisis management applications, most of which involve no recourse to violence. These include - in terms of increasing seriousness - warning, signalling, providing support, international rescue, injecting stability, deterrence (both implicit and explicit), non-lethal coercion and punishment:

a. **Warning.** Air power can be used to give prior and timely warning of an intended aggression and thus allow appropriate preventive action to be taken. The detection of Soviet ballistic missiles in Cuba in 1962 by the American U-2 aircraft allowed the United States to impose a naval 'quarantine' of the island, a measure which led to the removal of this potential threat. Since then capabilities have grown markedly and - despite the advent of reconnaissance satellites - airborne systems continue to provide unique surveillance capabilities. Advanced airborne surveillance systems - such as the E-313 Sentry Airborne Warning and Control System (AWACS) and J-STARS - can provide enormous quantities of detailed data, on the actions of potential aggressors.

b. **Signaling.** Air power can also be used to send clear political signals. These can help to remove uncertainty over intentions and thus reduce what is arguably the greatest danger in any crisis: miscalculation. Air power can do this through a range of measures including overt increases in readiness states, intensified peacetime training exercises or presence flights.

c. **Supporting Friends.** A third crisis management application for air power is to provide timely moral and physical support for allies and friends, thus strengthening their resolve in times of tension. Here, the Berlin airlift of 1948/49 provides a classic example. During the summer of 1948 the Soviet Union imposed a road and rail blockade on Berlin. This blockade was frustrated by a British and American airlift in which some 2 million Berliners were supplied by air throughout a difficult winter. The Berlin airlift demonstrated the capability and will of the Western powers to provide support for a threatened friend and as such had lasting and worldwide ramifications. On a far smaller scale, the 'persuasion flights' by American F-4 Phantoms over rebel Filipino positions during the attempted coup attempt of December 1989, demonstrated the United States' support for President Aquino's regime and contributed materially to the failure of the coup.

d. **International Rescue.** The use of air power to mount rescue operations in crisis situations has a long history. They include the evacuation of British citizens from Kabul during the Afghan rebellion of 1928/29, the release in 1976 by the Israelis of the passengers and crew of a hijacked Air France A-300 airliner being held hostage in Entebbe, Uganda and the evacuation of Europeans from Kolwezi, Zaire in 1978. However, such operations because they require large and vulnerable aircraft to fly over potentially hostile territory - tend to involve high risks and demand the most careful preparations. If the planning is faulty disaster can result; this was the case with the failed American attempt in April 1980 to use air power to release hostages held in Iran.

e. **Inject Stability.** Air power can also be used to inject air or land forces to improve stability in a region threatened with civil strife or in areas where regional conflict threatens to spill over into neighbouring states. For example, the rapid airlift of French and Belgian troops into Zaire in September 1991 helped to bring stability into a situation of increasing communal violence.

f. **Implicit Deterrence.** Perhaps the best known application of air power in crisis management is to deter aggression, and this can be achieved in a number of ways. At the lowest end of the deterrent scale, the deployment of reconnaissance or surveillance aircraft can - in addition to providing information - have a salutary deterrent effect on a potential aggressor. They can be used to warn him that his actions are being watched and could provoke a response. Because such specialist surveillance aircraft have wartime as well as peacetime functions, they can be invaluable in enhancing the fighting power of regional forces and/or preparing the ground for out-of-region reinforcements. In this context they play a key role in ensuring the continuity of crisis management options between 'implicit' and 'explicit' deterrence.

g. **Explicit Deterrence.** The proven ability to exact rapid retribution, strike into unfriendly territory and deny the potential aggressor the assurance that his homeland can be kept safe from attack is by any measure a strong and explicit deterrent. It is one which can be effective right across the spectrum of potential aggression. At the lower end of the scale, air power can help to protect and strengthen the hand of peacekeeping forces. For example, the Operation PULSATOR deployment of RAF Buccaneers to Cyprus in 1984 - and their subsequent 'demonstration flights' over Beirut - provided an intimidating presence which helped to safeguard British peacekeeping forces in Lebanon from the potential threats posed by the rival Lebanese militia groups. Similarly, the rapid deployment of RAF Harriers to Belize in 1972 and again in 1977 appears to have been a major factor in deterring the threatened Guatemalan invasion of that territory. More recently, the rapid deployment of Coalition air power to Saudi Arabia in the days following the 1990 Iraqi invasion of Kuwait acted as a signal deterrent to further Iraqi aggression. Indeed, had it been possible for the international community to President Saddam Hussein's intentions earlier, the rapid deployment of friendly air power into Kuwait before the invasion might well have defused the crisis before it had really developed. In many such situations air power will often be the only instrument, which has the requisite speed, reach, and hitting power to deter aggression.

h. **Non-Lethal Coercion.** Towards the top end of crisis management options, air power can be used not merely to deter aggression, but also to 'face down' a potential or actual aggressor without resort to physical violence. For example, in August 1976 the US responded to the killing of two of its soldiers in the Korean demilitarized zone with a rapid and ostentatious deployment of air power to Korea. The implied threat was clear, and North Koreans quickly offered a formal apology.

j. **Punishment.** If necessary, non-lethal coercion can be taken one step further and airpower used for precise punishment operations, short of full blown war. One obvious application of these punishment operations is as a response to an attack by state-sponsored aggression by guerrillas or terrorists. In such cases it is often impossible to strike directly at the aggressors themselves, but it is usually possible to punish those who support and encourage them. Such operations are not - of course - without their difficulties. Firstly, international legal opinion is divided on whether retaliation (or even anticipatory self-defence) breaches the prohibition on the use of aggressive force. Moreover, punishment operations are reactive rather than proactive and depend for their success on surprise. Hence, they are usually planned at short notice on a 'one-off' basis; there is little opportunity for practice and much scope for error.

10. **Wartime Applications.** Should crisis management measures fail, and crisis degenerate into armed conflict, then air power can make a decisive contribution to prosecuting operations successfully and with minimum loss of life. The unique ability of air power to concentrate military power in time and space when and where it is needed has in recent years become perhaps the dominant feature of contemporary high intensity conflict. Here again, air power offers decision-makers a wide range of options. These include observation and destruction and the consequential effects of lethal coercion, denial or containment, dislocation, delay, diversion and demoralisation:

a. **Observation.** In war, observation of the enemy provides the basis for intelligent planning and successful execution of military operations.. Air power's unique ability to exploit the third dimension allows it to make a major contribution to monitoring enemy activities and deployments and thus discovering his intentions. Aerial reconnaissance was the first use of military aviation. In the opening months of World War 1, Allied aircraft detected the divergence of the German 1st Army away from Paris during the invasion of France and thus contributed significantly to the subsequent 'Miracle of the Marne'- the defeat of the German Schlieffen Plan. In World War 2, aerial reconnaissance was of major importance not only at the tactical level, but also at the operational and military strategic level. For example, it played a major part in the destruction of the German battleship Bismarck in 1941 and in the battle against the V-weapons in 1944 and 1945. It also underpinned the strategic air offensive against both Japan and Germany. The importance of air observation continued to increase during the conflicts of the post-World War 2 period. It proved vital to the United States air operations in Vietnam, and the lack of an effective aerial reconnaissance capability was cited in the British Government's. Franks' Committee Report as a major British handicap during, the Falklands War. And during the Gulf War of 1991, air reconnaissance in crisis and conflict was vital to the success of the air campaign. In modern warfare, aerial reconnaissance is nearly always important and frequently essential.

b. **Destruction.** Air power's most obvious wartime application is to destroy. The ability to concentrate firepower - when combined with the direct fire inherent in the nature of aerial attacks - confers on air power enormous, potential destructive power. As early as 1918, the destructive potential of air power against enemy land forces was apparent. In 1918, British air power destroyed the retreating Turkish 8th Army at Wade el Far'a. Twenty six years later in the battle of the Falaise Gap in France, Allied air power destroyed the German 5th Panzer and 7th Armies - a total of sixteen divisions including nine panzer divisions. Speaking of the battle in later years, General Spieled (the Chief of Staff to General von Kluge - German Commander-in-Chief West) stated that their 'armoured operation was completely wrecked exclusively by the Allied Air Forces'. In the Vietnam War the North Vietnamese 9th Division attacking An Loc during the Tet offensive of 1972 was decimated by the concentrated use of airborne firepower. And during the Gulf War, air power destroyed nearly half of the Iraqi tanks, artillery and armoured troop carriers deployed in the Kuwait Theatre of Operations before the start of the Allied land offensive. At sea, the destructive potential of air power developed even more quickly. During the battles of the Coral Sea and Midway in 1942 five Japanese aircraft carriers were sunk by United States aircraft. Two years later in the Battle of Leyte Gulf in the Philippines, American air action accounted for the lion's share of the four carriers, three battleships, six heavy cruisers, three light cruisers and eight destroyers lost by the Japanese. During the Gulf War, air power accounted for all of the fourteen Iraqi warships (87% of Iraq's Navy) that were sunk by the Coalition. But the contribution to military victory of destruction per se can be exaggerated. It is not only destruction but also the consequential effects of air power's destructive capacity - set out below - that gives air power a true war-winning potential.

c. **Lethal Coercion.** The ability of air power to reach deep into enemy territory at any time and attack the full spectrum of target sets allows air power to be used to coerce an enemy during a conflict. Any state which faces an opponent with strong air power has to accept the possibility that opponent can escalate the scale or scope of the conflict rapidly and at will by extending the intensity and scope of his attacks. For example, in December 1972 -when the North Vietnamese stalled the Paris peace negotiations - the United States extended its bombing attacks to Hanoi and Haiphong. After eleven days of the bombing, the North Vietnamese leaders agreed to return to meaningful peace negotiations. As a result of this coercion, North Vietnam signed virtually the same treaty that it had rejected the previous October.

d. **Denial.** Air power can also be used to deny an enemy the ability to employ his air, surface and sub-surface forces effectively. The most prominent example of an air-to-air denial battle is the Battle of Britain, where air forces were the only practicable means open to Britain of denying the enemy the opportunity to launch a potentially war winning invasion against the United Kingdom. An example of an air-to-surface denial battle is provided by the Golan Heights battle in the 1973 Yom Kippur War. Caught by surprise, the Israelis had to use air power to contain the Syrian army's offensive until Israeli ground forces had deployed in sufficient strength. That the Israeli Air Force suffered relatively heavy losses during this operation is not of key importance; air power was the only means available to the Israelis of avoiding a major military and political disaster.

e. **Dislocation.** The capacity of air power to inflict dislocation is a key quality. Even if an aircraft fails to destroy its target, the impact on morale of a near-miss or of collateral damage may still cause the enemy major mental, moral and physical dislocation. Dislocation causes delay and confusion, and it breaks up unit cohesion. It also makes the enemy far more vulnerable to follow-up attacks by all types of forces. For example, in June 1944 the German Panzer Lehr division was subjected to continuous Allied air interdiction attacks during its deployment from Le Mans to contain the Allied D-Day landings. The attrition sustained by Panzer Lehr during this journey was significant (about 10% or 220 vehicles), but more importantly unit cohesion was lost and the division arrived on the battlefield in ineffective 'penny packets'.

f. **Diversion.** Air power can be used to divert enemy forces in order either to delay or destroy them. At the military-strategic and operational levels of war, diversion can be achieved by concentrating attacks against sensitive target sets, compelling an enemy to divert forces and resources from offensive into defensive duties. For example, the Allied Strategic Bombing Offensive forced the Germans to divert an estimated 10,000 artillery pieces, badly needed by their land forces, into their anti-aircraft artillery force. As early as 1942, anti-aircraft artillery took 25%-30% of the value of Germany's total weapon production. At the tactical level, air power can achieve diversion by selectively attacking choke points such as bridges etc. This can either delay the arrival of enemy surface forces or channel their movement into areas where they can more easily be contained or destroyed.

g. **Delay.** The effects of dislocation, destruction or diversion can in turn create delay, another important war time effect of air power. In defensive situations, imposing delays on the enemy allows friendly forces to deal more effectively with an attack, either by strengthening defences or by launch spoiling attacks. In offensive situations it allows friendly forces to prevent the enemy's escape. For example, in June 1944 two German Panzer divisions were transferred from the eastern front to help contain the D-Day landings. It took them only five days to cover the 1,000 miles to Nancy. In eastern France. But - because of air interdiction attacks - a further nine days of difficult travel were needed to cover the remaining two hundred and seventy miles to Normandy.

h. **Demoralisation.** One of the important effects that air power can create is demoralisation, because demoralisation is a factor which pervades all aspects of combat capability. Air attack has always had a particularly sapping effect on morale, almost irrespective of the damage inflicted. Perhaps the prime example of the demoralising impact of air power was in the Gulf War. By the commencement of Operation DESERT SABRE (the coalition land attack on Kuwait and Southern Iraq), aerial bombing had reduced the Iraqi army to a demoralised rabble, largely incapable of effective defence. It was this demoralising effect of the air attacks on the Iraqi Army that allowed the Coalition forces to liberate Kuwait, taking some 100,000 prisoners in just five days for the cost of less than five hundred Allied casualties.

Reference:

1. AP 3000 (2nd and 3rd Edition)

TOPIC-4

AIR POWER OPERATIONAL HIERARCHY

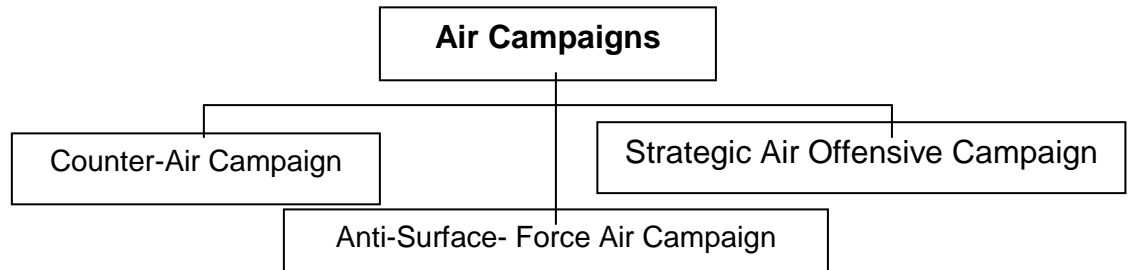
Air Strategy

1. **Air Strategy.** Air strategy is defined as the overall employment plan for air forces in a war.
2. **Air Strategy.** Air power, thanks to unique characteristics, has very wide potential military strategic applications. These fall essentially into three areas:
 - a. **Counter-Air Action.** Counter-air action is defined as the use of air power to deter, contain or defeat the enemy air forces. The strategic aim of counter-air action is to achieve the desired degree of control of the air.
 - b. **Anti-Surface-Force Action.** Anti-surface-force action involves the use of air power, in cooperation with friendly surface and sub-surface forces to deter, contain or defeat the enemy's army and/or navy. The strategic aim of anti-surface-force action is to deprive an enemy of the military power needed to occupy territory or exploit sea space.
 - c. **Strategic Air Offensive.** Strategic air offensive action encompasses the use of air power in precision operations to destroy or damage an enemy's war making capacity. The strategic aim of strategic air offensive action is to undermine the enemy's ability and will to continue with his aggression.
3. **Air Strategic Priorities.** Each conflict will generate its own air strategic priorities. However, when facing an enemy who is capable of exercising air power, priority in air strategy must be given to achieving the required level of control of the air. Experience has shown that unless this is achieved, all other types of air, surface and sub- surface operations become increasingly difficult, and often impossible, to sustain.

The Air Campaigns

4. The term air campaign is defined as a coordinated series of air operations designed to achieve a specific air strategic objective. To prosecute each of the military-strategic applications of air power, specific types of operational-level and tactical-level capabilities are required. These capabilities can only be fully effective if they are brought together in cohesive, dedicated air campaigns.
5. **Air Campaign Structure.** The three air campaigns are complementary, rather than alternative, strategic instruments. In most major conflicts they have been prosecuted concurrently. However, the proportion of total air effort that different nations have devoted to each air campaign has varied considerably, reflecting their differing strategic priorities.

This has been true not only for different conflicts, but also for different phases of the same conflict. The following two examples help to illustrate this:



a. During the first two days of the 1967 Six-Day Arab-Israeli War, Israel devoted virtually all of her air forces to the counter-air campaign. In the remaining four days the Israelis switched the bulk of their air effort into the anti-surface force campaign.

b. The Gulf War of 1991 provides a more complex example of strategic air planning the forces involved being far larger, the defences far more formidable, the planned duration of the operation far longer and the scope of operations far greater. The air strategy employed by the international coalition against Iraq was divided into four - rather than two - distinct phases. Phase 1 - planned to last for seven to ten days - was designed primarily to achieve control of the air and - in parallel - to damage Iraqi strategic capabilities. Phase 2-effectively a sub-element of the counter-air operations was' designed to suppress the Iraqi surface-to-air defences within the Kuwait theatre of operations. In Phase 3, the Allies intended to concentrate their attacks against the Iraqi Army in the Kuwait theatre of operations. The prime aim of the fourth and final phase was to cooperate directly with the Allied land offensive to achieve the physical liberation of Kuwait. However, typical frictions of war caused the planned timescales to slip, and, as a result, the different phases tended to merge and at times overlap as operations progressed.

Air Operations

6. **Categories of Air Operations.** Air operations fall into two broad categories: combat air operations and combat-support air operations.

7. **Combat Air Operations.** A combat air operation is defined as the integrated employment of combat air power to achieve a specific campaign objective. The combat air operations required prosecuting the counter-air, anti-surface-force and strategic air offensive campaigns are discussed separately.

8. **Combat-Support Air Operations.** Combat-support air operations are defined as non-combat air operations designed to enhance the combat capabilities of air, surface and sub-surface forces.

9. **Ground Combat-Support Activities.** Effective prosecution of all types of air operations depends on a range of supporting ground functions. These are termed ground combat-support activities. Ground combat-support activities are defined as the major non-flying" activities needed to support air operations. The different categories of air operation are shown graphically below:



Air Roles

10. The successful prosecution of combat and combat support operations requires the employment of air power in a number of specific, inter-related roles. An air power role is defined as a tactical-level function of air power. Air roles are prosecuted through tasks, missions and sorties.

Air Tasks

11. Air Tasks are undertaken to achieve a specifically defined objective.

Air Missions

12. A mission is defined as one or more aircraft ordered to accomplish one particular task.

Air Sortie

13. A sortie is defined as one flight by one aircraft.

The Air Power Operational Hierarchy

14. The overall air power operational hierarchy is shown graphically below:



TOPIC-5

AIR POWER COMMAND AND CONTROL

Introduction

1. Effective command and control is fundamental to the efficient employment of air power. Air power command and control doctrine is the product primarily of experience and has been steadily refined over the years.

Key Principles

2. Experience has shown that unified action is essential for the effective use of air power. As Marshal of the Royal Air Force The Lord Tedder pointed out "The old fable of the bundle of faggots compared with the individual stick is abundantly true of air power. Its strength lies in unity". However, the inherent speed, reach and flexibility of air power allow it to be employed in diverse and multiple tasks, and this can lead to fragmentation of forces and thus dissipation of effort. Moreover, there will rarely be sufficient air resources to meet all demands and tasking priorities will invariably have to be set. To achieve unified air action and to ensure that air power capabilities are used as the overall operational situation demands, certain key principles must be applied:

- a. Centralize command and control.
- b. Exercise command and control from the highest practicable level.
- c. Decentralize execution.

3. **Centralize Command and Control.** Centralized command and control promotes an integrated effort and enables forces to be employed to meet the recognized overall priorities. It also allows air action to be refocused quickly to exploit fleeting opportunities, be responsive to the changing demands of the operational situation and be concentrated at the critical place and time to achieve decisive results. Centralized command and control is essential if air power is to be employed in unified action; it helps to avoid air power being:

- a. Divided into fixed 'penny - packets' which would inhibit flexibility and hinder speedy concentration of force.
- b. Employed in un-coordinated actions or for impractical objectives.

4. Exercise Command and Control at the Highest Practical Level. Unity of air effort is best achieved when authority for command and control is exercised from the highest practicable level under a designated air commander. The factors which determine that level include the commander's operational responsibilities, the combined or joint force objectives, the composition and capabilities of the force involved, the control systems available for tasking and controlling air assets, and the functions of the air resources. Care must be taken not to set the level of centralized control too high, as this will inhibit flexibility and create inefficiency. For example, the most appropriate level for operational control of

the air effort will be that at which the relative priorities of combined/joint demands on air resources can best be assessed. For different types of aircraft, the level at which command and control is best exercised will depend on the reach and capability of the aircraft. In general, the greater the reach and capability, the higher the level at which command and control should be exercised. For example, fighter-bombers are highly capable and can reach targets across a theatre of operations; thus, they are best controlled at theatre level. In comparison, small observation helicopters have far less reach and, capability and are best controlled at a far lower level, typically at corps or division.

5. **Decentralize Execution.** No single commander can direct personally all of the detailed actions of a large number of air units or individuals. Therefore, decentralized execution is essential, and it is accomplished by delegating appropriate authority to execute tasks and missions. Decentralized execution allows subordinate commanders to use their judgment and initiative within the overall pattern of employment laid down by their superiors. It becomes especially important when command and control systems are lost through enemy action. Decentralized execution can lead to subordinate commanders taking divergent initiatives which would weaken the cohesion of a campaign. But this effect can be avoided if doctrine and the overall operational objectives are properly understood at all levels of command.

Elements of Command and Control

6. Command or direction is retained at the highest level necessary to achieve unity of purpose. This is combined with the delegation of authority to achieve military objectives at the lowest level appropriate for the most effective use of military forces. Command requires a combination of responsibility and accountability. Control, the second essential element, is one aspect of command. Both the commander and his staff share the execution of control. For combined and multinational operations, the key requirement is unity of effort.

Terms and Definitions

7. **Command.** Command is the authority vested in an individual of the armed forces for the direction, co-ordination and control of military forces. The command are practiced in following levels:

a. **Full Command.** Full command is the military authority and responsibility of a superior officer to issue orders to subordinates. It covers every aspect of military operations and administration.

b. **Operational Command.** The authority granted to a commander to assign missions or tasks to subordinate commanders, to deploy units, to reassign forces, and to retain or delegate operational and/or tactical control as may be deemed necessary. It does not of itself include responsibility for administration or logistics. It may also be used to denote the forces assigned to a commander.

- c. **Tactical Command.** Tactical command is the authority delegated to a commander to assign tasks to forces under his command for the accomplishment of the mission assigned by higher authority.
8. **Control.** Control is the authority exercised by a commander over part of the activities of subordinate organizations, or other organizations not normally under his command, which encompasses the responsibility for implementing orders or directives. All or part of this authority may be transferred or delegated.
- a. **Operational Control.** Operational control is the authority granted to a commander to direct forces assigned so that the commander may accomplish specific missions or tasks which are usually limited by function, time or location, to deploy units concerned, and to retain or assign tactical control of those units. It does not include authority to assign separate employment of components of the units concerned. Neither does it, of itself, include administrative or logistic control.
- b. **Tactical Control.** Tactical control is the detailed and, usually, local direction and control of movements or manoeuvres necessary to accomplish missions or tasks assigned.
9. **Co-ordinating Authority.** The authority granted to a commander or individual assigned responsibility for co-ordinating specific functions or activities involving forces of two or more countries, of two or more services or two or more forces of the same service. He has the authority to require consultation between the agencies involved or their representatives, but does not have the authority to compel agreement. In case of disagreement between the agencies involved, he should attempt to obtain essential agreement by discussion. In the event he is unable to obtain essential agreement, he shall refer the matter to the appointing authority.
10. **Joint.** The term 'joint' connotes activities, operations, organizations, etc in which elements of more than one service of the same nation participate.
11. **Combined.** The term combined connotes activities, operations, organisations etc in which two or more forces or agencies of two or more nations are involved.
12. **Tactical Air Control System.** The organization and equipment necessary to plan, direct, and control tactical air operations and to co-ordinate air operations with other services. It is composed of control agencies and communications-electronics facilities, which provide the means for centralised control and decentralised execution of missions.
13. **Functional Control.** Functional Control is the authority to lay down objectives, to give policy direction, and to task a subordinate organisation for the purpose of carrying out its function or functions. It does not include aspects of administrative control.
14. **Administrative Control.** Direction or exercise of authority over subordinate or other organisations in respect to administrative matters such as personnel management, supply, services and other matters not included in the operational missions of the subordinate or other organisations.

Command and Control of Air Forces for Tactical Air Operation

15. **Levels of Command and Control.** The characteristics and capabilities of air forces allow them to be employed in diverse and multiple combat air tasks in an area of operation. However, there will rarely be sufficient tactical air resources to meet all demands. To realize their full potential and effectiveness, available air resources must be employed under command arrangements that exclude undue dissipation and fragmentation of effort, and permit their integrated, responsive and decisive application to tasks in the overall air effort that best achieve designated objectives. Unity of effort is best achieved when authority for command and control of the air effort is established at the highest practicable levels, under a designated air commander. In determining these levels, consideration should be given to factors such as assigned mission, combined/ joint force objective, capabilities of forces and their composition, control systems available for tasking and controlling air assets, and functions of the tactical air resources to be controlled. The optimum level for operational control of the air effort would lie where the best assessment of the overall air, land, or naval situation can be made. Centralized control is necessary for effective application of air power in an area of operation, and promotes an integrated effort in execution of plans or adjustments to the tactical situation according to established priorities and objectives. No single commander can personally direct all of the detailed actions of a large number of air units or individuals. Decentralized execution of air tasks is therefore necessary and is accomplished by delegating appropriate authority for mission execution.

16. **Levels of Assignment.** Air assets can be assigned at one of four levels:

a. **Allotment.** Allotment is the temporary change of assignment of air forces between subordinate commands. The authority to allot is vested in the commander having operational command. The process of allotment is used to provide the balance of forces needed to achieve the objectives stipulated by that command.

b. **Apportionment.** Apportionment is the determination and assignment of the total expected effort by percentage and/or by priority that should be devoted to the various air operations and/or geographic areas for a given period of time.

c. **Allocation.** Allocation is the translation of the apportionment into total numbers of sorties by aircraft type available for each operation/task. When external or other forces become available for use by a commander he will allocate them, by sorties within a given period of time, to a subordinate commander or commanders in much the same way that he would allot assigned forces.

d. **Tasking.** Tasking is the process of translating the allocation into orders, and passing those orders to the units involved. Each order normally contains sufficient detailed instructions to enable the executing agency to accomplish the mission successfully.

17. **Apportionment and Allocation of Resources.** The apportionment plan of total air resources to execute the tactical air functions should be accomplished at the highest appropriate command level, and is expressed as a percentage and/or by priority. Based upon this apportionment decision, the actual allocation of sorties to perform specific tasks is normally accomplished at the tasking agency. Some of the factors, which may be considered before determining this apportionment, and before allocating resources, are:

- a. The objective to be achieved.
- b. The nature and intensity of the conflict, the strategy being employed, and in particular the threat, the types of probable targets, the likely response times required.
- c. The operational capabilities, limitations and security of all weapons, systems, the terrain and weather conditions.
- d. The availability of logistic support.
- e. The political restraints in effect.

18. **Combined/Joint Operation.** When tactical air operation are in support of land or sea objective, the air and the supported commanders and their staffs should work as a team throughout the period from the composition of joint/combined surface/air plans to their final execution. Ideally, a combined or joint headquarters should be established or the separate command centre should be collocated. When these alternatives are not possible, then it is essential that adequate communications and co-ordinating procedures are established between them.

Basic Composition of a Tactical Air Control Organization

19. The composition of a tactical air control organization includes control agencies and components with appropriate staff. It will include communication equipment and may have other electronic facilities such as computers, defence and surveillance radars if appropriate, with airspace co-ordination and base air traffic control facilities. The number and size of the various elements of a tactical air control organization depend on the requirements of the area to be served and the nature of the task. The basic composition and structure of typical tactical air control organisation are:

- a. **ACOC.** Planning and direction of tactical air operation should originate or be supervised from a primary agency such as an Air Command Operation Centre (ACOC). Staff composition of the agencies should reflect the functions of the elements they control in such a manner as to ensure that the air commander appreciates the tactics, techniques, capabilities, needs and limitations of those elements. Facilities should be provided to allow the air commander and his staff to maintain liaison with other commanders and their staffs. Control authority may be delegated to subordinate agencies or elements. The agency should be able to

communicate with the various elements that comprise the tactical air control organization. ACOC through an Air Defence Operation Centre (ADOC) and Air Support Operation Centre (ASOC) directs and tasks all air operations. In the context of Bangladesh BAF is likely to continue with one central ACOC to optimum centralised control and unity of effort.

b. **ADOC.** ACOC delegates some of the tasks/functions to subordinate agencies. ADOC is tasked for air space management and control, and air defence of the territorial airspace. It may be comprised of a number of Sector Operation Centres (SOC) for smooth functioning and controlling. BAF with a central ADOC controls all AD operations.

c. **ASOC.** ASOC is the air agency subordinate to ACOC and normally collocated at the Army/Navy HQ or at the highest land force formation deployed. It includes land force and if appropriate naval representation. Tasking authority may be delegated to the ASOC of the air effort allocated to OAS. The ASOC will jointly plan, request, coordinate and control, when approved, OAS sorties within its area of responsibility.

20. **Airspace Control in the Combat Zone.** Airspace control is provided in order to increase operational effectiveness, to permit greater flexibility by promoting the safe, efficient, and flexible use of airspace, while authority to approve, disapprove, or deny combat operation is vested only in the Operational Commander.

21. **Methods for Airspace Control.** There are two basic methods of exercising airspace control:

a. **Positive Control.** Positive airspace control employs positive identification, tracking, and direction of aircraft within airspace and is conducted with electronic means by an agency having the authority and responsibility therein. Positive airspace control relies upon real-time data using facilities equipped with capabilities such as primary radar, secondary radar and communications. All radars with these capabilities, such as air traffic control radars or tactical air operations radars, could be used for airspace control. Positive airspace control facilities may be subject to attack and sabotage and may be restricted by line-of-sight coverage, electronic interference and limited communications.

b. **Procedural Control.** Procedural airspace control is a method of airspace control which relies on a combination of previously agreed and promulgated orders and procedures. Procedural airspace control includes techniques such as these gentling of airspace by volume and time and/or the use of weapon control orders. This method is more restrictive than positive airspace control but is less vulnerable to interference by electronic and physical attack. It does, however, ensure continuity of operations under adverse environmental conditions and must always be available to provide an immediate fall-back system should positive control be degraded, or when positive control is not considered appropriate to the operation in hand.

22. **Selection of Method.** A combination of the two methods may be employed; the degree to which each method is used should be determined by considering the following factors:

- a. The nature and magnitude of the enemy threat and operations.
- b. The availability, capability and vulnerability of friendly management facilities, including airborne and surface-to-air defences as well as peacetime air traffic control and terminal control facilities.
- c. The number, flight profiles and speeds of friendly aircraft.
- d. The type of terrain and likely weather conditions in the combat zone.
- e. The number, deployment and characteristics of friendly surface weapons systems.

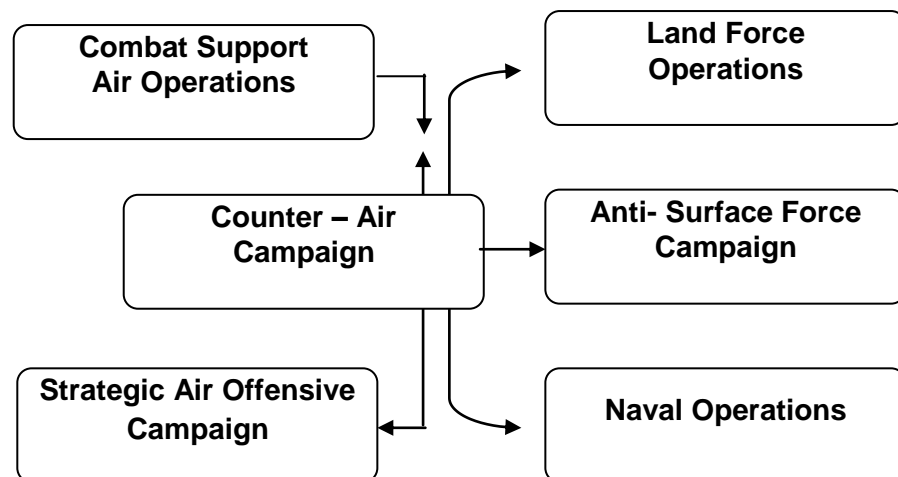
Reference:

- 1. AP 3000 (2nd and 3rd Ed)
- 2. Joint Services Glossary of Operational Terms
- 3. DSCSC Précis

TOPIC-6**COUNTER AIR CAMPAIGN****Counter-Air The Primary Campaign**

1. In most major conflicts all three of the air campaigns (Counter-Air, Anti-surface-force and Strategic Air) have had to be prosecuted simultaneously. Battle experience has shown that - when facing an enemy with powerful air power priority has to be given to achieving control of the air. The more formidable the opposing air power, the more important this task becomes. Thus, invariably, the counter-air campaign will be the primary air campaign, and the other air campaigns will be of subordinate importance. Emergency situations may occur when assets needed to achieve or maintain control of the air have to be diverted to other tasks. But such diversions must only be temporary, and they should never be used as the basis for planning.

2. The counter-air campaign - like the other campaigns - requires a wide spectrum of air and ground combat support operations to be fully effective. There are also significant interactions between the counter-air campaign, the other air campaigns and surface campaigns. Surface campaigns depend on control of the air, but they can also affect the outcome of counter-air battles. Thus the relationship between counter-air operations and other types of air and surface operations is inter-active and can be portrayed graphically.

**The Counter-Air Campaign - Interactions**

3. **Defensive-Offensive Balance.** Attaining the balance between offence and defence in counter-air operations is a complex challenge. The three most important variables in this challenge are depth, density and capabilities of the opposing air defence system. The further attacks have to penetrate over hostile territory to reach their targets, the more vulnerable they are likely to be to defensive air action, the greater the effectiveness of the defence in-depth, the earlier attacking air systems can be detected and defending forces can be assembled. Defence in-depth also allows a defender to construct a layered air defence system, which employs different weapons systems. This layering,

although it does not provide complete protection, could cause progressive attrition to an attacker. The defence/offence balance will also depend upon the nature and stage of a campaign.

4. **Offensive Air Action.** Carrying the fight to the enemy in the counter-air campaign confers the following inherent advantages:

- a. Offensive action allows the attacker to seize the initiative, exploit to the full the capabilities of air power and concentrate strength against weakness.
- b. It reduces the number of offensive sorties that he can mount and compels him to devote a proportion of his total air power assets to purely defensive duties.
- c. It can better exploit the three-dimensional space of the skies, the vagaries of light and weather and the masking effect of terrain.
- d. It denies the enemy a sanctuary.

5. **Defensive Air Action.** Some defensive counter-air action will usually be necessary to protect friendly air and surface forces. Moreover, defensive action may not be avoidable for the following reasons:

- a. There may be over riding political constraints on offensive action.
- b. An enemy's technological superiority in defensive operations may make offensive operations too costly.
- c. The enemy's bases and supporting facilities may be out of range, in which case defensive operations may be the only option.
- d. Defensive operations may have to be undertaken in order to weaken the enemy's air forces as a prelude to offensive operations.
- e. They may also be needed to secure a base from which offensive air action may be conducted.

6. Defensive air action also possesses certain inherent advantages:

- a. A defensive battle is normally fought over the defender's territory. This allows the defender to draw upon his supporting infrastructure and bring a greater number and diversity of weapon systems into the battle.
- b. Defending aircrew who abandon their aircraft over friendly territory can frequently be fed back into the battle, whereas aircrew who survive abandonment over hostile territory are generally taken prisoner.

c. The defender's airfields are normally far closer to the battle area than those of the attacker. Thus, the defender is able to achieve a higher sortie rate and hence make more intensive use of the assets at his disposal.

d. Historically, defensive operations have proved less difficult to sustain than offensive operations.

7. **Joint Nature of Counter-air Operations.** As control of the air is fundamental to the conduct of virtually all military operations, it will require the co-ordination of potential contributions of formal components. The Joint Force Air Component Commander (JFACC) has the pivotal role in achieving that co-ordination through the air battle management process.

8. **Variable Factors.** Assessing correctly where the balance lies between offence and defence is crucial to operational success. The advantages offered by offensive air action have traditionally been seen as decisive. However, a number of variables affect the extent to which offensive action is practicable:

a. **Depth.** In general, depth favours defensive air action. The greater the effective defensive depth, the earlier that attacking air systems can be detected and the better the prospects for a successful engagement. Early detection enables the defender to concentrate his forces against incoming raids, and it allows more time to prepare potential targets to withstand or survive an attack. Defensive depth enables the defender to construct a layered air defence system employing different weapon systems. This presents the attacker with successive hurdles which he must overcome to reach his target. Experience has shown that no air defence system can provide complete protection against air attack, but, historically, a layered system capable of inflicting progressive attrition on the attackers has always produced the best results.

b. **Force-to-space Ratio.** In general, the lower the overall force-to-space ratio within a theatre of operations, the more favourable the conditions for offensive air action. For the defender, a low force-to-space ratio means thinner defences supported by fewer local reserves which place a greater reliance on accurate and timely attack warning to enable forces to be concentrated against the attacker. But they do not impede the attacker's ability to concentrate. Indeed, by simplifying the problems involved in concentrating sufficient forces in space and time, they make it easier for him to saturate the defences. This is true in all forms of warfare, but in air warfare with its very high levels of speed and reach - it is particularly important.

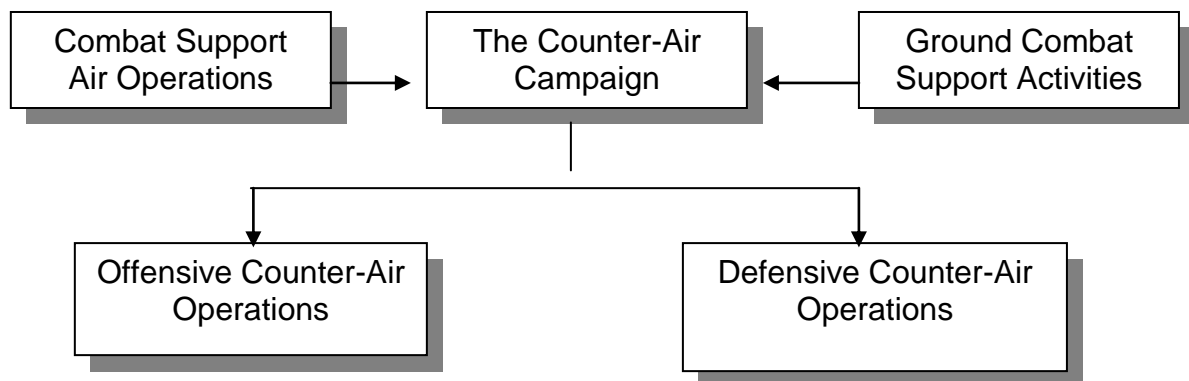
c. **Technology.** Technological changes can have a major impact on the offence/defence balance. For example, improved air defence sensor technology and longer-range air defence weapons tend to increase the effective defensive depth and theatre force-to-space ratios; thus, they enhance defensive power. In contrast, improved electronic countermeasures, longer-range stand-off weapons and "stealth" techniques can have the opposite effect. The expected rate and direction of technological change should thus have a major impact on future force-structuring

and resource allocation. However, two points need to be borne in mind in this context:

- (1) Technology has tended to deliver less than it has promised, later and at a greater cost. Therefore, over-reliance on purely technological solutions to operational problems should be avoided.
- (2) Technology should not be allowed to set its own agenda. There will always be an interaction between technology and doctrine, but in essence doctrine should drive - rather than be driven by - technology.

Counter-Air Operations

9. The counter-air campaign - like be anti-surface force and strategic air offensive campaigns - depends on the full range of combat-support air operations and ground combat-support activities. The counter-air campaign consists of two distinct but complementary types of operation: offensive counter air operations and defensive counter-air operations. The various components of the counter-air campaign can be displayed graphically as at Figure below:



Counter-Air Campaign Components

Offensive Counter-Air Operations

10. **Definition and Types.** Offensive counter-air operations are mounted to destroy disrupt or limit enemy air power as close to its source as practicable. To prosecute offensive counter-air operations, the following spectrum of offensive roles may be employed:

- a. Suppression of enemy air defences.
- b. Fighter sweep.
- c. Escort.
- d. Airfield attack.

11. **Suppression of Enemy Air Defences (SEAD).** SEAD is that activity which neutralizes, destroys or temporarily degrades enemy air defence systems in a specific area by physical attack and/or electronic warfare to enable air operations to be conducted successfully. Experience has shown that when faced with an enemy who has a strong surface-to-air defence system defence suppression can greatly reduce loss rates and help to sustain offensive air action. The extremely low allied air loss rates sustained during the first two weeks of the Gulf War were due in large part to very effective defence suppression. Target sets include radars and other sensors, surface-to-air missiles and anti-aircraft artillery batteries. SEAD is a role in which specialized weapons and tactics tend to play a particularly important part. Some surface-to-air systems have certain inherent potential weaknesses: they are finite and normally have flanks, they are orientated towards the expected approach routes of the enemy, they are rarely equally strong throughout their width and depth and they are either fixed or relatively immobile. Others deployed in zones or areas to provide all round defence - have fewer weaknesses. SEAD tactics are designed to exploit any potential weaknesses to the full.

12. **Fighter Sweep.** Fighter sweeps involve offensive action by fighter aircraft to seek out and destroy enemy aircraft or targets of opportunity in an allocated area of operations. Fighter sweeps are most effective when linked to air-to-surface offensive action. The air-to-surface attack force draws the enemy into the air where he can be destroyed, and the fighter sweep clears the way for the air-to-surface attack force's penetration to its targets. The RAF fighter sweeps over France in 1941 (known as 'Rhubarb' sorties) were costly failures, but fighter sweep proved particularly effective during the later stages of the Allied Strategic Bombing Offensive against Germany in World War II and in the United States air attacks on North Vietnam. Today fighter sweep is broken down into two groups:

- a. **Area Sweep.** An Area Sweep is used to establish air superiority in a given area. It may be used in isolation from other air assets or it may be used indirectly to support an attack force by decoying or destroying enemy aircraft that pose a direct threat to the attack force.
- c. **Route Sweep.** A Route Sweep is used in direct support of an attack force, clearing the planned route of enemy aircraft that may pose a threat to the attack force.

13. **Escort.** The escort role involves the assignment of aircraft to protect other aircraft during a mission. Escort fighters present a counter-threat to the enemy's air defence fighters and can be used in both offensive and defensive operations. For offensive operations the enemy must break through the escort before he can engage the air-to-surface attack force. There are two sub-groups of Fighter Escort:

- a. **Detached Escort.** The Detached Escort is tasked with providing a forward screen of fighters to protect the attack force from enemy aircraft. It is positioned ahead of the attack force.

b. **Close Escort.** Fighters in the Close Escort role are integrated within or positioned around the attack force but within visual range of the escorted aircraft. In practice, a combination of escort and fighter sweep has been found to be an effective means of destroying an enemy's air-to-air defensive capability. Close escort of high-speed penetrating formations has proved to be problematical, and detached escort is generally favoured.

14. **Airfield Attack.** Airfields are static and usually contain densely-packed high-value targets. Thus they provide attractive targets for offensive counter-air action. Harassing attacks can reduce the enemy's sortie rate through disruption and diversion, while sustained major attacks can bring his operations to a halt. In the 1967 Six-Day Arab Israeli War, airfield attack was used by the Israeli Air Force to devastating effect to destroy the Arab air forces. However, airfield attacks may not always be profitable. On January 1945 in Operation HERMAN, the Luftwaffe lost more aircraft attacking Allied airfields than they managed to destroy. Attacks against hardened airfields protected by effective point defences could be equally lacking in cost-effectiveness. Potential airfield attack target sets - that is, groups of target types - include operating surfaces (runways and taxiways), weapon and fuel dumps, aircraft and personnel:

a. **Operating Surfaces.** Attacks on operating surfaces can close airfields, but because operating surfaces can be repaired, the effects of such attacks can be only temporary. Closure of operating surfaces, per se, cannot reduce the enemy's overall sortie generation potential; it can only delay the enemy air power's entry into the battle. This may in itself be a worthwhile objective, particularly if it is important to win time for friendly forces. But it must be borne in mind that the losses that may be incurred in an extended effort to keep operating surfaces closed may render the attacker too weak to counter the opposing air power when operating surfaces are eventually repaired.

b. **Other Target Sets.** The disruption of operating surfaces 'fixes' the enemy air power to its airfields, but for full effectiveness, aircraft, personnel and/or support infrastructure must also be attacked. Replacing advanced aircraft and weapons or highly trained personnel is far more difficult than repairing operating surfaces.

15. **Participation of Surface Forces.** The major part of offensive counter-air operations will invariably fall to air forces, but the surface forces can also make an important contribution. The Special Air Service raid on the Pebble Island airfield in the 1982 Falklands Conflict was an example of surface forces acting in the airfield attack role. Similarly, the Israeli use of artillery to silence Syrian surface-to-air missile batteries in the 1982 Bekaa Valley operation demonstrated the potential for surface forces to act in the SEAD role. Thus, to ensure maximum effectiveness in offensive counter-air operations, the relevant capabilities of the surface forces should always be integrated as closely as possible with those of the air forces.

Defensive Counter-Air Operations

16. **Definition.** Defensive counter-air (or Air Defence) operations comprise all measures designed to nullify or reduce the effectiveness of hostile air action.

17. **Defensive Counter-Air Aim.** Establishing the correct aim is fundamental to the success of defensive counter-air operations. Essentially, there are two choices:

- a. To minimize the damage sustained by friendly forces and facilities.
- b. To inflict the maximum attrition on the enemy.

18. To a certain extent these aims are interdependent; the more enemy aircraft that are shot down, the fewer that are available to inflict damage in future raids. The less damage that the Allies sustain, the more capable they are of defending themselves if the enemy continues with his attacks. Deciding where the priority lies between these two aims has major implications for operational art and force structuring, and thus for resource allocation.

a. **Operational Art.** If the over-riding priority is to inflict maximum attrition, then enemy aircraft can be intercepted wherever they can be found, before or after they have attacked their targets. In contrast, if minimum damage is the aim, then all the resources need to be devoted to deterring or containing the incoming raids, even if that means leaving vulnerable homebound enemy aircraft.

b. **Force Structuring.** If the prime aim is to minimize damage, then significant resources will need to be allocated to passive defence and resilience measures. However, if the aim is to inflict maximum attrition on the attackers, then passive defence measures will be a less important part, and the need to provide the strongest possible active defence forces will dominate resource allocation.

19. **Priorities.** Deciding where the priority lies between the 'minimum damage' aim and the 'maximum attrition' aim will depend partly on friendly vulnerability and partly on the nature of the threat. For example, if the friendly infrastructure is seen to be particularly fragile or if the enemy is able to attack only intermittently, then a 'minimum damage' approach may well be best. On the other hand if friendly infrastructure is robust or if one is faced with the threat of a sustained attack, then 'maximum attrition' could well be the better option.

20. **Active Air Defence System - Requirements.** Although the aim will shape the relative allocation of the resources between active and passive defence systems, this will be a question of emphasis rather than of alternative. In all cases, an active air defence system will be needed, even though its scale might vary. And to be effective, such a system must be capable of carrying out the following sequence of functions:

- a. Detecting and identifying potential target(s);

- b. Assessing the potential threat posed by such targets and whether or not they need to be intercepted or engaged;
- c. Passing the tactical information needed by agencies and units involved in the interception or engagement;
- d. Assigning weapons and/or aircraft and placing them under appropriate tactical control.
- e. Intercepting or engaging the target(s).
- f. Recovering to their bases of any aircraft involved in the operation.

21. **Active Air Defence System - Structure.** Any active air defence system consists of three basic and closely integrated components:

- a. A detection system to track the enemy and direct friendly weapon systems, i.e. RADAR, Observe part etc.
- b. A command, control, communications and information system to link the weapon and detection systems and thus make best use of the available assets.
- c. A weapon system to destroy attacking enemy air vehicles, i.e. Interceptor aircraft.

22. **Detection System.** Detection and tracking information on hostile aircraft can be obtained from a variety of sources: for example, visual sightings, infra-red or acoustic monitoring, conventional line-of-sight radars (fixed, transportable, maritime and airborne), over-the-horizon-radars and space-based detection systems. The information from these systems must then be merged into a recognized air picture, which can then be disseminated to all agencies and forces involved in defensive counter-air operations.

23. **The Weapon System.** An air defence weapon system will normally consist of two complementary components: surface-to-air defences and fighter aircraft:

- a. **Surface-to-Air Defences.** Surface-to-air defences consist of surface-to-air missiles and anti-aircraft artillery. Surface-to-air defences allow high-readiness states to be maintained over long periods, they give quick response and - in certain cases - they can be used to counter ballistic missiles. But, in comparison with fighter aircraft, they have limited range and low mobility, and therefore relatively large numbers of surface-to-air defence systems may be needed to defend anything but point targets. Moreover, anti-aircraft artillery has very limited range and surface-to-air missiles have very limited flexibility; the latter are single-role systems and, except in the case of some point-defence SHORAD systems which can be optically sighted, are unable positively to identify their targets prior to engagement - a point which is of major importance particularly for peacetime air policing and during times of tension.

b. **Fighter Aircraft.** Fighter aircraft have limited endurance, and they cannot be rearmed, re-crewed or serviced in the air. But they are flexible and reusable and can therefore be switched to tasks other than air defence should the operational situation demand it. Fighter aircraft are also mobile and hence can be used to protect very large areas or be concentrated rapidly to counter enemy saturation raids. Moreover, they are far better able to identify targets positively before engaging them. Fighters can be used for the following types of task:

(1) **Interception.** An intercept mission may involve the scramble of fighters from a high state of readiness or the direction of aircraft from combat air patrols. Interceptions can be carried out autonomously or with the assistance of air defence radars.

(2) **Combat Air Patrols (CAP).** CAPs are mounted over an objective area, over the force protected, over the critical area of a combat zone, or over an air defence area, for the purpose of intercepting and destroying hostile aircraft before they reach their targets. They enable rapid reaction to enemy intrusion and may be positioned well forward of the areas to be defended. CAPs may be conducted to support both defensive and offensive counter-air operations. They are essentially defensive in nature, and sustaining them - particularly at long range and over long periods - can absorb a great deal of effort.

(3) **Escort.** Escort missions (defined above) by fighter aircraft may be needed to support other aircraft carrying out offensive, defensive or combat support tasks.

c. **Fighter Surface-to-air Force Mix.** The preferred force mix between fighters and surface-to-air defences within an air defence system - and the nature of their operational deployment - will depend on a variety of factors, of which perhaps the most important are warning-time and geography:

(1) **Warning Time.** When warning time is short and hence interception opportunities limited, effective defence is best provided by a screen of high-readiness surface-to-air systems backed up by a mobile reserve of air defence fighters. As warning time increases, so the opportunities grow for exploiting the air defence fighter's far greater mobility and ability to concentrate firepower in space and time.

(2) **Geography.** The larger the area, the more difficult and expensive it is to provide an effective level of surface-to-air defence cover. When large areas have to be defended, the mobility offered by air defence fighters makes them particularly cost-effective. Surface-to-air defences can offer a useful option for providing, for example, a permanent, forward, air defence presence along a continental border or within a limited geographic area. In general, surface-to-air defences are best suited to local and point defence, whereas air defence fighters are best suited to area defence.

24. **Layered air Defence System.** The Layard Air Defence system may comprise of the following:

- a. Early Warning - long range detection by AEW/AWACS and land based radars.
- b. Long range interception - by Combat Air Patrols with Air-to-Air Refueling support.
- c. Interception - by land based Quick Reaction Aircraft.
- d. Area SAM.
- e. Short Range Air Defence (SHORAD) - and point defence including IDF aircraft.

25. **Command and Control System.** The purpose of the defensive counter-air command and control system is to integrate all of the various elements of the weapon and detection systems into a coordinated entity, thus ensuring the optimum use of available resources against the threat. The overall command and control of defensive counter-air operations must be vested in one person: the air defence commander. If the area to be defended is large and the intensity of operations is likely to be high, a number of defensive sectors can be established, each under the control of a sector commander who reports to the air defence commander.

26. **Participation of the Surface Forces.** In defensive counter-air operations, naval and land force organic surface-to-air and detection capabilities can add greatly to effective defensive depth and increase the level of attrition on attacking enemy aircraft. Thus, the air defence command and control system must be integrated with the command and control systems of the surface forces within a theatre to ensure that joint defensive counter-air assets are employed in a fully coordinated fashion.

27. **Passive Air Defences.** Passive air defences are defined as all measures, other than active air defence, taken to minimize the effect of hostile air action. These measures include deception, dispersion, concealment and camouflage, the use of protective construction and the increased redundancy of operating strips. Some of these aspects are examined in the ground defence section and will be covered in separate subject under ground combat support activities.

28. **Conclusion.** As Lord Tedder argued:

"The fight for air superiority is not a straightforward issue like a naval battle or a land battle; it is not even a series of combats between fighters; it is frequently a highly complex operation which may involve any or all types of aircraft. It is a campaign rather than a battle, and there is no absolute finality to it so long as enemy aircraft are operating."

Reference : AP 3000 (2nd Ed) and RAF Air Op Manual

TOPIC-7

ANTI SURFACE FORCE CAMPAIGN

Introduction

1. The strategic aim of the anti-surface-force campaign is to deprive the enemy of the military power he needs to occupy territory or exploit sea space. Anti-surface-force action involves the use of air power, in cooperation with friendly surface and sub-surface forces to deter contain or defeat the enemy's army and/or navy. The ability to prosecute the anti-surface-force campaign effectively will depend heavily on the success of the counter-air campaign, and invariably these two campaigns will be closely integrated. Anti-surface-force combat air operations - like those of the counter-air and strategic air offensive campaigns - will also depend on the full range of combat-support air operations and ground combat-support activities.

2. **Historical evaluation.** The key doctrinal points which emerge from the history of anti-surface-force operations are as follows:

a. Anti-surface-force air action can be used either to supplement or to substitute for surface-force action. It is particularly effective in responding to surface force operational emergencies and dominating sea space.

b. Anti-surface-force air action works best when used in direct cooperation with friendly surface operations and where the enemy is forced to expose and attempt to manoeuvre his forces while under fire.

c. Air attack against surface forces is particularly effective when an enemy is confronted by geographical restrictions - such as being forced to operate without cover (as in a desert situation), or being forced to traverse narrow defiles, causeways or roads bordering inhospitable ground (for example marshes). Air attack has a profound impact on ground troops, often out of all proportion to the physical damage and destruction caused. However, this can result in troops fearing the enemy air force more than they respect friendly air forces, with consequent pressure from ground force commanders to press for direct control of air assets at too low a level to exploit their capabilities.

d. Surface and air commanders must work as a team, particularly in fighting the land/air and maritime/air battles.

e. Command of air forces in anti-surface-force operations must be retained at the highest practicable level.

f. At any given level of command, the surface force commander should deal with only one air commander.

Mutual Support

3. In the anti-surface-force campaign, air forces may be required to support the surface and sub-surface forces. But equally surface forces may need to operate in support of air forces. This has been long recognised in maritime/air operations where - since the battle of the Coral Sea in 1942 - air power has dominated the maritime surface battle. It is less well recognised in land/air operations, where the perceived inability of air power to take and hold ground is sometimes seen to limit the role of air power in operations against hostile armies.

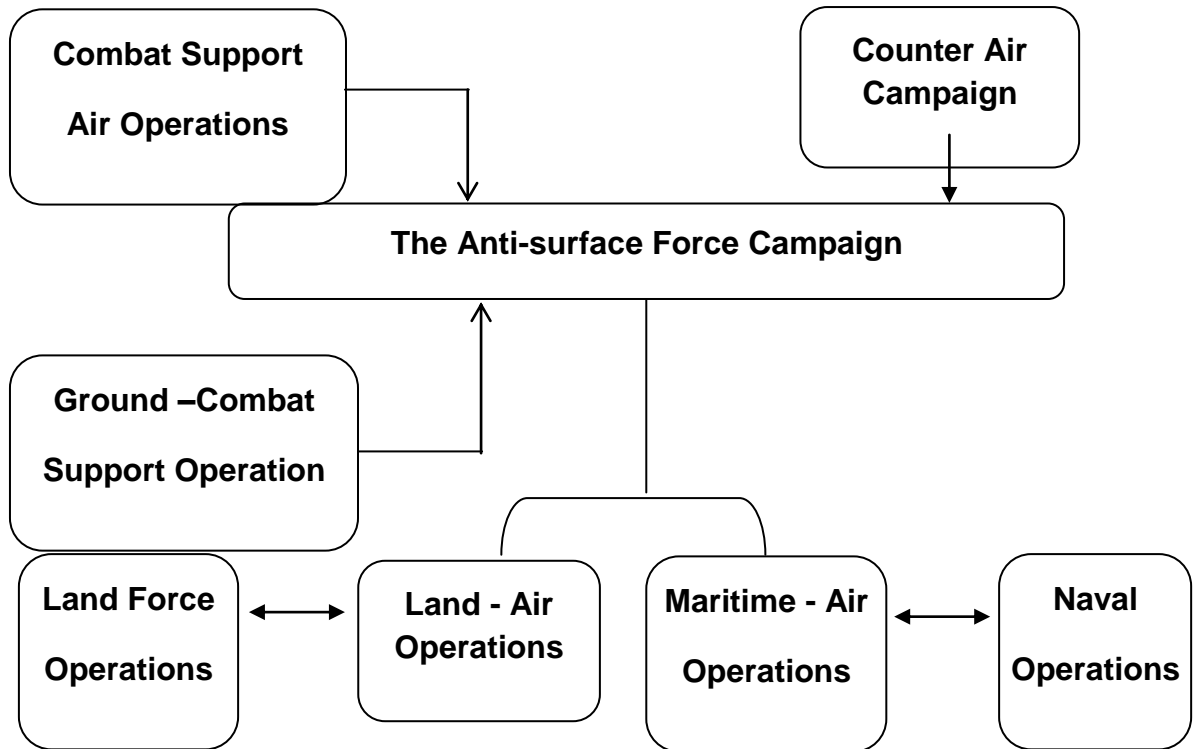
4. Although air power cannot physically be used to occupy ground, it can be used to defeat enemy land forces and dominate, take and hold ground. Three examples serve to illustrate this point. Between 15 May and June 1943, the Italian fortress Island of Pantelleria (garrisoned by 11,000 men) was subjected to concentrated Allied air attack. The island surrendered twenty minutes before the landing of assault troops. The bulk of the air forces then switched their attack to the nearby Island of Lampedusa, which capitulated the next morning. In France during August 1944, German forces south of the Loire (numbering 30,000 men) were vigorously attacked by Allied air power. Although at no time engaged by a sizeable element of Allied ground forces, their position became hopeless and they surrendered, in fact, to an air force. In January 1945 concentrated air power was used to take the fortified town of Gangaw in Burma from the Japanese. The commander of the British 14th Army in Burma, Field Marshal Sir William Slim was later to write "Gangaw was taken by the air force and occupied by the Lushai Brigade - a very satisfactory affair." Since World War II - and as the Gulf War clearly showed - the rapid growth in aviation technology has greatly expanded the opportunities for using air power to dominate, take and hold ground.

5. The anti-surface-force campaign is a truly joint campaign. The different force elements operate together synergistically, offering each other mutual support to achieve objectives. The dominant force element will vary from situation to situation; it will be determined by the nature of the operational conditions.

The Elements of the Anti-Surface-Force Campaign

6. **Introduction.** The ability to prosecute the anti-surface-force campaign effectively depends heavily on the success of the counter-air campaign. At the same time, progress with the anti-surface-force campaign can have important implications for maintaining control of the air; for example, the occupation of airfields by friendly ground forces can be a most effective counter-air measure. Thus, invariably the counter-air and anti-surface campaigns will be integrated.

7. **Structure of Anti-Surface-Force Campaign.** Moreover, like all types of combat air operations, anti-surface force operations will depend on the full range of combat-support air operations and ground combat-support activities. The anti-surface-force campaign itself can be divided into two distinct types of operations: Land-Air Operations, and the Maritime-Air Operations.

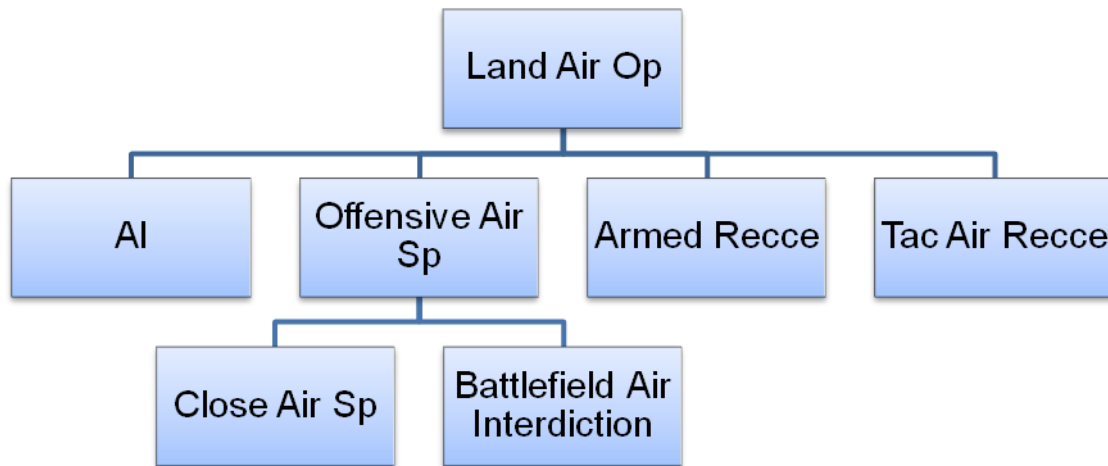


Structure of the Anti-surface-force Campaign

Land/Air Operation

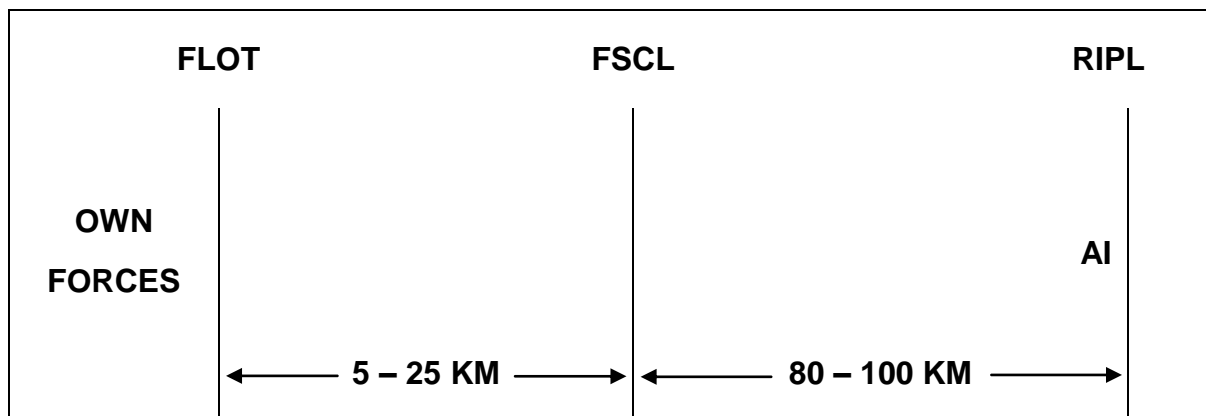
8. **General.** The inherent flexibility, reach and speed of air power allow combat aircraft to project firepower rapidly against enemy land force targets, both laterally and in depth. Land air operations include the following combat air power roles:

- a. Air Interdiction (AI).
- b. Offensive air support (OAS), which itself consists of:
 - (1) Close Air Support (CAS).
 - (2) Battlefield Air Interdiction (BAI).
- c. Armed Reconnaissance (AR).
- d. Tactical air reconnaissance (TAR).



Land - Air Operations

9. **Air Interdiction(AI)**. AI is conducted to destroy, disrupt neutralize or delay the enemy's military potential before it can be brought to bear effectively against friendly forces. AI missions are conducted beyond the range of army delivered weapons, and thus do not require detailed integration with the fire and movement of friendly forces. AI is the best means of exploiting the reach of air power against enemy land forces. It can strike at the enemy where he is most vulnerable and force him to extend his air defences over a far greater depth. The capacity of air interdiction for disruption, diversion and, particularly, delay can produce decisive effects.



Air Planning Line

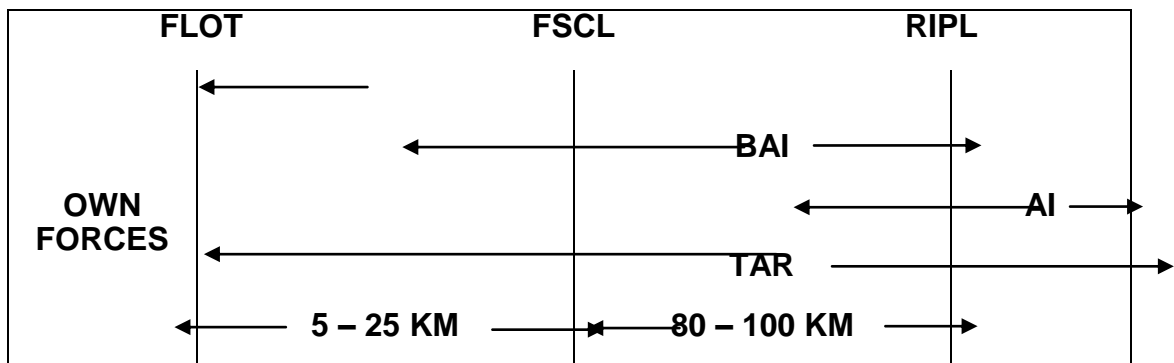
10. **Factors Affecting AI**. The greater the enemy land force's need for supplies and reinforcement, the more effective air interdiction is likely to be. Air interdiction is likely to have only a limited effect against regular land forces holding static positions or guerrilla forces with low logistic support requirements. In contrast, it can have a major impact on an enemy army conducting an intensive highly mobile battle. This will be particularly true for a retreating enemy, the synergism between air and land force offensive actions are most

likely to yield decisive results. However, there is inevitably a delay between an AI attack and its effects being felt at the battle front. Moreover, the effects of interdiction are cumulative, and to be fully effective AI should be pursued for an extended period. Air interdiction also requires careful planning and the expenditure of a great deal of effort. Therefore, it is important that:

- a. AI attacks should be linked with continuous direct action against the enemy's front-line ground troops by friendly air and/or land forces to exhaust his reserves of combat strength and supplies. It must deny the enemy more resources than he is consuming at the front; it therefore calls for joint planning and joint operations.
- b. Diversion of effort away from air interdiction should not be undertaken lightly.

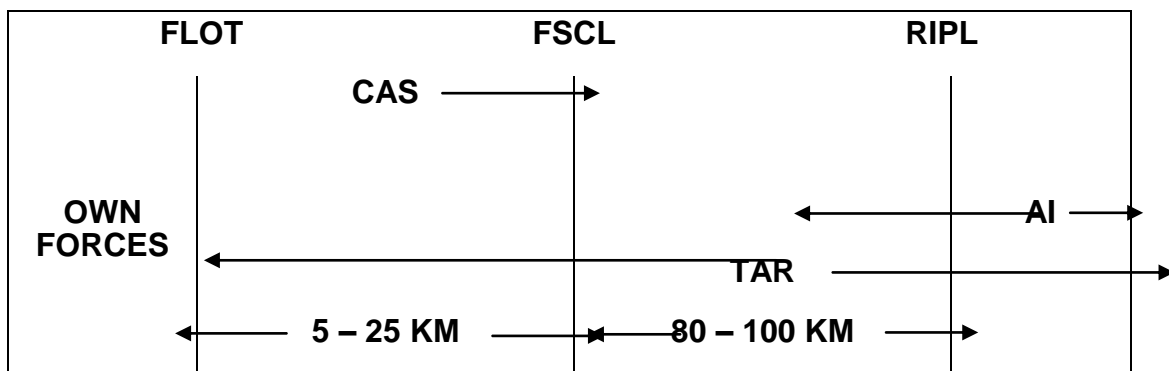
11. **Offensive Air Support (OAS)**. The objective of OAS operations is to directly support land force combat operations. CAS and BAI are direct forms of air support and are collectively known as Offensive Air Support:

- a. **Battlefield Air Interdiction (BAI)**. BAI is defined as air action against hostile land targets which are in a position to affect directly friendly forces and which require joint planning and coordination. It should be noted that, while BAI missions require coordination in joint planning, they may not require continuous coordination during the execution stage. The basic difference between BAI and CAS lies in the proximity of targets to friendly forces and the control arrangements which are therefore needed. BAI attacks are conducted to delay, destroy or neutralize enemy forces which are in the battle area but not yet engaged by friendly land forces they may be used to isolate the enemy forces in the battle zone from his reinforcements and supply and to restrict his freedom of manoeuvre. BAI missions are planned against targets within and beyond the limit of friendly artillery fire i.e. either side of the Fire Support Co-ordination Line (FSCL). Because they are conducted away from the confusion of the active battle front, they are potentially the most effective form of OAS offensive air support.



BAI Planning Line

b. **Close Air Support (CAS).** CAS is defined as air action against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces. The firepower and mobility of aircraft can make an immediate and direct contribution to the land battle, especially against targets which are either inaccessible or invulnerable to available surface weapons. CAS can supplement surface weapons in meeting particular threats; it is particularly important when concentrated firepower is needed and response times are short. In offensive actions, it can be especially effective as a means of offsetting shortages of surface firepower, for example during the critical landing stages of airborne, airmobile and amphibious operations by friendly forces. In defensive actions it may be the only means of providing the level of fire support needed to counter enemy breakthroughs, counter-attacks, assaults and surprise attacks.



CAS Planning Line

12. **Factors Affecting CAS.** CAS has a unique ability to concentrate firepower in time and space when and where required. The impact of such concentrated firepower on morale is likely to be even more important than physical effects it produces. However, CAS is but one of the sources of fire support available to friendly land forces. It can have a decisive effect on a battle, but it can also be problematical to execute effectively. There are inherent difficulties with target acquisition and inevitable complications and limitations in coordinating air attacks with the fire and movement of ground forces. Moreover, CAS can also be an expensive form of fire support if the enemy troops are protected by an effective, layered air defence system. Other factors affecting CAS should be included, i.e. response requirements, control and coordination requirements and column cover missions.

13. **AI versus OAS.** It will usually be necessary to concentrate air efforts effectively on one priority role at any one time; there will rarely be sufficient air assets, or the justification, to attempt more. Whatever role is chosen, it should be prosecuted as a sustained and concentrated effort. One or two missions by a handful of aircraft are unlikely to achieve anything worthwhile. In General, shallow attacks are likely to have a greater impact on the battle in progress, whereas deep attacks are likely to have a greater impact on the conduct of the campaign as a whole. Therefore, in circumstances short of the

greatest urgency or potential gain, AI or BAI are better able to exploit the inherent reach of air power than CAS. Diverting the limited air assets from interdiction to close support tasks will normally only be justified if the timely commitment of concentrated airborne firepower will achieve decisive results in a particular operation or battle. For example:

- a. If friendly ground forces are under great pressure from the enemy and need additional and immediate fire support to avoid defeat, or
- b. If timely additional fire support will ensure the success of a friendly land force offensive operation.

14. **Armed Reconnaissance.** Armed reconnaissance is defined as air missions with the primary purpose of locating and attacking targets of opportunity, i.e. enemy materiel, personnel and facilities in assigned general areas or along assigned ground communications routes. Essentially, it is a form of air interdiction against opportunity targets. Historically, armed reconnaissance has tended to prove to be wasteful in terms of assets and expensive in terms of attrition.

15. **Tactical Air Reconnaissance (TAR).** Although traditionally linked to the other land/air roles, TAR is not a combat role. TAR is air action to acquire intelligence information employing visual observation and/or sensors in air vehicles.

Maritime Air Operation(MAO)

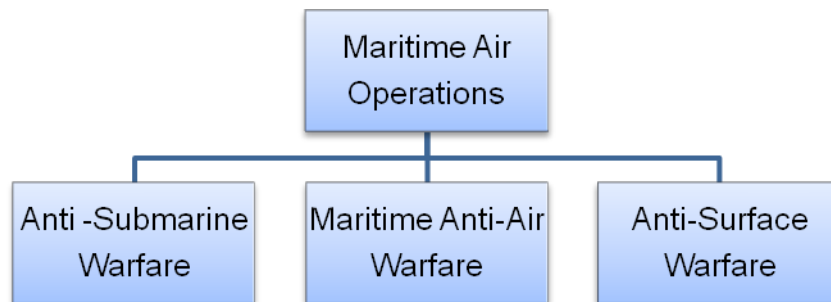
16. **Introduction.** In MAO, air forces work in close co-operation with naval forces to ensure the most effective use of available air assets. To this end, command and control is invariably exercised from a joint or combined headquarters using common procedures to ensure proper coordination of operations

17. **Principles of Maritime Warfare.** There are 3 key principles of maritime warfare:

- a. **Containment.** The aim of containment is to deploy naval and air forces forward at an early stage to inhibit the enemy's own forward deployment, thereby achieving maximum effectiveness from our own operations.
- b. **Defence in Depth.** Whenever and wherever possible all available, air, surface and sub-surface units should be deployed in depth between the expected threat and the defended target. This allows a layered defensive system to be created which presents an enemy with a high risk of detection and which can inflict upon him progressive attrition.
- c. **Keeping the Initiative.** Maritime warfare takes place in a mobile battle environment in which seizing and retaining the initiative is of key importance. Seizing and retaining the initiative allows forward defence to be maintained more efficiently, and it inhibits the enemy's ability to take offensive action.

18. **Maritime Air Power Roles.** Maritime air power roles may be performed independently or in coordination with friendly surface and sub-surface units. Joint operations help to exploit the natural synergies between air and naval forces. Because of their far greater speed and reach, air forces may also have to carry out independent actions. Those combat roles specific to maritime air operations are as follows:

- a. Anti-submarine warfare.
- b. Anti-surface-vessel warfare.
- c. Maritime Anti-Air Warfare.



Maritime Air Roles

19. **Anti-Submarine Warfare.** The potential threat posed by submarine attack will depend to a large extent on geography and hydrograph, but the experiences of World Wars I and II show the scale of damage and disruption that submarines can inflict on both trade and naval operations. The submarine today is a more formidable weapon system than ever; nuclear submarines in particular can cruise at higher speeds and for longer periods than can surface vessels. This superior speed can be used either to maintain contact with surface forces or to attack without unduly advertising the submarine's presence. A skillfully conducted submarine offensive can be switched rapidly from one area to another, and submarine forces may be concentrated or dispersed within relatively short periods of time. Countering such a threat demands an extensive range of capabilities force-mix of air, surface and sub-surface platforms, systems and weapons. The aim then of anti-submarine warfare is to deny the enemy effective use of its submarines. This may be done initially by surveillance, overt or covert, then by deterring the submariner by making him aware of the aircraft's presence and as a result limiting his freedom of action. Alternatively, the situation may demand that the submarine be destroyed. Detection, location and tracking may be done either covertly or overtly, using fixed wing maritime patrol aircraft or helicopters. In turn, these can either work independently or in cooperation with friendly submarines, surface ships or other aircraft. Any or all of these assets may be used subsequently to destroy the submarine; destruction can be achieved by a variety of weapons e.g. homing torpedoes or mines.

20. **Anti-Surface-Vessel Warfare.** The aim of anti-surface-vessel warfare by air is to deny, at the earliest opportunity, the effective employment of enemy naval surface forces. Essentially, anti-surface vessel warfare tasks are carried out in three phases: detection,

identification, and attack. Aircraft, submarines or surface warships can be used in coordinated action to carry out any or all of these phases. For example, in the case of an all-aircraft operation, maritime patrol aircraft or helicopters may be tasked to search, locate and identify enemy surface forces by overt or covert means. A shadowing operation may then be ordered, and it too may be carried out overtly or covertly. Maritime patrol aircraft or helicopter may subsequently be tasked to attack the target independently or in concert with missile-armed Strike/Attack aircraft. They can also be used to provide attack support for those aircraft. Alternatively, attack support could be provided by an airborne early warning aircraft. It should be noted that aircraft are particularly useful for responding to short notice requests by the sea commander to counter short-range enemy surface threats, or for carrying out operations close to shore to counter enemy amphibious forces. Aircraft can also be used to lay mines in waters which are inaccessible to friendly naval forces.

21. **Maritime Anti-Air Warfare.** Maritime anti-air warfare can involve the use of the same aircraft, sensor systems and weapon systems against the same enemy as the counter-air campaign. Thus, while it plays a key part in maritime air operation, maritime anti-air warfare is best considered as an integral element of the wider counter-air campaign.

22. **Employment of Ship-Based and Shore-Based Aircraft.** Where a choice exists between ship-based and shore-based aircraft, the advantages and limitations of each should be evaluated before selecting the optimum force-mix. Ship-based aircraft can react more rapidly from alert. However, shore-based aircraft are not so restricted in size, and thus tend to have longer range and endurance, greater payloads and more capability. Thus, ship-based aircraft are best suited to providing quick-reaction forces and local defence, whereas shore-based aircraft are best suited to providing area cover and the outer defensive layers.

Reference:

1. AP 3000 (2nd Ed)
2. DSCSC Précis.

TOPIC-8

THE STRATEGIC AIR OFFENSIVE CAMPAIGN

The Aim of The Strategic Air Offensive Campaign

1. The strategic air offensive campaign involves the use of air power to strike directly and with precision at the enemy's strategic centres of gravity including leadership, military forces, infrastructure and research and production facilities. Selection of targets is fundamental to the success of the strategic air offensive.

The History Of The Strategic Air Offensive In War

2. **World War 1.** Strategic air offensive operations were first carried out in January 1915 when German Zeppelin airships attacked towns in Norfolk. A total of twenty Zeppelin raids took place that year, inflicting some 1900 casualties, of whom 1700 were civilians. The Zeppelins proved to be relatively vulnerable to air defences and were replaced by the Gotha bombers, which first made their appearance in May 1917. The Gotha force never numbered more than forty aircraft, but it proved to be a strategic weapon whose effects were out of all proportion to its size. The Gotha attacks on London inflicted hardly more damage and casualties than the Zeppelins. But they disrupted war production, caused widespread fear and often panic amongst the civilian population and forced the diversion of a substantial force of fighters from France to defend London.

3. **Inter-War.** During the inter-war period, strategic air offensive action was increasingly seen as a potentially decisive weapon. The RAF's second Chief of Air Staff, Sir Frederick Sykes, saw the strategic air offensive as "the dominant factor in air power". His successor (and predecessor), Sir Hugh Trenchard, came to think in similar terms, and in 1928 declared it to be the "inevitable aerial strategy". Generals Douhet in Italy and Mitchell in the USA shared Trenchard's views and advocated the creation of strong strategic bomber forces.

4. **World War II.** World War II witnessed strategic air offensive action on a grand scale but with mixed results. The bombing of Warsaw and Rotterdam appeared to show the effectiveness of strategic air attacks, but the Luftwaffe was unsuccessful in the Battle of Britain and unable to inflict decisive damage in the subsequent 'Blitz'. German strategic attacks, using V1 cruise missiles and V2 ballistic missiles in 1944 and 1945, were no more decisive. The Allied Strategic Bombing Offensive against Germany inflicted enormous damage. It helped to bring about the destruction of the Luftwaffe as an effective force; it made possible the Allied D-Day invasion; it brought the German economy to a virtual collapse; and it brought home to the German people the full consequences of Germany's aggression. But it did not - on its own - cause Germany to collapse. Strategic air offensive operations did not always succeed, and it came to be realised that if they were to be sustained without unacceptable loss - control of the air had to be established. Experience in Europe also suggested that strategic air attacks could not be fully effective unless they were properly integrated with the other air and surface campaigns. However, the

effectiveness of the US nuclear bombing attacks on the Japanese cities of Hiroshima and Nagasaki seemed to indicate that the strategic air offensive could - after all - be used independently of other air and surface operations and would become the principal weapon in future wars.

5. **Post-World War II.** The post-World War II decades proved that nuclear weapons could deter major attacks, but - because of political factors - could not be used in limited conflicts. Nuclear weapons progressively came to be seen as political instruments, to be used for signaling purposes or as a last resort. Moreover, the appearance of land-launched and submarine-launched ballistic and later cruise - missiles removed the monopoly of the manned aircraft as a nuclear delivery vehicle. The 1970s and 1980s witnessed a number of successful strategic air attacks using conventional weapons. These included the US Linebacker-2 Operation against Hanoi and Haiphong in 1973, the Israeli attacks on the Iraqi Osirak nuclear reactor in 1981 and the Palestinian Liberation Organization headquarters in Tunis in 1985, the US Eldorado Canyon operation against Libya in 1986 and the Iraqi attacks on the Iranian oil installations (an economic target) during the Iran-Iraq war.

6. **The Gulf War.** During the Gulf War of 1991, Coalition strategic air offensive operations achieved major results. The attacks disrupted Iraq's nuclear research and production capabilities and severely damaged its chemical and biological warfare facilities. Half of Iraq's oil-refining capacity was destroyed, the national electricity grid was 'broken', transport feeder routes to Kuwait cut by half and communications were severely disrupted. This enabled Coalition air forces to attack successfully a large number of strategic centres of gravity within a single wave, thus achieving strategic paralysis of the enemy.

7. **Summary.** The doctrinal points which emerge from the history of strategic air offensive operations are as follows:

- a. Strategic air offensive operations can be carried out largely independently of other air and surface operations. But becomes much more effective when fully integrated into theatre campaigns.
- b. Control of the air is needed if strategic air offensive operations are to be sustained. However, it may be possible in certain circumstances to achieve a sufficiently favourable air situation through technological means (e.g. 'stealth').
- c. Unfocused attacks are unlikely to yield decisive results; the target sets must be carefully chosen and linked directly to the grand-strategic object of the war.
- d. Strategic air offensive operations - far more than counter-air or anti-surface force operations - are likely to be shaped by political constraints and aims.

The Elements of The Strategic Air Offensive Campaign

8. The classification of an offensive air operation as 'strategic' is determined not as a function of range, platform type or (necessarily) weaponry; it is determined by the target(s) and objectives. Strategic air offensive action is directed at undermining the enemy's ability and will to continue his aggression by attacking industrial, political and economic target sets, rather than direct action against the enemy's forces.

9. **Campaign Structure.** Experience has shown that the strategic air offensive campaign - like the other types of air campaign - is closely inter-related with all air power elements. The normal range of combat support ground activities are naturally as vital to the effective prosecution of strategic air offensive operations as they are to that of counter-air or anti-surface force operations. Similarly, strategic air offensive operations often rely heavily on specific types of combat support air operations, most notably air-to-air refueling and reconnaissance. There can also be a strong relationship between the progress of the anti-surface force campaign and that of the strategic air offensive campaign. However, the most important interaction which affects the strategic air offensive campaign is that with the counter-air campaign. The success of strategic air attacks - like other types of air operations - depends heavily on the existence of a favourable air situation, but because strategic air attacks can threaten the enemy's ability to continue the war they may be instrumental in helping to create that friendly air situation. They may prove to be the best way of forcing the enemy to commit his air forces to battle and thus expose them to destruction (as was the case in World War II). The strategic air offensive campaign itself can be divided into two basic types of operation: nuclear and conventional. The resultant overall structure of the strategic air offensive campaign is represented graphically at the following Figure.

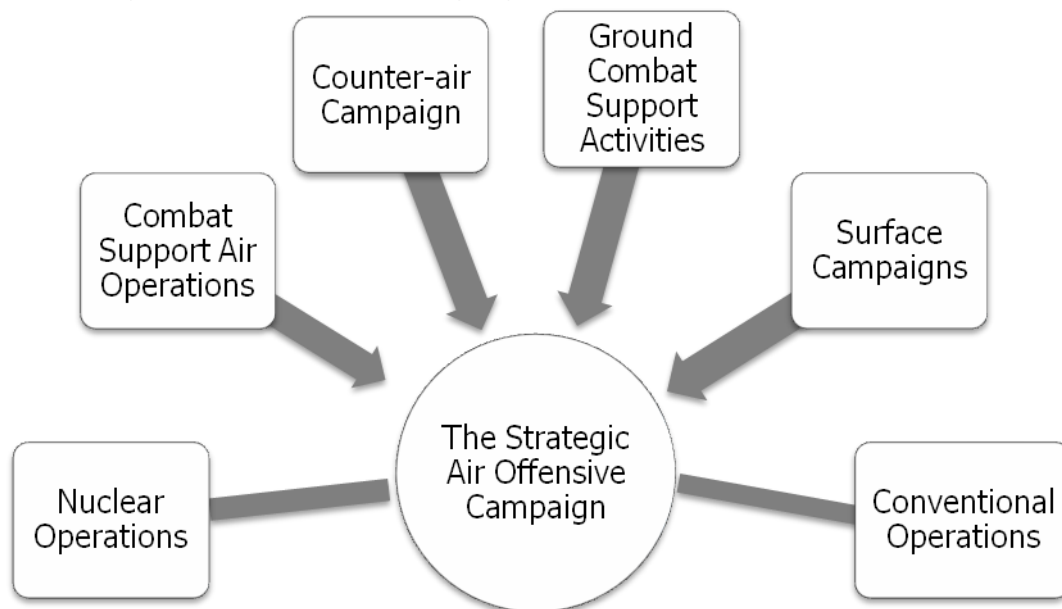


Figure: The Structure of the Strategic Air Offensive Campaign

Nuclear Strategic Air Offensive Operations

10. **General.** All nuclear operations must, in essence, be considered as strategic operations. NATO considers nuclear weapons to be weapons of last resort and not war-fighting weapons in the accepted sense of the term. Nuclear weapons are intended to be used to convey political signals and to act as the ultimate national or multi-national defence sanction and safeguard. Consequently, the authority to decide when or where nuclear weapons should be used rests not with military commanders but at the highest political level.

11. **Deterrence.** The enormous power of nuclear weapons, the lack of experience in their use and the inherent dangers of escalation confer a major deterrent capability on all types of nuclear forces. Nuclear operations can be carried out by land or sea-based cruise and ballistic missiles or by manned aircraft carrying free-fall or stand-off weapons. These systems are essentially complementary instruments of deterrence.

The Conventional Strategic Air Offensive Operations

12. Conventional strategic air offensive operations can be used either for political signaling purposes, to punish small-scale aggressions, or as an integrated element of a theatre campaign.

13. **Political Signaling.** The threat or the use of, conventional strategic air offensive action provides governments with a flexible and responsive instrument of crisis management. It can be used, as a means of signaling political intentions, either independently or in conjunction with other force elements. An aggressor must always take into account that if the victim state has a strategic air offensive capability - it can retaliate immediately and strike at any part of his national infrastructure.

14. **Punishment Operations.** Strategic air offensive action is well-suited as an instrument for punishing small-scale aggressions (e.g. a state-sponsored terrorist attack) where the deployment of troops on the ground would be either impracticable, too costly or disproportionate to the original aggression (and thus contrary to international law). Such operations require precision attacks to avoid inflicting collateral damage.

15. **Campaign Element.** Strategic air offensive operations can also form a valuable element of a joint campaign. Inter-war and World War 2 concepts - that conventional strategic air attacks could, in isolation, force an adversary to submit - have given way to the concept of integrating strategic air action with other air, surface and sub-surface operations.

16. **Target Selection.** The accuracy and destructive power of modern weapons allow significant results to be achieved with relatively small numbers of strategic air offensive sorties. Targets must be selected carefully to concentrate on the enemy's centres of gravity. The targets for conventional strategic air attacks action could include civilian and

military command and control structure, key industries essential to the opponent's war-sustaining capabilities, transportation systems and the enemy population. There will be others and the aim usually will be to attack a large number simultaneously to achieve strategic paralysis overall.

17. **Intelligence.** To be effective, strategic air attacks need accurate pre-attack and post-attack intelligence. Clear and precise intelligence, preferably gathered in peacetime, is a prerequisite for logical target selection. As a corollary, accurate post-attack reconnaissance is essential, not only to deciding whether to mount further operations, but also for assessing the likely impact of the results thus far achieved.

18. **Weapon System Options.** Conventional strategic air attacks can be carried out either by pure missile systems (cruise or ballistic) or by manned aircraft. Essentially, these are complementary systems. Missile systems offer sustained levels of high readiness and a strong probability of arrival, attributes which could be of key importance in mounting selective attacks. However, manned aircraft also possess important advantages, particularly for sustained attacks:

a. **Accuracy.** Manned aircraft - using for example laser-guided weapons - currently offer greater accuracy than missiles for attacking fixed point targets such as bridges. They can also be used autonomously against moving targets, whereas surface-to-surface missiles need targeting information from a third party.

b. **Flexibility.** Surface-to-surface missiles are inherently far less flexible than manned aircraft. Their warhead and guidance systems are normally optimized to particular target type and this limits the scope of their employment. The manned aircraft can be switched between strategic air offensive tasks and a wide range of other tasks as the operational situation demands.

c. **Cost-effectiveness.** Missiles are less costly than manned aircraft, but they are one-shot weapons and carry relatively small payloads. Unless attrition is exceptionally high, manned aircraft tend to be far more cost-effective than surface-to-surface missiles for sustained strategic air offensive tasks.

TOPIC-9

SECTION-1

COMBAT SUPPORT AIR OPERATIONS

Combat Support Air Operations

1. **Definition.** Combat support air operations are those designed to enhance or support the effectiveness of air, surface and sub-surface combat forces.
2. **Types of Combat Support Air Operations.** Combat support operations fall into the following categories:
 - a. Tactical Air Transport Operations.
 - b. Air-to-Air Refueling (AAR).
 - c. Search and Rescue Operations (SAR).
 - d. Electronic Warfare (EW).
 - e. Surveillance and reconnaissance.
 - f. Airborne Early Warning/Airborne Warning and Control System (AEW/AWACS).

SECTION-2

AIR TRANSPORT OPERATION

Introduction

3. Although the value of air transport was recognised from the early days of military aviation, development was limited by financial restrictions. Because of global commitments during the Second World War and the developments of airborne warfare, the requirement for air transport forces grew rapidly. For example, the RAF Transport Command was formed in 1943 and by the end of the war the RAF was operating over 3,000 transport aircraft.

4. Air transport forces were involved in most of the major campaigns as, for example, in the airborne operations in Normandy, at Arnhem, during the Rhine crossing and in Burma. World-wide air routes and aircraft delivery services were also maintained.

5. **Definition.** Air transport operations are defined as those, which involve the movement, by air of personnel and cargo within and between theatres of operation. Air transport operations can be conducted in support of all types of sea, land and air forces. Mobility is a key requirement, particularly for small-scale armed forces with worldwide commitments. Mobility can compensate for lack of numbers by allowing the available forces to be rapidly deployed, redeployed, supplied or evacuated. Air transport is an indispensable element in this. However, air transport provides more than just a means of moving troop and cargo. It can act – particularly in peacetime – as a tool for building trust and confidence around the world.

Advantages of Air Transport

6. **Freedom of Communications.** By its wider choice of routes, subject to diplomatic clearance for over flight, air transport may enjoy freedom of communication when surface lines are blocked or non-existent.

7. **Tactical Mobility.** The tactical use of air transport increases the mobility of forces in the field.

8. **High Speed.** Air transport can deliver men and materiel more quickly than other means of transport. The speed of reaction thus possible in delivering troops or urgently needed supplies may well be a key factor in preventing a minor problem developing into a more serious situation.

9. **Flexibility.** Air transport aircraft can perform a wide variety of tasks and can be switched, fairly rapidly, from one role to another by changes in aircraft equipment. However, this flexibility can be achieved only if aircraft are suitably designed, aircrew are suitably trained, and equipment is readily available for ground handling and for converting aircraft from one role to another. Examples of the varied roles of air transport include scheduled services, airborne operations, air-logistics support, VIP flights, aero medical evacuation and SAR.

Limitations of Air Transport

10. **Load.** Compared with surface transport, aircraft carry only limited loads. Loads must be very carefully planned if maximum use is to be made of the space and payload available. This limitation must not be overstated, however, because the payload capacity of a fleet of modern transport aircraft can be substantial. Constant research and development is reducing the number of items of military and other equipment which cannot be made air-portable but some items, such as tanks and heavy items of engineer plant, cannot be broken down into smaller units and their bulk makes their movement by air an expensive business. Thus, despite the advent of very large, fast transport aircraft, load restrictions are still a limiting factor, and for large-scale military deployments some complementary use of surface transport may be necessary in some cases.

11. **Ground Organisation.** However urgent the task, an air transport force cannot function properly without a certain minimum ground organisation. The role and complexity of this organisation will, of course, vary according to the task. At one end of the scale there may be a highly specialized terminal base for strategic transport while at the other there may be merely a small jungle fort with a big enough gap in the trees to allow a helicopter to land. The following facilities, however, are normally required:

- a. Bases from which to operate.
- b. An air movement organisation with reception, loading, unloading and despatch facilities.
- c. If the route is long, staging posts with facilities for refueling and limited maintenance.
- d. Efficient surface-to-surface and air-to-ground communication.
- e. A meteorological service.
- f. Navigational aids en route and air traffic control at bases.

Depending on the nature of the operation, these facilities may be simple or complex. Mobile Air Movement Squadron (MAMS) teams and aircraft servicing teams are used to 'activate' routes in advance of operations away from the regular routes.

12. **Vulnerability.** Transport aircraft are normally unarmed, relatively slow and have poor maneuverability. In consequence, they are vulnerable and can operate efficiently only in circumstances when they are relatively free from enemy interference. If the air situation is unfavorable it may be possible to elude the defences by evasive routing by operating at night, at low level, or in restricted weather conditions. Electronic and other defensive measures may also be used. The potential airlift may, however, be reduced by the limitations imposed by the air situation.

13. **Over flying and Staging Rights.** The need to obtain permission from nations whose territory it is necessary to overfly, or to establish staging posts on, can be important limitations on the use of air transport. It is possible to negotiate long-term arrangements on some routes but foreign governments can withdraw permission without notice and, for political reasons, have done so on a number of occasions. This limitation means that contingency plans for reinforcement must include alternative routes, which in turn may require the use of different aircraft types. Longer routes may result in a slower reinforcement unless more aircraft are used. However, surface transport can suffer from similar limitations in rights of passage. For example, in territorial waters, and a lack of over flying rights does not imply that air transport is necessarily at a disadvantage compared with surface means.

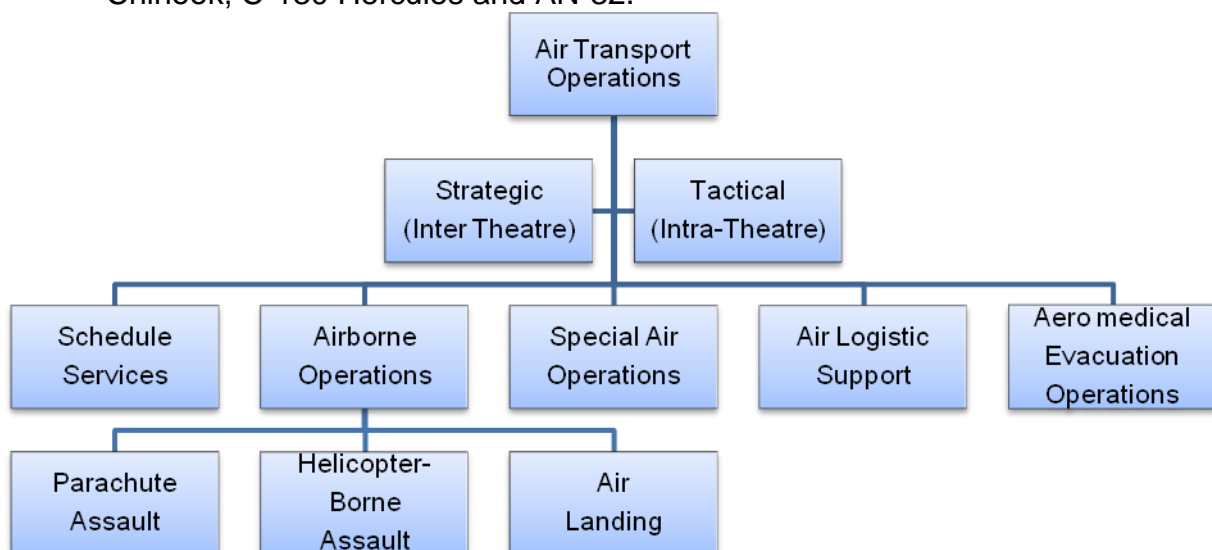
14. **Weather.** Adverse weather conditions may affect air transport operations.

Air Transport Categories

15. Transport aircraft are classified according to the broad category of air transport support they can provide:

a. **Strategic Transport (ST).** Aircrafts are designed primarily for carrying personnel and logistics between theatres of operations. Aircraft, such as C-5A Galaxy, C-141, Boeing-707, VC-10, IL-76, AN-124 and AN-225 are classified as ST aircraft.

b. **Tactical Transport (Tack T).** Aircrafts are designed primarily for carrying men and material within an area of operations. It includes support helicopters and medium range aircraft e.g. MI-8, Puma and Chinook, C-130 Hercules and AN-32.



Role Structure of Air Transport Operations

16. It is sometimes difficult to draw a clear distinction between the two classifications. When, for example, a long range flight terminates in a low level phase and Para-drop, this can either be represented as a strategic mission with a tactical dimension or vice versa. The question is further blurred because, while some strategic airlifts have a tactical capability, there are also some tactical transports like C-130, which have certain inter-theatre qualities and applications.

General Characteristics

17. The characteristics required of the various aircraft are as follows:

a. **Strategic Transport.**

- (1) A range of about 3500 nm with a good payload.
- (2) A large passenger/cargo compartment.
- (3) A high cruising speed.
- (4) A rear front loading capability.
- (5) An all-weather capability.

b. **Tactical Transport (Medium Range).**

- (1) Rugged construction and the capability to operate from any hard and flat surface.
- (2) A radius of action in the order of 1000 nm with full payload, a ferry range around 4200 nm and an in-flight refueling capability.
- (3) A cargo compartment capable of carrying the largest single item of air portable Army and Air Force equipment required in the operational area.
- (4) The ability to carry out airborne assault operations and air supply missions.
- (5) Large rear loading doors and integral ramps to facilitate rapid loading and unloading.
- (6) An all-weather capability.
- (7) A good cruising speed along with good slow flying characteristics.
- (8) The ability to change role quickly, e.g. from cargo to airborne assault, passenger to air supply.

c. **Tactical Transport (Short Range).**

- (1) A radius of action of about 200 nm.
- (2) Capable of operating from unprepared strips not more than 1500 feet in length.
- (3) Able to carry light vehicles and guns (land rover, 105 mm gun etc).
- (4) Sturdy and robust, capable of all-weather operations.
- (5) Fitted with large rear doors and integral ramps to facilitate rapid loading and unloading.
- (6) Ferry range of about 1000 nm.
- (7) Capable of air dropping.
- (8) Rugged and simple construction to permit lengthy periods of operation under field servicing conditions.

d. **Support Helicopters.**

- (1) A radius of action of about 120-130 nm with full payload.
- (2) Capable of carrying under slung loads (land rover, 105 mm gun).
- (3) Worldwide operating capability.
- (4) Capable of carrying armament.
- (5) Minimum servicing requirements.
- (6) A good night/poor-weather capability.
- (7) Capable of being adapted for Search and Rescue (SAR) operation.
- (8) A ferry range of about 600 nm or be air portable in medium range tactical transport aircraft.
- (9) Tactical refueling capability.
- (10) Cross-operating capability between aircraft and their bases.

Role

18. Air transport operations encompass five major roles:

- a. Scheduled Services.
- b. Airborne Operations.
- c. Special Air Operations.
- d. Air Logistic Support Operation.
- e. Aero medical Evacuation.

19. **Scheduled Services.** The term scheduled services, is the name given to the routine airline-type operations when it would clearly be uneconomic not to make use of the large airlift capability of the air transport force. Using the force to operate scheduled services between the home base and overseas areas provide training for air and ground crews and fulfils a requirement for peace-time movement of personnel and materiel which would otherwise have to be met by charter of civil aircraft. A further advantage derives from exercising the routes, which may be needed for strategic reinforcement; staging posts are given practice in fulfilling their task, and the political impact of military aircraft movements is reduced. Special flights may be under taken of a specific load other than scheduled services. It may vary from delivery of a load to a remote airfield to carrying VIPs on an extended tour.

20. **Airborne Operation.** These are operations involving the movement of combat ready forces and their logistic support into an objective area by air. The combat forces and their support may be landed or dropped from fixed wing aircraft or helicopters.

21. **Special Air Operation.** Special air operations include clandestine operations such as the delivery and recovery of agents, patrols, and psychological operations such as leaflet dropping and voice broadcasts. Transport forces may be employed in flood relief, financial relief and earthquake relief operations and the evacuation of civilians from distressed areas.

22. **Air Logistic Support Operation.** These include air supply, movement of personnel, evacuation of casualties and prisoners of war and recovery of equipment and vehicles. These operations do not normally involve the carriage of troops ready for immediate combat.

23. **Aero-medical Evacuation.** In limited war, there would always be considerable spare capacity in aircraft returning from operational areas but occasionally it would be necessary to provide aircraft specifically for aero medical evacuation. The normal practice is that casualties await aircraft rather than aircraft await casualties; in this way air movements can be organised so that the flow of returning aircraft is not interrupted. However, should the need arise, special flights could be provided.

BAF Transport Fleet

24. BAF air transport fleet is comprised of AN-32 and C-130 tactical transport aircraft, MI-17, MI171 SH and Bell-212 helicopters. BAF transport fleet under takes all the major roles of air transport operation at a tactical level. BAF C-130 aircraft could be employed in the entire role ranging from tactical to strategic. Presently both BAF C-130 aircraft and MI-17 and Bell-212 are employed in air transportation role in various missions under United Nations Organisations.

Bangladesh Army Aviation

25. Bangladesh Army has an aviation wing with a mission to provide integral air support as air arm of the army. Presently it is operating Cessna-125, which is a trainer/ light utility aircraft. The major roles of army aviation are:

- a. Reconnaissance, observation and battlefield surveillance.
- b. Target acquisition and direction of artillery fire.
- c. Airborne FAC.
- d. Assist in command and liaison.
- e. Conduct courier service.

Civil Aircraft

26. Civil aircraft can be used under charter arrangements to supplement military airlift capability. Most civil aircraft are suitable only for carriage of passengers, but there is an increasing number with a cargo capability (reinforced floor, large freight doors). These can be used in the strategic role. Some owners and aircrew may be reluctant in peacetime to hazard their aircraft or themselves in areas of conflict. However, in times of tension, grave national emergency or in war, a government may take power of direction, under which civil aircraft could be used.

SECTION-3

AIR-TO-AIR REFUELLING OPERATIONS

27. **Definition.** Air-to-air refueling operations are those which involve the transfer of fuel from one aircraft to another in flight.

28. **Applications.** Air-to-air refueling can contribute to combat-air and combat support air operations by extending the range payload time-on-task and flexibility of aircraft. It can be used to support all three air campaigns as well as all types of combat air support operations. Air-to-air refueling can be used to enhance the capabilities of virtually all types of aircraft in almost all air power roles. For example, it enables:

- a. Short-range fighter-bomber aircraft to be given strategic reach and, for example, to be used for strategic air offensive tasks.
- b. Combat or combat-support air missions to be extended in duration and range.
- c. Aircraft under threat of attack to be held airborne for survival or delayed tasking.
- d. Combat aircraft to be held airborne, thus increasing their ability to respond to short-notice tasks.
- e. Short-range combat aircraft to escort large combat or combat-support aircraft over long ranges.
- f. Deeper incursions and variable routing to be made to targets.
- g. Range and mission endurance to be limited only by aircrew fatigue, weapon availability and engineering constraints.
- h. Aircraft to take-off at lower weights, permitting greater opportunities for short-field operations (and hence dispersal) with greater weapon loads.

29. **Roles.** Air-to-air refueling operations are divided into two roles:

- a. **Towline.** In the towline role, tanker aircraft fly a set pattern (typically a racetrack) in a predetermined position. Aircraft that require air-to-air refueling plan their routes via that pattern to take on fuel as required.

b. **Trail.** The trail role can be carried out in one of two ways: accompanied transits and en route rendezvous. In accompanied transits, the tanker aircraft escorts the receiver aircraft along a route transferring fuel as required. The en route rendezvous technique requires the tanker and the receiver aircraft to meet at predetermined locations along the route to conduct air-to air refueling.

30. While air-to-air refueling offers greatly enhanced flexibility and capability to a force, it nevertheless has important limitations. The process of in-flight refueling takes a finite time, during which both tanker and receiver aircraft are very restricted in their manoeuvres. Moreover, there is a limit to the number of aircraft that a tanker can refuel at any instant. Refueling a multi-aircraft formation can take a long time, requires a large volume of airspace and render tankers and receivers vulnerable to enemy attack. Consequently, air-to-air refueling operations - particularly large-scale operations - should, whenever possible, be planned to take place outside hostile airspace.

31. Tanker ground survivability is another important wartime planning factor. Large tankers are very vulnerable on the ground. It is impractical to protect them with hardened aircraft shelters, and even constructing viable revetments can pose major problems. Hence, dispersing tankers away from their main base (off base dispersion) will generally be the best survival option. However, this will complicate planning, especially for multi-tanker operations. It will, in any case, be limited by the availability of dispersion airfields with the effective communications and extensive fuel supplies that are essential to sustained tanker operations.

32. Air-to-air refueling operations are subject to a range of operating constraints as well as operational constraints. Diversion requirements in the event of a failure to refuel mean that receivers have to be refueled frequently and the route must come within range of suitable diversion airfields with acceptable weather states. That in turn can pose serious problems, particularly for oceanic transits in winter where the lack of such airfields and the frequency of poor weather can often lead to major delays. Similarly, equipment failures must be expected, and thus tanker and receiver redundancy have to be built into any in flight refueling plan. Air-to-air refueling is very much like a chain; the failure of anyone link can break the chain and lead to the failure of the complete operation.

SECTION-4**AEROSPACE SURVEILLANCE AND RECONNAISSANCE OPERATIONS**

33. **Applications.** Aerospace surveillance and reconnaissance provide the information needed to formulate strategy and plan and execute operations by friendly air, surface and sub-surface forces. Information can be collected from a variety of sources - such as photographic, radar, and opsonic sensors - and the latter can be mounted in a variety of aerospace vehicles (for example manned and unmanned air vehicles and space-based systems). Certain ground-based systems (for example over-the-horizon-radars) can also have important aerospace surveillance and reconnaissance applications. A critical function of these systems is to detect abnormalities in the behaviour of actual or potential enemies. To do this successfully in war, it is essential to have a dynamic aerospace surveillance and reconnaissance programme in peace. Long-range surveillance aircraft can also be used to deter potential adversaries by letting them know that their moves are being monitored. Deployments of United States reconnaissance and surveillance aircraft to Saudi Arabia, Chad and Egypt in the mid-to-late 1980s were examples of this.

34. **Force Mix.** Space-based systems, aircraft and ground-based systems have complementary attributes for reconnaissance and surveillance tasks. Due to their elevation, space-based systems offer the widest coverage. But geosynchronous satellites suffer from relatively poor image definition, while low-Earth-orbiting satellites suffer from extended re-visit times. Manned aircraft offer high levels of definition and flexibility but tend to be more vulnerable than other systems. In contrast, unmanned air vehicles lack flexibility and reach but are relatively cheap and survivable. Ground based systems offer permanent cover but normally only within a specific area. The overall force mix needed will vary from nation to nation depending on perceived strategic, operational and tactical needs.

35. **Interpretation.** The usefulness - in both peace and war - of the imagery produced by air reconnaissance and surveillance operations will depend on the speed and skill with which it is interpreted. Speed is needed because out of date information may do more harm than good, particularly if is to be used for targeting purposes. But achieving the required speed demands extensive resources. Skill is equally important, for wrongly interpreted information could be worse than no information at all. For strategic reconnaissance, interpretation skills involve a high level of subjectivity because they are centred mainly' on reading intentions from actions. At the tactical level, the problems of interpretation tend to centre on training and experience. For example, a tank may be blown to pieces by a direct hit from a laser-guided bomb, but the reconnaissance imagery may not be able to detect any of these pieces of the tank; even if it can, the interpreter may fail to recognise their significance.

SECTION-5

SEARCH AND RESCUE OPERATIONS

36. **Definition.** Air search and rescue operations involve the use of aircraft (usually helicopters) to locate and rescue personnel in distress and, in particular, to recover aircrew who have abandoned their aircraft.

37. **Planning Considerations.** Search and rescue helicopters and longer-range rescue aircraft tend to be unarmed and therefore vulnerable to enemy attack. This is particularly important when downed aircrew have to be rescued from within enemy territory or near to enemy coasts. In these circumstances it may be necessary to mount what are known as combat search and rescue operations, involving combat forces such as attack helicopters or fighter-bombers to provide covering firepower for rescue aircraft. Such operations can be costly, because the enemy may know the area in which an aircraft has crashed and deploy air and surface forces to that area. Hence, combat search and rescue operations should only be undertaken if the prospects of success are strong or if there is an overriding operational reason to rescue the downed aircrew.

SECTION-6

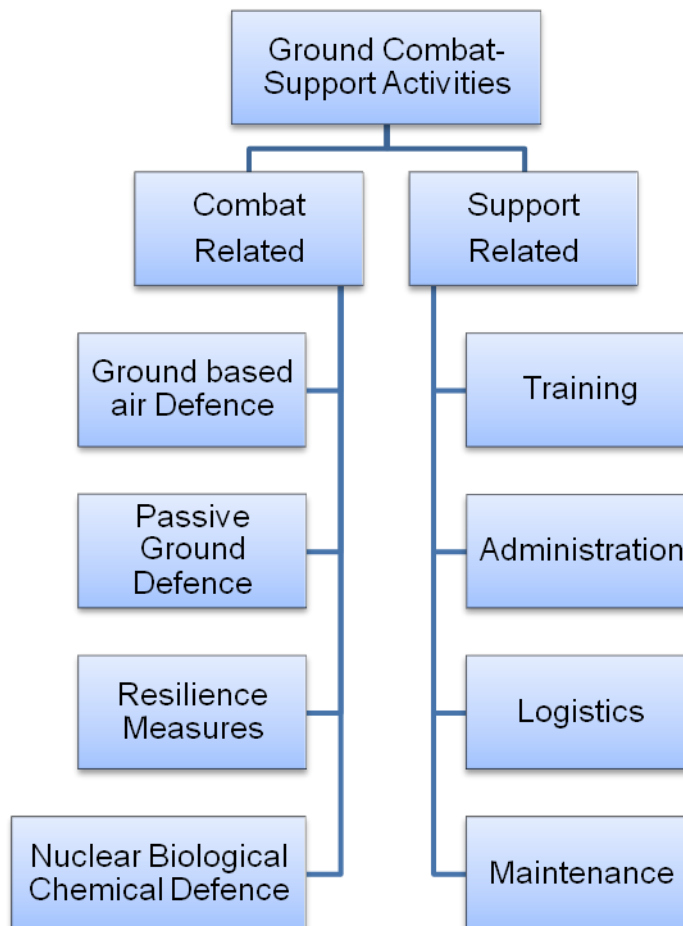
ELECTRONIC WARFARE OPERATIONS

38. Electronic warfare involves the military use of electronics to determine, exploit, reduce or prevent hostile use of the electromagnetic spectrum and actions taken to ensure its effective use by friendly forces. The details of the Electronic Warfare are discussed in separate subject.

Reference: AP 3000 (2nd Edition)

TOPIC-10**GROUND COMBAT SUPPORT ACTIVITIES****Historical Background**

1. The successful German airborne assault on Crete in May 1941 prompted Winston Churchill to give his famous direction "Every airfield should be a strong hold of fighting air-ground men, and not the abode of uniformed civilians in the prime of life protected by detachments of soldiers...It must be clearly understood by all ranks that they are expected to fight and die in the defence of their airfields.". More recent history has provided ample proof that air operations cannot be sustained unless the bases from which they are mounted can survive air and ground attack. In the Arab/Israeli Six-Day War of June 1967, the inability of the Arab Air Forces to survive concentrated attacks on their bases resulted in their effective destruction within two days. In the Vietnam War, small-scale Vietcong ground forces, using simple weapons, were able to inflict serious damage on complex installations and costly aircraft.



Ground Combat-Support Activities

General

2. Air installations present potentially lucrative targets for attack. They are geographically fixed, generally in open countryside, difficult to conceal, susceptible to peacetime observation and usually have long perimeters. Moreover, they contain areas packed densely with personnel and with valuable, complex and costly equipment. However, because airfields (even dispersed airfields) tend to be fixed, so is the defensive battlefield. Therefore, a defence plan be prepared and developed in advance and the defences practised and perfected in peacetime.

3. **Command and Control.** Effective command and control is essential for effective ground defence. Commanders normally delegate the authority for control of ground defence operations to Ground Defence Commanders who, together with their staff, normally operate from ground defence control centres. The ground defence control centre should be collocated with air, engineering and logistics operations in a combat operations centre to ensure full integration. An alternate ground defence control centre will also be required and should be located in the alternate combat operations centre; it should be able to assume ground defence command immediately if the primary combat operations centre becomes inoperative.

4. **Allocation of Resources.** Ground defence resources are always finite, and priorities have to be set. Those units which are assessed as being most at risk from ground and air attacks must clearly enjoy a high priority for defensive resources. However, the units which must have the first call on defensive resources are those which have the greatest operational importance. This protection can be in the form both of active and passive defences. The former is concerned with using friendly combat forces to counter enemy attacks, the latter with reducing the effects of the enemy attacks which penetrate the active defences.

Active Defence

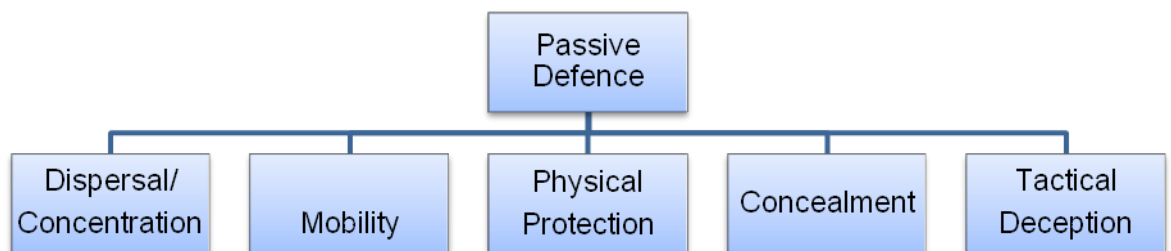
5. **Active Air Defence.** Active local and point air defences can be fully effective only if they are integrated into the wider air defence organization. They not only help to protect air installations from air attack, but also form an integral part of the counter-air campaign by inflicting attrition on the enemy air forces.

6. **Active Ground Defence.** The aim of active ground defence should be to prevent or pre-empt attack rather than to exact retribution. Since prevention is a continuing requirement whenever a threat exists, active ground defence cannot be relegated to distant, on-call forces; it must be the responsibility of those personnel on the threatened bases. For this reason, all air force combatant personnel should be trained in active ground defence.

7. **Active Ground Defence Organization.** It is unlikely that sufficient manpower will be available to meet all needs, so active ground defence of airfields will always represent a compromise between resources and requirements. Careful planning is essential if the best use is to be made of the available resources. Plans should be based on the principles of defence and should take into account the defensive problems which are peculiar to air force installations. Such consideration would include the need for close-in defence, reserve forces, aggressive defence and defensive positions, in addition to the tactical isolation and size of airfield in question. The majority of air force installations are not sited to take account of ground tactical considerations. Perimeter fences, where they exist, are designed primarily to control access in peacetime. They are generally inappropriate as boundaries behind which military forces could be expected to operate effectively in countering, or preparing to counter, a determined attack by an enemy armed with modern weapons. A ground defence area should be established so that military forces can patrol, clear fields of fire, establish field defence, deploy detection systems and erect barriers. The extent and boundaries of the ground defence area have to be agreed between the station commander, the local civil authority (normally the civil police) and the area Army authority.

Passive Defence

8. **Definition.** Passive defence includes all measures, other than active air defence taken to minimize the effectiveness of hostile air action. These measures include deception, dispersion and the use of protective construction. They are shown graphically below:



The Elements of Passive Defence

9. **Rationale.** Active defence can be expected to blunt attacks on friendly installations, but a number of attacks - particularly air attacks - will inevitably get through the active defences. Installations must be robust and resilient; they should be protected as far as is practical from attacks, not only with conventional weapons, but also with chemical and biological weapons and in conditions of nuclear fall-out. All these activities are inter-related, as indeed they are with active defence and post-attack recovery. However, for simplicity, they are here considered separately

10. **Concentration or Dispersal.** In general, dispersal offers the best protection against air attack, whereas concentration offers the best opportunity to defeat ground attack. The balance between dispersal and concentration will thus be dynamic and will be closely linked to the nature of the threat. Basing policies should be formulated to enable this balance to be changed in response to an evolving threat. In practice, the greater the number of potential basing options, the greater the targeting difficulties faced by an attacker. The degree to which the resources of a unit can be dispersed is a question of judgement for the unit commander. Vital assets which cannot be adequately protected should be dispersed to aid their survivability.

11. **Mobility.** The periodic movement of air force units between a number of different operating locations - i.e. mobile basing - can confuse the enemy and thus aid survivability. Clearly, a unit can only be targeted if its location is known, and thus frequent movements to new locations can force the enemy to devote attack forces to the less operationally-rewarding tasks of armed or unarmed reconnaissance. However, moving units to different locations takes time, incurs disruption and reduces sortie rates. Supplying dispersed units that are moving their base frequently can be highly problematical, and deep servicing, of aircraft in such circumstances becomes very difficult. Moreover, exercising effective command and control in such a situation is complicated. Furthermore because mobile basing will normally involve the use of unhardened airfields or even roads, the consequent loss of physical protection will increase vulnerability if such bases are found by the enemy. In short, mobile basing makes everything more difficult. Hence, it will normally only be justified when operations from main bases become unsustainable and when an abundance of alternate bases is available.

12. **Physical Protection.** An airfield, air installation or deployed unit will contain key personnel, equipment and facilities, which must be protected from small arms fire and bomb and rocket splinters. Where unit self-help is the only source of protection, it must set priorities as to what and who should be protected. Deciding the level of protection that should be provided is the responsibility of the unit commander.

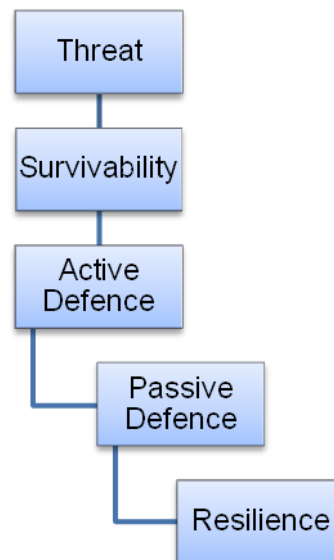
13. **Concealment.** Concealment of installations and equipment can provide valuable contribution to survivability, particularly against fast, low-flying aircraft. Concealment can either confuse enemy target acquisition or reduce the, time from acquisition to weapon release; in either case the accuracy of the attack is reduced. Concealment can also deny the enemy the ability to pinpoint and designate individual targets and gather critical intelligence. Visual concealment can be achieved by applying

tone-down and camouflage, augmented by deception techniques. Reducing or disguising a unit's electronic signature (particularly that of a mobile unit in the field) can also make a major contribution to its survivability. An effective emission control policy forms a key part of a unit's concealment plan.

14. **Tactical Deception.** Tactical deception includes not only the deployment of decoys, but also activities such as varying unit procedures, obscuring and disguising the purpose of buildings and facilities and deploying radar reflectors to distort ground attack navigation and bombing radars. Tactical deception is closely associated with concealment; therefore, concealment and deception measures must always be planned and implemented in concert.

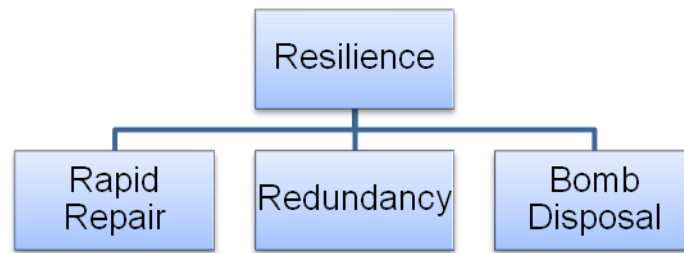
Resilience Measures

15. **Rationale.** Linked to active and passive defence are resilience measures. Whatever the effectiveness of the defensive measures, it will always be prudent to assume that a base will sustain at least some damage. To ensure that operations suffer the minimum disruption, each base must therefore have the capability to restore rapidly its essential services and facilities. This is the province of resilience measures. Hence, active, defence, passive defence and resilience act as successive layers in the overall air base survivability package as shown graphically below:



The Air Base Survivability Layers

16. **Spectrum of Measures.** Air base resilience can be enhanced by a variety of measures, e.g. bomb disposal, rapid repair and redundancy; these are shown graphically below:



Resilience Measures

17. Unexploded ordnance remaining on a base after a ground or air attack can present serious hazards and may need to be disposed of quickly to prevent further damage and/or allow friendly air operations to recommence. A rapid repair capability is also needed, both for operating surfaces and for essential base services (eg electricity, water, fuel supplies, communications). Such a capability will normally require considerable civil engineering plant and manpower which should whenever possible be immediately available to a base when it is attacked. It will also require specialist damage control teams to direct the repair efforts. But rapid repair - however fast - may still involve delays in restoring an air base to an operational condition. Thus, a measure of redundancy will be needed to ensure that operations can continue while repairs are underway. Again this will apply both to services and systems as well as run-ways. To achieve service and system redundancy, particular care should be taken to duplicate key service nodes; this will ensure that a single hit does not bring operations to a halt, even temporarily. Runway redundancy can be provided through a number measures. For example, minimum operating strips can be identified on taxiways or disused runways; taxi tracks can be built from the base to nearby stretches of straight road; and auxiliary runways can be built to minimum standards and reserved for wartime use only.

Nuclear, Biological and Chemical Defence

18. **Planning.** Operational planning should take into account nuclear, biological and chemical defence requirements, while the specific defence measures taken should be based on the theatre threat and the operational situation. A balance must be struck between achieving total protection and ensuring the minimum constraints on air operations. The aim must be to produce the maximum operational capability that is practicable within the existing conditions.

19. **Organization.** Successful nuclear, biological and chemical defence relies heavily on effective warning and reporting. However, the channels of such reports and warnings have to reflect local, national and Alliance responsibilities. Therefore, staffs have to interpret national and Alliance warning and reporting requirements into explicit instructions for individual units. During periods of tension there is little time to improvise defence measures. Appropriate plans must be made in advance and rehearsed frequently. All personnel must be able to contribute to a unit's defence organization, and defence skills and knowledge must be maintained in peacetime. The organization should, as far as possible, be based on the normal command structure and provide the following capabilities:

- a. Command and control, including data handling.
- b. Nuclear, biological and chemical reconnaissance (monitoring and survey teams).
- c. Support elements, including contamination and exposure control.

Support-Related Ground Combat-Support Activities

20. **General.** Support-related ground combat-support activities include training, administration, logistics and maintenance.

Training

21. Sound and effective training is a key factor in the effectiveness of all types of all military forces, but for air forces it is particularly important. The air is the least forgiving environment in which to fight, and high levels of operational proficiency are vital. While technology is an important factor in air power effectiveness, it is of little use unless the aircrew have the appropriate skills to exploit to which is peculiarly demanding on the individual and which can involve a high level risk if not carried out proficiently. Similarly, ground branches – such as engineering and air traffic control etc-involve highly demanding skills which can be critically important to air operations, both in peace and war. Hence, training needs to be rigorous and representative of operational conditions.

22. It is particularly important that all forms of training should focus not merely on individual skills, but on developing a collective war-fighting capability. An essential element of this is realistic large-scale exercises which are designed as far as is practicable to replicate likely wartime conditions. For example, exercises should include disrupted communications and logistics, degraded command and control and a representative opposing force. In all cases flexibility and innovation must be developed at the appropriate level. The inherent flexibility of air power can only be fully exploited if the people who exercise it are themselves trained to be flexible.

Administration

23. **General.** Administration embraces all administrative activities, other than training, and the planning, direction and execution of operations, which are necessary to enable an air force to operate effectively and economically. The administrative factors affecting air operations are principally concerned with organisation and planning.

24. **Organization.** A force which is badly organized, or not best organized to meet its task, will be severely handicapped and liable to collapse, particularly when fighting in adverse circumstances. The more complex the organization, the more weaknesses it is likely to contain, a maxim which is particularly valid in the military context. Therefore, if an organization is to work, it must be sound, simple, and effective.

25. **Planning.** Effective planning is essential if the administration is to keep pace with the requirements of operations. At all stages in the formulation of operational plans, therefore, there must be corresponding administrative plans. Operational plans can be changed at relatively short notice, but only if the administrative plan permits it. Hence, administrative planning must always be sufficiently reactive to operational requirements or probable operational requirements to ensure that the required flexibility and intensity of operations can be achieved.

Logistics

26. **General.** Logistics is the science of planning and carrying out the movement and maintenance of forces. At all levels of war, logistics is a major concern of the commander. Lack of logistic capabilities may force a commander to phase, constrict, interrupt, delay, or even cancel operations. Failure to manage logistics properly may well lead to defeat.

27. **Scope.** In its most comprehensive sense, logistics includes those aspects of military operations which deal with:

- a. The design and development, acquisition, storage, movement, distribution, maintenance, evacuation, and disposition of material.
- b. The movement, evacuation, and medical care of personnel.
- c. The acquisition or construction, maintenance, operation and disposition of facilities.
- d. The acquisition of furnishing of services.

28. **Sustainability.** Sustainability is the key aim of logistics. It can be described as the ability of a force to sustain the necessary level and duration of its operations to achieve its assigned objectives. Sustainability hinges on the likely duration of war and is normally expressed in terms of days. It requires having sufficient men, equipment and stocks on hand and the ability to crisply and reinforce. This last requirement depends upon the resilience of the logistics system, Inter-operability of equipment and commonality of weapons and ammunition. High-tempo operations, leading to high rates of consumption of war consumables, pose major challenges for sustainability. Weapon usage rates have in recent conflicts been increasingly intensive. Effective peacetime planning is the key to meeting these challenges.

29. **The Need for Balance.** A balance will always need to be struck in providing logistic support for the front line. It is as much a failing to build up large unwanted reserves of equipment, ammunition and supplies, as it is to run short at a critical phase of operations-particularly if these unwanted reserves are obtained at the expense of other Services or forces.

Maintenance

30. Whatever the inherent levels of equipment reliability, an efficient maintenance organisation will still be needed. If maintenance is poor, serviceability will quickly degrade, sortie rates will fall and operational effectiveness will decline. To avoid this, equipment must be regularly and efficiently maintained. Moreover, the maintenance organization must be capable of performing its task in tune with the intensity and duration of operations. If the repair organization is unable to deal with damaged or unserviceable equipment and return it to service within the required time-scale, additional replacement items will need to be obtained. Apart from absorbing manpower and material, this will tend to reduce the effective size of the front line, and would be met only at the expense of other Air Force requirements.

31. In order to meet operational demands, maintenance capabilities must meet certain key criteria:

- a. Maintenance organizations must be robust; a maintenance organization designed purely for peacetime operations is likely to collapse under the stress of battle. This means that maintenance in combat conditions must regularly be practised. Battle damage repair will form a key element of this and can itself act as a very important force multiplier. Whenever possible, maintenance capabilities should be able to restore damaged aircraft to a fully operational condition, but the minimum requirement should be to achieve at least one further sortie.

b. Maintenance organizations must also possess a measure of redundancy. Damage must be expected in war, and hence planning must ensure that critical items of servicing equipment are held in reserve. In pursuit of this, servicing equipment should, whenever possible, be provided with hardened protection or dispersed to improve its survivability. But redundancy is also important to ensure that maintenance has a surge capability to cope with the major-but temporary-bursts of high activity rates that are often needed in war.

c. Maintenance organizations must be capable of coping with the demands of mobility. Setting, aside the possible need to move units within and between theatres of operation, it is unsound to rely on being able to operate air forces purely from main bases.

Conclusion

32. Security of the base-in all its many senses-is a key principle of war, and ground combat-support activities provide the essential foundation on which air power operational capabilities are constructed. They also set the effective boundaries for what can be achieved with air forces. While sound ground combat-support cannot in isolation win wars, unsound ground combat-support can certainly lose them - easily and quickly.

Reference:

1. AP 3000 (2nd edition)

TOPIC-11

MILITARY DOCTRINE

Introduction

1. The term 'Doctrine' is very familiar, the meaning of which can be both simple and complex. Simple, because a good number of definitions – both official and unofficial – about doctrine are available. Complex, because despite doctrine's influence and its abundant use in literature, it is a poorly understood and confusing subject.

2. Many believe that doctrine is a sort of broad concept, and abstract in nature. It is a theoretical perspective with little practical application in the real world. It is a loaded term because it has developed differently amongst different nations. But they are wrong. It is essentially linked with the ways a nation conducts its business. Its importance is felt when it directly impacts upon taking decision on a particular matter.

Definition

3. The term 'Doctrine' has originated from the Latin word 'Doctrina'. It signifies the process of conceptualizing any subject. It provides intellectual basis for guidance in the process of undertaking a task.

4. Oxford English Dictionary defines Doctrine as a body of instructions. In literary sense, it is usually meant to convey a principle of religious or political beliefs. So, in simple terms, doctrine is what we believe about the best way to do things. Here, two words '*believe*' and '*best*' are important for the connotation of doctrine. '*Believe*' suggests that doctrine is the result of an examination of past experiences. '*Best*' suggests a guideline for those who conduct a particular business. Therefore, it is clear that doctrine is authoritative but requires judgement in application. It is dynamic and must be reviewed for relevance.

5. In military, we conduct business both in peace and war. Therefore, there is a need for sound military doctrine in the armed forces of a country. *To define Military Doctrine, it may be said that it is what is believed about the best way to conduct military affairs.* To refine the definition a bit, '*Military Doctrine is about fundamental principles by which military forces guide their actions in support of objectives*'. The broad aims of military doctrine are:

- a. To provide direction and aid understanding in conducting military affairs.
- b. To inspire effective training with consistent behaviour, mutual confidence and understanding, and collective action.
- c. To help individuals to think more clearly in chaos, fog and friction of crisis, conflict and war.
- d. To establish a framework to understand the approach to the planning and conduct of operations.

6. An example as to how doctrine helps in conducting our affairs will be relevant here. During Liberation War in 1971, the civilians worked side by side our military and we have won a victory in that war. If we believe that this was a very effective way to fight the aggression and adopt this as a guideline for our future planning, then this can become a doctrine for us. This would lead to further doctrinal development as to how we integrate the citizens with the military forces.

Sources of Doctrine

7. Doctrine is derived from a number of sources. The main ones are:

a. **History**. The principal source of doctrine is history. Successful stories of the past encourage us, and serve as model for adoption in the present or the future. While taking lessons from history, we must be careful about their relevance. We must make an accurate analysis and interpretation of history. Thus, doctrine is a constantly maturing and evolving thing.

b. **Theory**. Theory, which is the outcome of strategic thought, is a source of doctrine. The strategic thoughts of Sun Tzu, Clausewitz, Jomini, Mahan and Douhet remain a useful tool in the development of doctrine. They have provided us with an insight into things that can be interpreted in many ways. It is for us to evaluate their contextual merit in time and space, and judge their relevance.

c. **Technology**. Technology acts as an important source of doctrine. The debate whether doctrine drives technology or technology drives doctrine is very stimulating. Both doctrine and technology are inter-related. Technological developments must be constantly evaluated because they can modify beliefs about the important lessons of history.

Types of Doctrine

8. There are three distinct types of doctrine. These are as follows:

a. **Fundamental**. Fundamental doctrine is the foundation for all types of doctrine. Essentially, fundamental doctrine defines the nature of war, the purpose of military forces, the relationship of military force to other instruments of power, and so on. So the scope is broad and its concepts are abstract. The following statements are examples of fundamental doctrine:

“War is an instrument of policy”

“The object of war is to defeat the will of the enemy”.

“Military objectives in a war must be clearly defined and achievable”.

“Offence is the best form of defence”.

b. **Environmental**. Environmental doctrine is a compilation of beliefs about the employment of military forces within a particular operating medium. It is the basis of land power, sea power and aerospace power doctrine. It has several

distinctive characteristics. It is narrower in scope than fundamental doctrine because it deals with the exercise of military power in a particular medium. It is greatly influenced by such factors as geography and technology. For example, there are many places one cannot take a naval vessel, so sea power doctrine is obviously affected by geography. On the other hand, air power doctrine depends totally on technology for its existence. In fact, in modern day, technological advancements are shaping the ways in which the maximum potential of land, sea and air power is to be integrated jointly for a common mission objective.

c. **Organizational.** Organisational doctrine is about the basic beliefs relating to the operation of a particular military organisation or group of closely linked military organisations. It discusses roles and missions of an organisation, current objectives, administrative organisation, force employment principles and so on. It has several distinctive characteristics that distinguish it from fundamental or environmental doctrine. It is very narrow in scope. It concerns the use of a particular force (e.g. Bangladesh) in a particular environment (e.g. Bangladesh Army, Navy or Air Force) at a particular time – today. As such, organisational doctrine is current and must change to stay current.

Levels of Doctrine

9. Like the levels of warfare, doctrine, should also be developed in levels: strategic, operational and tactical.

a. **Strategic.** Strategic doctrine states the most fundamental and enduring principles, which guide the use of military forces in action. It is the foundations of all military doctrine. It establishes the framework and effective use of military means. Defence policy is developed at the strategic level of war. Accordingly, strategic doctrine is a consideration in the development of defence policy. For example, *BR 1806 The Fundamentals of British Maritime Doctrine* is a strategic decision.

b. **Operational.** Operational doctrine applies the principles of strategic doctrine to military actions by describing the use of military forces in the context of distinct objectives, force capabilities, generic mission types and operational environments. Operational doctrine describes the organization necessary for the effective use of military assets. It also takes into cognizance the changes and influences that might affect future operations. Advances in technology might be one of those influences. For example, *US FM 100-5 Operations* is guided by strategic doctrine of US Army and provides detailed guidance for commanders at the operational level.

c. **Tactical.** Tactical doctrine applies strategic and operational doctrine to military actions by describing the proper use of specific weapons systems and other types of system to achieve detailed objectives. Tactical doctrine deals with the execution of roles and tasks. For example, the manuals published by the RAF dealing with the techniques, tactics and procedures of close air support are tactical doctrine.

Structure of Doctrine

10. Having seen the types of doctrine and the levels at which it should be developed, there is the need for structuring doctrine in view of exploiting the full potentials of military operations. On the basis of this, doctrine may be structured under the following three categories:

a. **Single-Service Doctrine**. Army, Navy and Air Force have distinctive characteristics and functions. They operate in three different environments. They are all quite different in nature. As such, each service needs its own doctrine to conduct its business. Single service doctrine deals with organizational and operational guidelines peculiar to a particular service.

b. **Joint Service Doctrine**. Military operations are inherently joint in nature. Joint Doctrine is the first step towards developing joint culture amongst the three services personnel. It helps in understanding what the fellow sister services bring to the table of corporate endeavour of military functions and operations. It deals with the fundamental issues of employing the national military power to achieve operational objectives leading to strategic ends.

c. **Combined Doctrine**. When two or more nations are formed into an alliance and operate together, it is imperative that they must have a document that provides effective and useful guideline for their activities. Combined doctrine describes the best way to integrate and deploy the armed forces of different nations or alliances in coalition warfare. It establishes the principles of organization, command and control arrangement and employment of the armed forces of the allied nations for combined operations. An example of the combined doctrine is the NATO Doctrine developed to ensure smooth performance of the armed forces of the different nations of NATO alliance toward a unified action.

The Doctrinal Process

11. There is a particular way in which doctrine is developed. It is a continuous process and needs constant review and refinement. The factors, which influence doctrine, can be arranged in a closed loop. These factors can be considered as Inputs, Outputs and Feedback.

12. **Inputs**. Input factors drive a change in doctrine. These factors are responsible for bringing about a reform in the military way of conducting its own affairs. These inputs include:

a. **National Interest and National Military Objectives**. 'War is an instrument of policy', this statement by Clausewitz embodies the superior relationship of the government to the military. As such, the 'will of the government' ought to decide what the military should achieve. Such national military objectives will be limited by resources available for defence and the strategic aim in the event of conflict. During Vietnam War, North Vietnam knew that it could not match the military resources and vastly technological superiority of the United States: therefore, its national interest

was aimed at hurting the will of the American people, and to achieve that strategic aim, its military objectives were primarily focused upon prosecution of guerrilla warfare.

b. **The Perceived Threat.** Correct assessment of threat helps in taking proper measures for meeting the enemy during conflict. A clear and concise assessment of the threat warns both the government and the military in the direction of maintaining a balanced force structure. A change in the intent or a capability of potential enemy could have a profound effect reassessment and change of doctrine. In the period of cold war, massive development of nuclear arsenal by the USSR led the United States to constantly review and update its strategic air power doctrine.

c. **Political/Policies.** The wishes of the government are paramount for a society in which the armed forces are under democratic control. Changes in political structures, security policies and specifically the defence policy of a government will have an influence on doctrine. For example, Japanese constitution bars its defence from being used in foreign territory: as such, entire military doctrine of Japan is focused upon 'Defence of Homeland Japan':

d. **Experience.** We have already seen that the lessons from history are a fundamental ingredient in the formulation of doctrine. For example, General MacArthur inherited 4,000 books on military subjects from his father and was never at a loss to underscore his point of view.

e. **Theory.** We have seen previously that 'Theory, which is the outcome of strategic thought, is a source of doctrine'. For example, Clausewitz's book 'On War' is a strong source for developing strategic doctrine. But we must guard against the belief of perpetuity regarding a particular theory. A good example of variability in a theory is found in the 'Theory of Strategic Bombing'.

f. **Education.** Study of conflict and of history makes for better commanders in conflict and war. Education is a personal preparation for commanders. It helps him in commanding and directing his troops in battle. For example, Patton took the time in 1943 to read a book on the Norman Conquest of Sicily nearly nine centuries earlier and ponder the main points in common with his current operations.

13. **Outputs.** Once doctrine has been formulated, which affect tactical, operational or strategic level, it will have a continuous effect and impact on the routine operations of all forces. The output of doctrine has the following four categories:

a. **Organization.** Military organization must clearly reflect national aspirations. The role and task of the military must address the responsibility entrusted upon it by the nation. Civil Military relations, in responding to a particular nation's requirement, show how best higher defence organization should be set up to transform the military as an effective instrument of national power.

b. **Force Structure.** Force structure is best defined as the mix of people, weapons, associated systems and equipment allocated to execute given tasks. One of the most enduring tasks of the superior military commanders is to comprehend the economic difficulties and limitations in maintaining the armed forces. Force structure connects directly with the state's budgeting programme that requires an exceptionally brilliant thinking for it to become rational, scientific and pragmatic.

c. **Training Requirements.** Training and exercises must be an accurate reflection of current doctrine and incorporate lessons identified into the formulation of future doctrine. The results of training exercises can be used to validate and refine doctrine at all levels. Command Post Exercises (CPX) and war-gaming are the means by which we can check the correctness of existing procedures and concept of operations respectively. Unless we train well during peace, we can not fight well during war.

d. **Plans.** Plans are the most specific output of the doctrinal process. It must be developed upon current doctrine. But it must also cater for the flexibility of plans so that plans are adaptable to variation in context and scenario.

14. **Feedback.** Doctrinal development is a reiterative process. This is required because doctrine must support the formation of strategy. Hence, validation as to the coherence and realism of doctrine of formulate strategy, demands a system of feedback through experience, current combat and training results:

a. **Experience.** We have seen that how doctrine is influenced by experience. The study of Military History and personal experiences can provide as a strong feedback to the existing wrong practices in military affairs.

b. **Current Combat.** Forces do not need to be in combat for important lessons to be learnt. Particularly, for nations involved in conflict, it is important that they take into cognizance of the experience of the nations at war. In this regard, the study of doctrine or combat results of advanced countries may serve as cautionary point of adoption in one's own military. Doctrine has an important influence on the preparation and conduct of combat. First, it serves as an essential guide to the weapons acquisition process. The design, development, and procurement of armaments is determined, in large measure, by the battlefield requirements set forth by service doctrine. Second, doctrine serves as an important organising function, in that it determines how forces are to relate to one another, and how they will be structured and controlled. For example, armies all over the world more or less is structured along the lines of corps, divisions, brigades and battalions. But the way these forces fight vary from army to army. As such their performance has great bearing on the individual army's system of decision – making. So, the current combat of a particular army may either be useful or not to another country, is dependent on how much the latter can accept from the former. So, third and finally, we can come to the conclusion that doctrine guides the actual employment of forces in battle.

c. **Training Results.** The results of training exercises can be used to validate and refine doctrine at all levels. In fact, the lessons of past experience and current combat should be tested through a rigorous and methodical training process. During Vietnam War, the US pilots gained new understanding both in terms of experience and current combat for which USAF introduced tactical training in close combat. The results obtained from such training were included in their operations documents, and later applied by the pilots in the scene of battle. Training must aim at reality both at the theoretical and practical levels.

15. Doctrine should remain flexible and adaptable to meet the ever changing demands of conflict in its entire guise. In a changing strategic environment, we need to be ready to respond around the spectrum of conflict and, if when necessary, change our doctrine to meet the demands of a new strategic environment. The diagram below explains the doctrinal process:

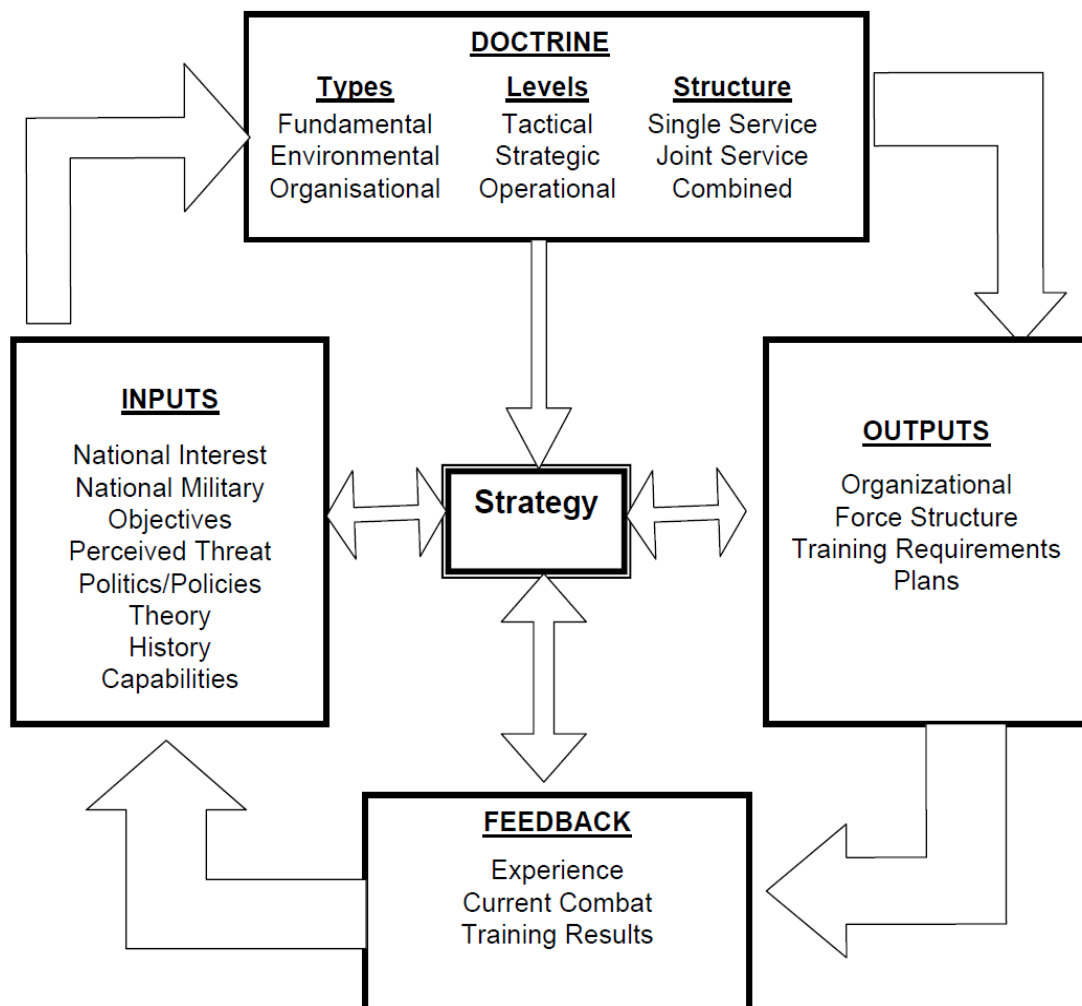


Fig 1: The Doctrinal Process

Conclusion 5

16. The influence of doctrine upon the activities of the military is immense. Without doctrine, military is left without a guide. Both in peace and at war, running military's own business taking cue from doctrinal documents helps the military to function efficiently and effectively. However, doctrine is not a dogma; as such, requires judgement in its application. Increasing attention in recent years has been devoted to the issue of military reform, such as civil – military relations, media handling etc. Availability of doctrinal literature will enable a commander to prosecute his business in this regard along the desired line of military interest and political directive.

17. The most important source for the formulation of doctrine is history and past experience. A constant touch with Military History with a penetrating and analytical mind will help in taking lessons both from failures and successes of previous generations. This can be useful in the framing of steps for military activities and operations both in peace and war. Besides, there are other sources of doctrine, such as results of training exercises.

18. It is equally important for the armed forces to structure doctrine in a manner that it facilitates single service, joint service and combined military activities. The most important use of doctrine is its relationship with strategy. Where strategy is the method of employment of forces for national objectives, doctrine keeps a close connection with strategy. Finally, doctrinal change is a dynamic process. The process must continue in peacetime, so that the military is not caught unprepared in meeting the challenges of unforeseen circumstances.

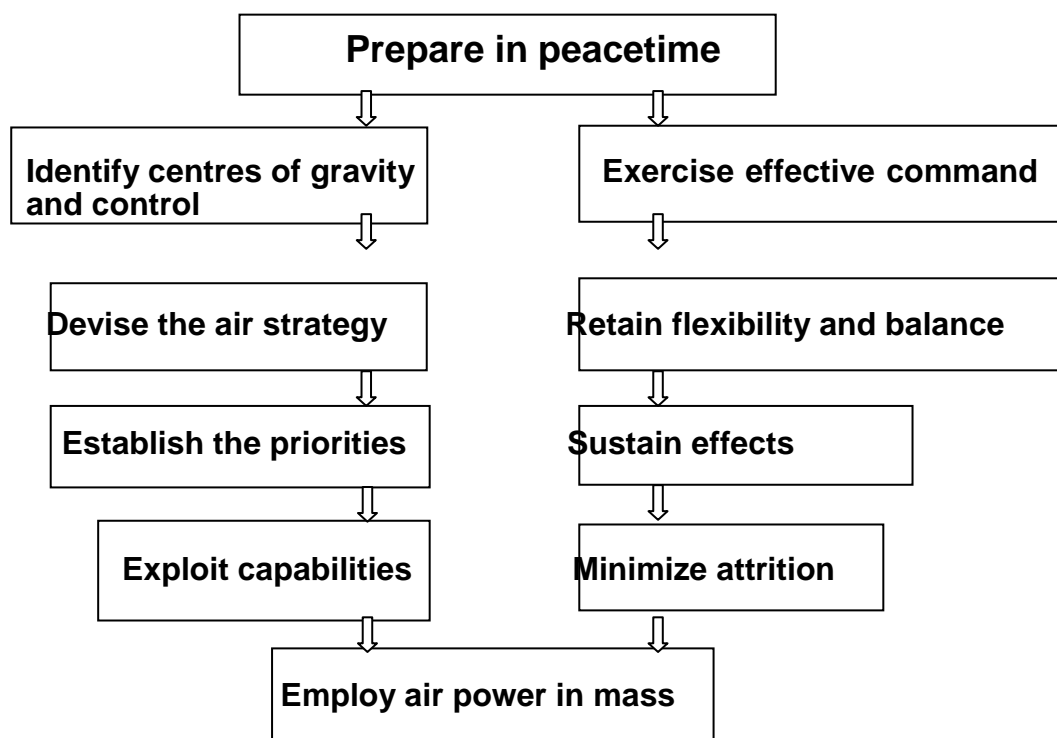
TOPIC-12**APPLYING THE DOCTRINE**

'War should be made methodically, for it should have a definite object; and it should be conducted according to the principles of the art.'

Napoleon Bonaparte

Introduction

1. The ultimate purpose of air power doctrine is to provide the best guidelines for applying air power in support of national and/or multi-national defence. This chapter summarises how the doctrine should be applied. It is the air commander, supported by his staff, who is ultimately responsible for applying the doctrine. His success in employing air power will depend on a range of actions, the most important of which are shown in Figure below:

**Prepare in Peacetime**

2. **Introduction.** Forging an effective and responsive fighting force takes time, and the importance of preparedness in peacetime cannot be overstated. Similarly, air forces must react as swiftly as resources allow to changes in threat and advances in technology, adjusting training objectives accordingly. In reaching and maintaining an appropriate level of preparedness, personnel and organization are the critical factors:

3. **Personnel.** Of all the factors in war, that of personnel is the most decisive. As General George S Patton pointed out "Wars may be fought with weapons, but they are won by men. It is the spirit of the men who follow and of the man who leads that gain victory."The key elements in preparing personnel for war are training, leadership, professionalism and tenacity:

a. **Training.** Advancing technology can offer impressive potential capabilities, but these can be fully realized only if personnel are properly trained. Training in peacetime must be realistic; air forces must train in peace as they plan to fight in war. Exercises must mirror as far as possible the uncertainties and stress of war, but commanders must not expect even the most realistic training entirely to simulate the rigours of combat. Training must always be worthwhile and cost-effective. Exercise reports must be ruthlessly honest in exposing weaknesses in force structure, operating procedures, and capabilities. Notwithstanding peacetime pressures against widespread delegation, commanders at all levels must take every opportunity to give their subordinates the experience they need and to prepare them for the greater responsibilities which they may have to assume in battle.

b. **Leadership.** The nature of leadership has been a source of debate throughout history, but there has never been any doubt about its importance as a war-winning factor. Leadership is the foremost element in raising and sustaining morale, and morale in combat will often be the deciding ingredient, even against the most overwhelming odds. Born leaders tend to be few, but a good proportion of the art of leadership can be learned, particularly from the example of others. It is important to understand that successful leadership can take many forms and styles. In peacetime, a fighting force must provide the encouragement and the conditions in which leaders of different styles can thrive and develop. Commanders should be tolerant in peacetime of unconventional subordinates who can form the cutting edge of operational leadership in war. When asked what his most important role had been as the United States Army Chief of Staff in the mid-1950s, General Ridgeway replied: "To protect the mavericks".

c. **Professionalism.** The nature of modern warfare is increasingly complex, and there is a growing need for very high levels of expertise. This is particularly so in the case of air forces. Consequently, the highest levels of commitment and a wholly professional attitude towards training and the conduct of operations are essential for success. Because air power is so ubiquitous, a heavy burden is imposed on airmen. Thus they need to have a detailed knowledge of war in all three environments if air power is to be applied economically and effectively.

d. **Tenacity.** Tenacity - in this context - is the quality of holding fast to a principle or course of action. Like courage, it can take many forms. It is more than just simple perseverance under adversity: it also involves courage and the capacity to innovate, to be audacious, when others would accept defeat, and then to turn defeat into victory. At the heart of tenacity is the belief in a cause and the determination to win. Like leadership, it can and must be acquired and nurtured in peacetime through training and the development of personal qualities.

4. **Organization.** Air forces must be organized primarily for wartime effectiveness rather than peacetime efficiency. Organizational structures should be designed to exploit air power's unique strengths while mitigating its limitations. Success in war demands an organizational structure in peace which effectively integrates personnel policies operational and logistical! concepts and equipment procurement decisions. The following organizational factors must be borne in mind when planning in peacetime for the unexpected events that war will inevitably bring:

a. **Equipment.** Modern weapon systems are very expensive and the numbers purchased will probably be very limited. Numbers per se are important and the lack of adequate force size can limit the inherent flexibility of air forces and render them highly sensitive to unexpected attrition. Thus, equipment procurement decisions must balance cost and capability against numbers. They must also balance reliability and ease of maintenance (which effectively helps to increase available numbers) against maximum combat performance (which can compensate for lower numbers).

b. **Logistics.** Logistics provide the key to sustainability. Logistics considerations must play a central role in equipment procurement decisions. They dictate the scale, scope, pace and effectiveness of military operations. If aircraft cannot be maintained or supplied they quickly become worthless. Logistics facilities must be designed to survive and operate under attack; they must be optimized first and foremost for combat effectiveness, not peacetime efficiency. Therefore, it is vital that logistics requirements are taken into account fully during the procurement process.

c. **Tactics.** Tactics should normally be designed to exploit the capabilities of equipment. But in some circumstances the reverse will be true; equipment may need to be adapted or produced to fulfill tactical requirements, and the direction of research effort will have to be focused accordingly. New weapon systems should enhance the capabilities of air power - speed, reach and flexibility in particular. Multi-role aircraft increase the flexibility of air forces, but necessitate expensive and demanding training. Multi-role capabilities must be balanced against the need to

preserve important single-role capabilities. At times, specialized, single-role aircraft may be most cost effective but single-role specialization becomes increasingly difficult to sustain as force size decreases. Similarly, a mix of manned and unmanned systems will complicate the enemy's problems, insure against unexpected technological developments, increase friendly employment options and provide complementary capabilities. However, it will also demand additional resources, and this - together with the need to retain the maximum flexibility - will tend to limit the proportion of unmanned systems that can be afforded.

Identify Centres of Gravity

5. **General**. The term 'Centre of Gravity' describes a point of crucial vulnerability against which a successful attack is likely to be decisive. Clausewitz called the centre of gravity (the schwerpunkt) the 'hub of all power and movement'. One of the most important responsibilities of a commander is to identify his own centres of gravity, so that they can be best protected, and those of the enemy, so that he can concentrate his forces against them.

6. **Enemy Centres of Gravity**. Enemy centres of gravity fall into two categories: accessible and ultimate. A commander must first identify the ultimate centres of gravity and then, if he has neither the resources nor the authorization to act against them, identify accessible centres of gravity. He must avoid distributing his forces equally (or, conceivably, at all) between all centres of gravity and should not assume that an enemy action demands a reaction in kind. Instead, he must focus on the nature and objective of the war, and the nature of the enemy; these will determine the enemy centre of gravity against which his attacks should be concentrated.

7. **Friendly Centres of Gravity**. The same formula for identifying enemy centres of gravity must be applied equally to friendly centres of gravity (either national or Alliance). Once identified, friendly centres of gravity must be protected as far as possible and their vulnerability reduced, for example by diversification. Plans to minimize the effect of successful attacks on such targets should also be formulated.

Devise the Air Strategy

8. **General**. Military strategic goals determine the nature of the air campaigns and operations that will be needed within each theatre of operations. The development and execution of these air campaigns and operations must be totally integrated with those of the surface and sub-surface forces. In devising the overall air strategy, and in the deciding the types of campaigns and operations required, the following factors must be taken into account:

a. **Political Aims.** Political objectives determine to a major extent military objectives and in turn, heavily influence the subsequent campaign and operational planning. The political objective of a war can range from demanding unconditional surrender to seeking favourable terms for an armistice. In many cases military commanders may have little say in establishing grand strategic or even military strategic objectives. They may be given both and simply instructed to devise a campaign plan to attain the latter. However, in cases where military considerations weigh particularly heavily, military commanders must be prepared and able to offer decisive advice.

b. **Geography.** Geography is a keystone of strategy and will often be the only fixed factor in a conflict. Air operations can take place over any type of terrain, but the geography of likely areas of operation will influence air force equipment procurement decisions and the preferred methods of employment. Operations over sea areas differ from those over mountainous terrain. Questions of distance, terrain and types of surface could have far-reaching effects on the offence/defence balance, basing policy and logistic requirements. In peacetime, these decisions will be fundamental to the design of the air power force structure needed for war.

c. **The Weather.** Modern aircraft are becoming less dependent on good weather for success. Bad weather has become something to be exploited, especially when taking on a technologically inferior or poorly trained enemy. Nevertheless, some roles need clear visual conditions in order to obtain an acceptable return on the risks of exposure to be found on the modern battlefield. This is particularly true of close air support, and the air commander must weigh the weather factor very carefully before committing multi-role aircraft to close air support tasks in preference to, say, battlefield air interdiction tasks.

d. **Night.** Historically, night has been a major factor in air operations. Night protects aircraft from visually-sighted weapons, but makes it more difficult to find and hit the target. Night has also traditionally been a time of rest and recuperation for the surface forces. Continuing developments in night vision devices are increasing the effectiveness of aircraft at night, and may allow 'around-the-clock' air operations. Such operations would deprive the enemy surface forces of respite, but would demand higher crew-to-aircraft ratios.

e. **The Offence-Defence Balance.** The short history of air power has shown that, in most circumstances, the inherent strengths of air power tend to favour offensive rather than defensive action. Offensive action allows the attacker to seize the initiative, exploit to the full the capabilities of air power and saturate enemy

defences. It carries the war to the enemy and forces him to react. On the other hand, some defensive action is invariably necessary to protect friendly air and surface forces and may be unavoidable for other reasons. Adopting a defensive stance allows the enemy to mass his forces for an attack from the direction and at a place of his choosing. Therefore, the decision to rely on defensive action, even for a short time, must be taken cautiously; by so doing the air commander surrenders the initiative and incurs the risk that the balance of forces can quickly swing against him.

f. **Needs of Surface Forces.** In essence, the successful employment of air power in meeting the needs of the surface forces can be achieved in two ways: firstly, through operations designed to create the most favourable conditions for the success of surface action and, secondly, by exploiting fleeting opportunities that arise to achieve campaign objectives. The winning of a theatre campaign usually depend on the employment of air power in joint action with land and naval forces in a way that best exploits potential air/surface force synergies. In some circumstances, air power can achieve campaign objectives while operating largely independently of the surface forces, although - ultimately - ground forces are needed to hold ground, and naval forces are needed to exploit the use of the seas. Nevertheless, air power is likely to exercise a decisive influence on the outcome of virtually all major surface battles.

Establish Priorities

9. **General.** In deciding how to achieve the chosen strategy, unambiguous priorities need to be established. At the same time, flexibility is needed to change priorities when circumstances demand, although such changes should always be clearly expressed. Within the overall military priorities, the respective contributions of air, sea, or land forces must be determined. Invariably, all three of the basic components of military power are needed, but it is unlikely that their respective contributions will be of equal importance. Therefore, the key force element must be identified at the outset, so that the operational effect of the other two types of force can be orchestrated in its support. The principal factors in reaching the right decisions about operational priorities for air forces and the selection of the key force element are as follows:

a. **The Air Priorities.** Air action may be either the primary or the supporting effort within a theatre of operations. In either event, an air strategy will be essential. The plan should identify the air centres of gravity, the phasing of operations and the resources required. It must provide general guidelines for the division of effort between counter-air, anti-surface force and strategic air offensive action. It must also explain how other arms will support or be supported.

b. **Control of the Air.** Gaining and maintaining the required degree of control of the air will always be the air commander's first concern when faced with an enemy equipped with air forces. Because control of the air is a necessity, the air commander should subordinate all other air operations to its achievement and maintenance. The weight of enemy surface attacks may induce commanders to switch air forces to support friendly surface forces without first gaining control of the air. But the consequent reduction of pressure on the enemy's air forces may allow them to win control of the air, with potentially disastrous long-term results. Thus, except in extreme circumstances, no air operation should be undertaken which jeopardizes the achievement or the maintenance of friendly control of the air.

c. **Exploiting Control of the Air.** Having achieved the required degree of control of the air, subsequent operations would be dedicated to exploiting it to the full. Whatever the chosen campaign, operation or even role, it must be pursued as a sustained, concentrated effort. It is highly unlikely that one or two missions in any particular role by a handful of aircraft armed with conventional weapons will achieve a worthwhile result.

d. **Depth Attack or Shallow Attack.** In the past, resource limitations have generally compelled commanders to concentrate the majority of their air effort into one key campaign, or even one key operation. The fundamental choice is whether to concentrate air action on deep attacks or shallow attacks. The relative benefits of each were described in detail in Chapters 6 and 7. In general, deeper attacks are more likely to affect the outcome of the war as a whole; in contrast, shallower attacks are more likely to affect the outcome of the surface battles in progress. It follows from this that, whenever possible, a commander should seek to exploit the reach and speed of air power by striking deep into enemy-held areas, switching to shallow attacks only if deep attacks are impracticable, in times of operational emergency or when decisive tactical results are possible. Reach is a most valuable asset, and one which should never be sacrificed without the most careful consideration.

Exploit Capabilities

9. Any plan involving air power should seek to exploit the inherent speed, reach, flexibility and hence striking power of air forces to the full. Air power should always be employed as a united and indivisible entity. It has the distinctive ability to concentrate military power in time and space across long distances. Powerful synergies can be obtained when air power is applied in comprehensive and mutually supporting operations and campaigns. Similarly, air and -surface operations, applied in coordinated joint

campaigns, can also produce decisive synergies. Exploiting these capabilities must be a fundamental enabling aim in any air strategy.

11. The strategic air offensive campaign has historically tended to be considered in isolation from other air campaigns and opportunities for mutual support lost as a result. For example, air interdiction missions are likely to be more productive, and their effects more long-lasting, if they are targeted against the war materiel products of the industrial centres which are being attacked in the strategic air offensive campaign. In the same way, surface forces must be in a position to benefit from, or take advantage of, the results of air interdiction missions. Strategic air attacks may take place independently of the surface forces. However, in a joint campaign, strategic air attacks should be integrated with other air and surface operations.

Employ Air Power in Mass

12. To achieve its greatest effects, air power must be concentrated at a decisive time and place. Mass increases destructive capacity and reduces friendly attrition through the saturation of enemy defences. In defence, air commanders must concentrate decisive force against enemy attacks, and in an offensive they should identify crucial objectives and mass overwhelming strength against them. For example, the use of the 'bomber stream' by Bomber Command in the night element of the strategic bombing offensive helped to swamp German air defences and contain British casualty rates. Similarly, as the day element of that offensive progressed, so the Luftwaffe used increasing concentrations of formations against the attacking American bomber formations, achieving some notable successes, notably over Schweinfurt on 17 October 1943. The use of mass, in both attack and defence, should be short and sharp - like a hammer-blow - to ensure the maximum impact on the morale of friendly and enemy forces, and their commanders.

13. Mass should be combined with surprise in order to obtain the most rewarding returns, and this can be achieved only through properly coordinated offensive action. The piecemeal use of air assets may not only fail to accomplish the task, but may also necessitate further attacks. Inevitably, these would have to be undertaken without the same level of surprise, thereby incurring increasing risks and greater losses.

Minimize Attrition

14. Air forces are sensitive to attrition for two reasons. First, because aircraft undertake operations every day and night, often flying several missions in a twenty-four-hour period, even apparently small-scale losses can have a major cumulative effect over an extended period. For example, a force which flies two sorties per day and sustains a 5% loss rate (ie five aircraft lost per one hundred sorties flown) will - if not reinforced - decay to 36110 of its

original size by the end of tenth day of a conflict. Secondly, the costs and the lengthy production schedules of modern combat aircraft, and the time needed to train new aircrew to an operational standard, mean that timely replacement of losses in war has become increasingly difficult. Thus, air commanders must balance attrition rates against achievements. Attrition will be known precisely, but achievements may take many hours or even days to emerge. In addition, air commanders must conserve the range of capabilities, the level of forces and the strength of aircrew morale needed not only to achieve immediate objectives, but also for success in future critical operations.

15. The creation and maintenance of reserves may be an air commander's only way to stem the loss of his assets, but such decisions may be difficult to reach when numbers are insufficient to meet immediate objectives. Steady commitment of reserves as replacements to committed units can enhance sustainability and depress enemy morale. Alternatively, the shock value of committing new units to a battle can be decisive, provided they are committed correctly. Choosing the right moment will always be difficult, and there may be pressure to commit air reserves in support of subsidiary operations. However, these must be resisted. The mere existence of uncommitted reserves may 'wrong foot' the enemy commander, either by presenting him with an operational surprise at a crucial time or by forcing him to hold equivalent forces in reserve.

Sustain Effects

16. The effects of even the most successful air missions can be short-lived, and therefore air power must be applied persistently. The need for re-attacks against important targets should be assumed in planning. The results of air attacks are often not readily apparent; thus, patience and determination are required by commanders to ensure that campaigns and operations are sustained long enough to pay worthwhile dividends. Some campaigns and operations will never succeed despite the most dogged persistence, and these reversals must be accepted if they can be identified. Nevertheless, such disappointments do not alter the fact that the most effective and rewarding campaigns are likely to be those which are both sustained and persistent. It must be appreciated that the full effects of some attacks - particularly those against an enemy's national infrastructure, his economic system, his logistics, and even his air forces - may take time to reach fruition.

17. Persistent attacks must be aimed at preventing the enemy from recovering. For example, as long as the enemy retains the capability to regenerate air forces or air defences, he can challenge for control of the air. Consequently, control of the air can be a fragile and temporary condition that has to be fought for frequently. The enemy must not be allowed time to recover. Hence, repeated, concentrated air attacks must continue until the required military objective has been achieved.

Retain Flexibility and Balance

18. The dual flexibilities of being able to concentrate force anywhere and to attack any element of the enemy's power are fundamental to the employment of air power. Any compromise of these flexibilities reduces the effectiveness of air power and undermines its responsiveness. Demands for air forces to be segmented and diffused should be resisted so that a balance of forces and capabilities can be maintained. Only a balanced force, consisting of the widest practicable spectrum of capabilities, can adapt rapidly to changing priorities. In certain circumstances, the need to retain balanced forces in order to preserve flexibility may induce the air commander to modify the normal principles of employment for air forces.

Exercise Effective Command and Control

19. Few operations and campaigns can be expected to proceed as planned. Success will depend on effective command and control being exercised at every stage. Effective command and control depends on centralizing command and control, exercising command and control from the highest practicable level and decentralizing execution. These principles are implemented by means of a planning process carried out in four phases: analyze the situation plan direct, and control. These aspects were discussed in detail earlier.

TOPIC-13

ELECTRONIC WARFARE

Introduction

1. Electronics control every facet of modern air ops. Starting with communications, the all-pervasive electronics have penetrated into the sphere of weaponry, navigation and target acquisition systems; into reconnaissance and intelligence gathering systems; into command and control facilities, and many other areas. Additionally, the use of the electromagnetic (EM) spectrum has been broadened to include the visible light range with television, laser and other electro-optical devices. An ability to degrade, disrupt or exploit enemy EM emissions, while at the same time safeguarding our own use of the spectrum, is correspondingly of importance to the successful conduct of air operations.

2. It is, therefore, essential that BAF officers filling command and staff appointments have a sound understanding of the basic theoretical aspects of electronics and a clear picture of electronic combat activities. This précis outlines the various uses of the EM spectrum in air warfare and introduces the principles and doctrine of electronic combat.

Objectives

3. At the end of this package you should have a broad based understanding of:

- a. The uses of the EM Spectrum in air warfare.
- b. Electronic Equipment for Air Warfare.
- c. Electronic Warfare.

The EM Spectrum

4. A EM wave can be represented by a sine curve. The length or distance covered by one complete cycle at an instant is called the wave length and is usually measured in meters from crest to crest. EM waves travel at a speed of light, i.e. 186,000 miles/second or 300,000,000 meters/second. The number of complete waves passing through a particular point in one second is called the frequency of EM waves which are expressed in Hertz (HZ), 1 Hz being equal to one complete wave or cycle per second. The wavelength

RESTRICTED

of any frequency can be found by dividing the speed of propagation by the frequency. For example, a frequency of 30 MHz would have a wavelength of:

$$\frac{300,000,000 \text{ meters per second}}{30,000,000 \text{ cycles per second}} = 10 \text{ meters}$$

5. Although radio frequencies occupy only a small part of the EM spectrum they cover a wide frequency range. The lowest frequencies are in the order of 15 KHz and the highest are about 300,000 MHz. The following is the classification of radio frequency bands adopted at the International Telecommunications Conference held at Atlantic City, USA in 1947:

<u>Band</u>	<u>Frequency</u>	<u>Wavelength</u>
Very Low Frequency (VLF) km	less than 30 KHz	over 10
Low Frequency (LF)	30-300 KHz	10-1 km
Medium Frequency (MF) 100m	300-3,000 KHz	1 km-
High Frequency (HF)	3 -30 MHz	100-10m
Very High Frequency (VHF)	30-300 MHz	10-1m
Ultra High Frequency (UHF) cm	300-3,000 MHz	100-10
Super High Frequency (SHF)	3,000-30,000 MHz	10-1 cm
Extremely High Frequency (EHF) cm	30,000-300,000 MHz	1 cm-0.1

Electronic Air Warfare

6. **VLF, LF and HF.** The portion of the EM spectrum used for military communication purposes normally extends from the start of the low-frequency (LF) band at 30 kHz, up to 18 GHz, the top end of the centimeter radar band, although recent developments exploit the extreme ends of the spectrum - very low frequencies (VLF) and millimeter waves. VLF transmissions - below 30 kHz - are used largely for communication with strategic submarines, and for the world-wide Omega radio-navigation system. Low-frequency (LF) transmissions (30-300 kHz) are used for low-quality but reliable long-range communications, and for navigation aids (naiads) such as Loran. Medium frequency (MF) - 0.3-3 MHz - is the old "medium wave", band used largely for broadcasting, although some

Loran and ADF (automatic direction-finding) equipment also shares the band. High frequency (HF) - 3-30 MHz - is what used to be called "short wave". HF signals can travel long distances after being reflected by the Earth's ionosphere. Until the arrival of satellite communications, HF was the only method of long-range radio communication. It is also used by the over-the-horizon (OTH) radars.

7. **VHF and UHF.** Very high frequency (VHF) and ultra-high frequency (UHF) span the spectrum from 30-150 MHz and 150-400 MHz respectively. These frequencies are not reflected by the ionosphere, but are used for short-range communications, IFF (identification friend or foe) systems, TACAN (Tactical Air Navigation) and television services, radio relay and long-range search radars. Above these frequencies, radio waves can no longer be passed down conventional cables, but must be led from one part of an electronics system to another using wave guide, which are metal pipes often of rectangular cross-section. This is the part of the spectrum exploited by most forms of radar.

8. It has been found that high information rates require large bandwidths, it is not acceptable to pass such signals in the HF or lower frequency bands: yet only these bands give a long range transmission path by using the surface and sky waves. Considerable work has been undertaken in the last few years to find a means of passing such traffic over long distances. The various techniques that have been successfully developed are outlined below. Each depends on bouncing signals from objects or layers in space.

Electronic Warfare

9. **Electronic Warfare.** Electronic Warfare is a military action involving the use of EM energy to determine, exploit, reduce, or prevent hostile use of the EM spectrum and action that retains friendly use of that spectrum.

10. EW is divided into 03 component elements which are generally defined as follows:

- a. **Electronic Support Measures.** Electronic Support Measures (ESM) are electronic measures which involve passive techniques, ie, those where we do not transmit at all but listen to and exploit the transmissions of the enemy. (You may hear this being called Electronic Warfare Support Measures in some circles).

b. **Electronic Counter Measures.** Electronic Counter Measures (ECM) are those methods by which we can interfere directly with enemy systems.

c. **Electronic Protective Measures.** Electronic Protective Measures (EPM) formerly known as Electronic Counter-Counter Measures (ECCM) are measures designed to protect our own systems from electronic attack.

Electronic Support Measures (ESM)

11. ESM is that division of EW which involves actions taken to search for, intercept, locate, record and analyses radiated EM energy, for the purpose of exploiting such radiations in support of either pending or immediate EW operations. ESM is mainly, therefore, the collection, evaluation and dissemination of information about a potential enemy's electronic systems and devices, although the range of ESM activities has been extended to include threat detection and warning, and the acquisition of, and homing on to, a target. In short ESM acts as the eyes and ears of EW.

12. The great advantage of ESM both for general surveillance and target warning and indication is that it is passive. In today's increasingly dense electromagnetic environment this can be a vital factor in both preserving anonymity and providing effective defence. The collection devices do not radiate energy to any significant extent and so the enemy cannot electronically detect when ESM operations are taking place. Consequently opportunities for deception or for planting false information are few. The interception equipment is usually located out of enemy reach, on home territory or in international waters, airspace or space. But ESM does not only cover the radar frequency bands. Special ESM receivers also carry out a similar function on all radio frequency bands from HF to the radar bands.

Electronic Counter Measures (ECM)

13. ECM is the active arm of the EW scenario, providing an aircraft with specific forms of defence to counter the threat, as opposed to just surveillance and detection. There are three primary areas which can be easily identified as lending themselves vulnerable to electronic countermeasures; and all, obviously, make use of the EM spectrum. These areas are:

a. **Communications.** Disruption of communications affects command and control and can be directed to disrupt strategic plans, tactical situations and even local (on board) control.

b. **Surveillance**. This covers a very extensive field involving primarily radar but also includes thermal imaging, lasers and optical systems (ie TV, human eye).

c. **Weapon Control**. In this area again radar is the primary system requiring disruption (both radar tracking in the launch platform, and radar tracking and homing on board the weapon itself), but other important systems to be disrupted include laser, IR, TV and radio frequencies.

14. Interference with the EM spectrum in any of these three areas will cause severe problems for any adversary wishing to use those frequencies (it will also, of course, interfere with friendly forces unless they carefully chose other parts of the EM spectrum for their equipment to operate in).

15. For example, jamming of communications frequencies can seriously affect how any potential adversary views the strategic scene, and will affect any decisions he may make regarding command and control of his forces. Such disruption can affect not only immediate tactical situations, local actions etc, but also complete campaigns. Jamming of communications frequencies will seriously impair the efficiency with which forces are administered and controlled.

16. Denying the enemy intelligence of one's own plans and operations is a very important by-product of any attempt to disrupt communications. Disruption of an adversary's capability to carry out accurate and efficient surveillance also has the effect of denying him intelligence on the immediate tactical situation. This again prevents the enemy from building up a picture regarding one's own potential, probable plans and the immediate development of operations.

17. Disruption of the adversary's weapon control system again denies him tactical information on the exact disposition of one's forces and seriously affects his ability to track and direct his weapons on to their target. The effect of such disruption means that the enemy is either unable to launch or fire his weapon, or, if he has achieved such a move, it causes the weapon to miss its intended target.

18. The countermeasures must be applied at the same frequency and cover the bandwidth of the target radar and preferably be polarized in the same plane as the radar waves. Each type of radar has its own 'signature' which enables the correct choice of ECM

to be made. The ways in which countermeasures can be taken against radar can be conveniently divided into 2 categories:

- a. Offensive ECM (OECM).
- b. Defensive ECM (DECM).

Electronic Protective Measures (EPM)

19. When countermeasures to a friendly EM transmission are taken by the enemy it is necessary to take some action (or to have taken some action in the past) which reduces the effectiveness of the countermeasures. EPM are that division of EW involving actions taken to ensure friendly effective use of the EM spectrum despite the enemy's use of EM energy. There are two subdivisions of EPM:

- a. **Active EPM.** It involves taking detectable measures, such as alerting transmitter parameters, to ensure friendly effective use of the EM spectrum.
- b. **Passive EPM.** It involves undetectable measures, such as operating procedures and technical features of equipment, which are meant to ensure friendly effective use of the EM spectrum.

Ref:

- A. AP 3000 (2nd and 3rd Edition)
- B. DSCSC Précis on 'The Role of Electronics in Air Warfare'

TOPIC-14

INFORMATION WARFARE

Introduction

1. We are now at the dawn of a new age of 'Information Revolution', a Third Wave' which is breaking on the shores of countries around the world. All these are changing the perception about the national and global security. There are now new definitions and parameters of battle space and measurement of force. In this new era of globalization information is playing a pivotal role. Whoever controls the access to the information will control in tomorrow's world affairs.

2. As the human civilization has entered in the third Millennium, the information revolution led by the on-going rapid evolution of cyberspace, microcomputers and information technology (IT) related systems are growing with an unprecedented speed. Thus the nation states are becoming more and more dependent on their information resources, be it for the military or e-commerce or national infrastructure or economy. As such, just a denial of access into one's own banking sector computers or military surveillance or fire control System even for a single day will be enough to bring someone to his knees. All these have led towards emergence of the term '**Information Warfare**' (IW).

3. The technological development has picked up such a momentum that it has already gained significant primacy over the pull of age-old doctrine and tactics. This was vividly demonstrated during the last Gulf War of 1991. For the first time IW related techniques were used effectively in that campaign.

4. Now IW is a buzzword for military thinkers and a hot topic in many countries. Despite all these, the term has still remained imprecisely defined like blind men's effort to discover the nature of elephant. Experts believe that information warfare might have the impact like the erstwhile nuclear threat of the cold war era. In the 21st century instead of hum-drum conventional military hardware and dug-in armies that fight bloody attrition wars, small, highly mobile forces, armed with real-time information from the satellites, sensors or even Internet and Cyberspace might strike with lightning speed in unexpected places. The winner will be the one who could exploit information to disperse the '**Fog of war**'. Undoubtedly, the IW will continue to alter the world at an ever-increasing speed whether someone chooses to engage himself in it or not.

What is Information Warfare?

5. The concept of information warfare (IW) is yet to be in its matured forms. Currently, there is neither formal military doctrine nor official definition of IW. Many writers call IW with different names. These include the term Net-War, Software, Cyberwar and Information Operations. The widely accepted terminology is "Information Warfare". And according to Dr. John Alger the working definition of IW is "*Actions taken to achieve information*

superiority by affecting adversary's information, information based processes, and information systems, while defending one's own information and information systems". Now a day, the modern states have substantial amount of information-based resources, including complex management systems and infrastructures. These may include systems, which control flow of money, export-import, air-traffic, electric power grid, telephone network etc. Similarly, modern military force's war fighting capability today is also increasingly relying on information based systems: ranging from sensors and weapons to the vital Command, Control, Communication, Computer and Intelligence and Information (C⁴ I²) systems. Conceptually, if and when potential adversary attempt to disrupt these systems using IW techniques, IW inevitably may take a strategic dimension.

Forms of IW

6. The primary functions of IW include the activities that deny, exploit, corrupt, destroy or protect information. These can be achieved through different forms of IW. The commonly accepted forms are as follows:

a. **Command and Control Warfare (C²W).** The IW may be directed from or on the command-control centres. C²W is the military strategy that implements IW on the battlefield and integrates physical destruction. Its objective is to decapitate the enemy's command structure. During the recent Gulf War the US forces showed their skill over IW by destroying Iraqi forces vital command & control structures. This rendered Iraqi forces largely ineffective when the US forces were advancing. *"C²W provides the sword against an adversary's command and control system, and 'shield' against the counter C²W actions of the adversary"*

b. **Intelligence Based Warfare (IBW).** IBW consists of measures and counter-measures that seek knowledge to dominate opponent's combat power in the battle space. It is related with the Sensors, Radars, Fire Control systems and other means that contribute in achieving the targeting information. "It occurs when intelligence is fed directly into operators (notably, targeting and battle damage assessment), rather than used as an input for overall command and control. In contrast to other forms of warfare it results directly in the application of steel or weapons to the target (rather than corrupted digital data). It can be both offensive and defensive. In the offensive mode it exploits the space-based sensors (satellites, AWACS and JSTARS), near standoff sensors like Unmanned Aerial Vehicles (UAVs), Optical, Infrared and Laser devices. Defensive mode encompasses variant of traditional cover (concealment) and deception with an admixture of stealth.

c. **Electronic Warfare (EW).** EW is the operational technique by which hostile use of electromagnetic spectrum is reduced or prevented. As it is gradually acquiring certain cachet, researches and efforts are underway to reinvent EW under the new moniker of Anti-Radar Warfare, Anti-Communication Warfare and Cryptography.

d. **Psychological Operations (PSYOPS)**. This is the use of information against the human mind. During the Somali crisis photographs of Somalis dragging corpses of U.S. soldiers through the streets of Mogadishu were transmitted by the CNN. This led towards the complete withdrawal of U.S. Forces from Somalia and Gen. Farah Aideed won the information war. Humiliated in Somalia, the Clinton administration was very cautious while launching the operation 'Uphold Democracy' in Haiti. They took extensive programmes to distributed hundreds of thousands of leaflets and 1030 soccer balls painted with crossed U.S. and Haitian flags. Similarly, during the Gulf War and Balkan War strategic salience of PSYOPS was more evident. Hence, media will have preponderance in the future conflicts too.

e. **Hacker Warfare.** In Hacker Warfare only computer systems are attacked. Here the attacker can completely, partially and intermittently paralyze or intercept the system. These attacks may range from wholesale theft of information, theft of services (like making unpaid overseas telephone calls), illicit system monitoring to injection of false message and access to the data banks for blackmailing. It is worthy to note that such attacks on military targets by the civilian hacker is better to deal within the preview of C²W. During the Gulf War, according to Pentagon report, Saddam Hossain offered US \$ 10 million to a Dutch hacker group to disrupt the command and control system of coalition forces. As the US military communication systems uses commercial channels there were about 250,000 hacker attacks on these in 1995, and in 65% cases these were successful. FBI estimates that electronic crimes are running at about US \$ 30 billion a year (Data of 2000).

f. **Economic Information Warfare.** At the dawn of 21st century information may function as a form of currency in world trade convertible into goods and services anywhere. Not only the commercial and economic organizations are increasingly relying on computers but also shifting to e-commerce. As such, dominance in the info-sphere might be the instrumental power for promoting development and progress of society. As the concept of 'global village' propounded by Marshall McLuhan is almost to become a reality world is becoming increasingly interconnected through the info-sphere for bilateral relation, trade, commerce etc. All these have led towards the concept of 'Economic Information Warfare'. It has got two forms: namely, '**Information Blockade**' and '**Information Imperialism**'. In the first type the wellbeing of the societies will be affected by blockade of information flow instead of materials e.g. formula for COCA-COLA. Nations would struggle to access or to deny the access to information. The second one implies to someone's complete information superiority or dominance over others. In both cases winner will have an edge to cripple the weaker side's economy.

g. **Cyber-warfare.** IW focused on Cyberspace is Cyber-warfare. There are a number of schools of thoughts on Cyber warfare. However, for general understanding their basic characteristics are given below:

- (1) Such warfare may be waged through super-intelligent and interactive global intermitted type information sphere.
- (2) The target will human knowledge, beliefs and mind.
- (3) Rather than the conventional battlefields the people will fight on the giant displays. Once defeated, people will be pushed in a total information eclipse. His all activities may come to standstill due to future day's absolute information dependence of human being.
- (4) Rather than real men, their virtual images may reside inside the cyberspace or computers. So fighting may take place between the virtual soldiers.
- (5) The bizarre concept of 'Cyborgs' may be turned into a reality.
- (6) Even by DNA identification future warriors may be capable to develop biological weapons or software graphics or other means which will be effective against a particular race or people, such as the blacks or whites.

C²W, IBW and EW may be exclusively directed towards the military assets, while Economic Information Warfare and Hacker may be against the non-military assets. But PSYOPS and Cyber warfare would affect the both equally.

Weapons and Systems of Information Warfare

7. **IW Systems.** Besides state-of-the-art EW systems, IW systems include different types of command and control systems; communication, surveillance and computer networks; and UAVS, AWACS, JSTARS and Fire Control Systems.

8. **IW Weapons.** IW Weapons may include Computer Viruses, Chipping Devices, Nano-machines and Microbes, and HERF Guns and EMP Bombs. Synergy of all these may enable an '**information Warrior**' to Create a havoc. IW weapons are as follows:

- a. **Viruses.** A computer virus is a self-replicating and potentially dangerous software programmes, which attack computer memory. There are about more than 12000 viruses in circulation today. Commonly encountered Viruses are 'Trojan horse', 'Worms', Sniffers, Logic Bombs' and 'Trap Doors'. They differ in the method of replication, transmission and attack.
- b. **Chipping Devices.** Like the bugs in the software, it is also possible to implement similar bugs or functions in hardware. Today's electronic chips contain

millions of integrated circuits. Manufacturer may one day configure these circuits so that they can do some bizarre. On receiving the appropriate signals, they may stop functioning or blow up for self-destruction or may send location signals. On the basis of these enemy position may be identified. According to declassified report, it is believed that the US manufacturers did the same while supplying military hardware to Iraq during Iran-Iraq War and it served their purpose during the Gulf War.

c. **Nano-Machines and Microbes.** Nano-machines and Microbes are tiny robots (smaller than ants). Unlike viruses, their targets are computers hardware. Nano-machines may crawl down to the enemy computer systems and launch attack on Central Processors. Microbes are unique in the sense they may eat up the materials (Silizium) of electronic chips. Already the US and Japanese scientists are working on theses.

d. **HERF- Guns and EMP Bombs.** High Energy Radio Frequency Guns (HERF-Guns) and Electromagnetic Pulse Bombs (EMP) are able to shoot a high power electromagnetic energy on the targets. Thus these overload the electronic systems rendering them non-operational. The targets can be a mainframe inside business buildings or an entire network in the buildings.

e. **Other Information warfare Weapons.** The several other weapons are as follows:

(1) **Low Energy Lasers.** These Lasers can be used to damage the optical systems of sensor, thus attacking the information systems at the data collection level. A number of systems are reported to be under further development in the US and UK.

(2) **Electrical Power Disruption Bombs.** The technology originated after an accident on the US West Coast when chaff cut power supplies to the city of San Diego in 1985. The weapon uses light and conductive carbon fibres that wrap around transmission lines and distribution points to cause a massive short circuit. The fibre must be removed during restoration of power. This weapon can be delivered by cruise missiles, as was the case in the Gulf War or from unmanned aerial vehicles.

(3) **Graphite Bombs.** During the Kosovo conflict the power stations in Belgrade were paralyzed by the U.S. through the use of Graphite Bombs. It is believed that their Nuclear Driven Radio Frequency (NDRF) Warheads are under development. From satellite NDRF can be activated at a height of 50 to 100 Km over a target. Creating an intense electromagnetic field it would be capable of disrupting all Command Control Centres, computers networks, power grids and telecommunication system within a radius of 1000 Km, without any fall-out or collateral damage on the ground.

Why IW is Different From Other Forms of War?

9. IW is totally a new type of challenge for the human civilization. Recently RAND and DoD (USA) undertook a number of studies on IW. Based on these studies following uniqueness of IW could be identified:

- a. Firstly, it is shifting the centre of gravity of traditional method of force and combat towards the non-traditional methods.
- b. Leading towards an intellectual change in perceiving the concept of security of states and military threats.
- c. Historically defined distinctions between geographical boundary, military versus non-military, war versus criminal act may gradually blurred due to integration of global information infrastructure.
- d. Concept of traditional battlefield may be diminished.
- e. Strategic alliance may become vulnerable to unknown threats.
- f. Due to low-entry cost even a small nation or non-state body or individual may pose great threat.

Implications of IW

10. The implications of Information Warfare will be numerous. The basic implications are discussed in the foregoing paragraphs:

- a. **Non-military.** These are as follows:
 - (1) **Proliferation of Conflicts.** In addition to the existing ways and means, Information systems will open up the electronic superhighway as another sphere of conflict. States, groups, nationalist or ambitious individuals may try to use the Internet, computer networks, media and databases to achieve their aim.
 - (2) **Erosion of State Sovereignty.** In the information age neither the state will dominate the means of force nor will be able to deter or defend against IW. There is general erosion of the concept of sovereignty. States, NGOS, organizations and individuals will become equally important.
 - (3) **Scope of International Law (IL).** Different forms of IL may become ineffective to deal with IW comes and offensive actions. As such, these will need readjustment accordingly.

b. **Military** .IW has changed the way we think, organize and fight:

(1) **Battle Space**. The major impact of IW on operations should be to speed them up so that commanders can 'stay inside' their opponent's OODA Loop during the battle. With increased tempo, however, command and control problems will become exacerbated. Time compressed and space enlarged. The reach of future battlefield will increase manifolds. Transcending the classical definition now it will encompass information power as the fifth dimension's. The higher is the information power the less will be freedom of enemy forces in the battle space.

(2) **Concept of Manoeuvre**. Application of IW will radically change the meaning of manoeuvre warfare. Neither the attritional approach nor the explosive thrust will suffice. Instead, the information warfare will be focused to systematically disorganizing the enemy and exposing his Centre of Gravity (COG).

(3) **Doctrine**. Information is not only being regarded as an adjunct of strategy or tactics but warfare itself. As such, the Doctrine needs to incorporate these changes for providing a holistic basis for conduct of war. Now there is a paradigm shift in the orthodox thinking of military leaders and more new concepts like, Network-Centric Warfare, Digitized Battlefield, RMA, Dominant Battle space Knowledge (DBK) etc are now emerging in the military lexicon.

(4) **Training & Organization**. Drastic change in the organization and training system is also essential in view of upcoming information warfare. Hence the U.S. National Defense University has already launched an extensive programme for 300 World Web-based training. In 1996 alone 48 Officers were graduated on information warfare and a huge defense budget is allocated for this.

Defence Against the IW

11. This is the most obscure part and less talked subject of the information warfare. Security restrictions and technical limitations are the main reasons behind this. At one end information warfare's targets encompasses both military and non-military objects, on the other hand due to economical constraints military systems will mostly rely on commercial-of-the-shelf (COS) systems. As such defensive measures should be adopted basing on a common approach for all of these. Moreover, an integrated approach is required both from the military and non-military end. Few probable defensive measures are described below:

a. **Deterrence.** Like the cold war era 'Strategic Deterrence' concept may be developed to prevent the proliferation of information warfare. On the other hand all the nations may be brought under a free and common network. Then floating surveillance software, known as "know bots" may be incorporated in it. On tracking the corrupted line, it will proceed towards the threat and render the enemy's system inoperative.

b. **Procedural Measures.** These may be:

- (1) Creating a general awareness amongst the users.
- (2) Assessment of infrastructure vulnerabilities and dependencies.
- (3) Identifying the most vulnerable part of the system. Then developing a concept of working with a modified and redundant system once the system is attacked.
- (4) Define threat conditions and responses.
- (5) Use of identification systems.
- (6) Establishing R&D.
- (7) Avoiding large-scale integration where delicate data are handled.

c. **Technical.** Scientific approach may be adopted to minimize the vulnerability of information during processing, transmission and storage. Based on these following may be the viable options.

- (1) High Density data storage (terabytes/sq. inch) technique may reduce the computer hackers attack.
- (2) Introduction of reconnaissance systems in the information net, which will identify the threat and its direction by special software. Then it will initiate spontaneous countermeasures.
- (3) Introduction of improved software and encryption method.
- (4) Creating immunity of the system by both hardware and software. Here analogy may be adopted from the biological viruses and Anti-bodies.

Actually more research is essential to conceive the nature of threat before devising the defenses for IW.

IW in the Context of Bangladesh

12. **Common Perception.** A common misconception is prevailing that IW does not have greater relevance for Bangladesh. It is argued that Bangladesh is relatively "Low-Tech" and less computerized. As such, she has little too loose from information attacks. But fact is that South Asia has already entered in the sphere of IW. This was amply demonstrated by the recent IW attacks. Both Pakistan and India has undertaken a number of pragmatic steps to "augment their IW capabilities. Bangladesh has already been on the verge of threats from IW and it has significant number of assets that are to be protected from enemy information attacks. Hence, we need to give due emphasis on the subject to evaluate our vulnerabilities and conceive practical measures for our defence.

13. **Vulnerability-of –Bangladesh.** In future possibility of IW attacks on Bangladesh may not be ruled out. The author could not exactly pinpoint the vulnerable assets of Bangladesh due to lack of data. So far Bangladesh did not carry out any in-depth study on this. However, research revealed the following vulnerable sectors:

a. **Internet and e-mail Services.** At present a few thousand people of Bangladesh are using the Internet, and is expected to reach more than one million by the end of 2004. The academicians, scientists, govt.-officials and military personnel are exchanging classified or semi-classified data through these. Hence the information security of Bangladesh may seriously be threatened by the IW through the Internet.

b. **Community Services.** The potential attackers may create havoc by breaking in the central computer of T&T(which controls more than 0.5 million telephones); PW&D and DESA (which controls the distribution of 11.039 billion kWh), and Bangladesh Biman. Concomitantly, our Banks, Stock Exchanges and similar financial organizations also are prone to IW attacks.

c. **Software Industry and E-Commerce.** At present Bangladesh is exporting software to the international market worthing Tk 140 Crores. Provided a conducive environment is created for our software wizards it has the potential to reach even up to US\$ 15 billion by the end of 2010. This software is passed through Internet. Hence any attack on Internet will disrupt this business.

d. **Propaganda Against Bangladesh.** The hackers may break-in in the official web sites of the government and modify the recorded data. Then transmit these corrupted data to the outsider world. For example, data on human right violation or child labour in Bangladesh, and may cause defamation to Bangladesh.

14. **Options for Bangladesh.** At the moment there is no organizational set up in Bangladesh to evaluate, survey, monitor the IW and formulation of defensive measures. Concomitantly there is a general ignorance on the subject, both in military and civil sectors. Most people consider IW as only media-warfare or psychological warfare. But its dimension is far more wider than this. As such, it is the need of the day that an IW Cell is set up at the government level for undertaking the required activities. In the military sector too, the subject is required to be introduced in the curriculum of senior level courses. The formulation of defence against IW may seem a difficult task at the moment. But Bangladesh has a good number of scientists, software experts and experienced military personnel, who may be employed to undertake R&D jobs. Although the high-tech equipment or supercomputers may not be available or obtainable due to obvious reasons or budgetary constraints, even commercially available computers and other total may be used for developing defensive measures.

Conclusion

15. As the human civilization has entered the third Millennium, the information revolution is changing the concept of state's security and war-waging. Whoever controls or dominates the info-sphere will have the power in society and will dominate the future battlefield. Now-a-days access to information can drive a thriving economy downward, or propel a weak one into the position of power. The primary functions of information warfare include activities that deny, exploit, corrupt, destroy or protect information. Accordingly, the nature and types of information warfare is classified into seven widely accepted sub-groups. These are Command and Control Warfare, Information-based Warfare, Electronic Warfare, Psychological Operations, Hacker Warfare, Economic Information Warfare and Cyber warfare.

Reference:

1. DSCSC Précis
2. Alan D. Campen, "The First Information War The Story of Communications, Computers and Intelligence Based Systems", Fairfax, AFCEA, International Press, 1992.
3. Alvin and Heidi Toffler, "War and Anti-War Survival at the Dawn of 21st Century", Warner Book, UK, 1994.

TOPIC-15

PSYCHOLOGICAL OPERATIONS

Introduction

1. A proven winner in combat and peacetime, Psychological Operations (PSYOP) is one of the oldest weapons in the arsenal of man. It is an important force protector/combat multiplier and a non-lethal weapons system. PSYOP or Psychological Warfare (PSYWAR) is simply learning everything about the target enemy, their beliefs, likes, dislikes, strengths, weaknesses, and vulnerabilities. Once it is known what motivates the target, it is ready to begin psychological operations. PSYOPS may be conducted by the various government organizations and military staff and organizations. Military PSYOPS must always conform to national objectives and policies. Within this framework, military PSYOPS will support the mission assigned to the military commander and reinforce all actions and programmes implemented by the military units.

2. Although the term “psychological warfare”, is of a recent origin but it is not new. It was practiced as early as 500 BC by SUN TZU; by GIDEON and JOSHUA from 15 BC to 1300 BC; by NERO from 37 to 84 AD and by CHENGHIS KHAN in early Thirteenth Century. In the recent past it was practiced by the Germans and British during 1914-18 war; by the Germans, British and Americans in the 1939-45 war and by the Americans in the Gulf War.

Definition

3. PSYOPS may be defined broadly as the planned use of communications to influence human attitudes and behavior to create in target groups behaviours, emotions, and attitudes that support the attainment of national objectives. PSYOPS are planned operations to convey selected information and indicators to audiences to influence their emotions, motives, objective reasoning, and ultimately the behaviours of organizations, groups, and individuals.

Aim, Objective and Task of PSYWAR

4. **Aim and Objectives.** The aim of PSYWAR is firstly demoralize the enemy soldier and population. Secondly, to indoctrinate him i.e. eradicate the doctrine in which he has been taught to believe on his own side and finally, to indoctrinate him with the positive doctrine we wish him to possess. Following are the objectives of PSYWAR:

- a. Reduce the combat efficiency of the enemy by exploitation of all political, economic, social and moral aspect of the enemy.
- b. Facilitate reorganization and control of occupied of liberated area.
- c. Produce cumulative affects upon the opinions emotions attitudes and behavior of the target audiences that will assist in the defeat of the enemy.

5. **Tasks.** Like military operations, psychological warfare objects are achieved by assigning tasks to lower levels, each encompassing a particular project the accomplishment of which will achieve the psychological warfare object. The tasks may be any one or more of the following for various target audience depending upon the situation and the level to which the task(s) is assignment:

a. **Towards Enemy Soldier.**

- (1) To induce malingering, desertion, mutiny surrender among enemy troops.
- (2) To create distrust in the existing enemy leadership, arms and equipment.
- (3) To create confusion as to the righteousness of enemy war aims.
- (4) To install a lack of faith in the enemy's ultimate victory.

b. **Towards Enemy Population.**

- (1) To develop resistance to the political ideologies of the enemy govt.
- (2) To drive a segment between the enemy's government and the people.
- (3) To create conflict within specific enemy groups.
- (4) To encourage resistance move within enemy areas.

c. **Towards Foreign Groups.**

- (1) To gain cooperation of foreign groups within occupied areas.
- (2) To deny the cooperation of foreign groups within areas occupied by the enemy.

d. **Towards Allies of Own and Enemy.**

- (1) To increase the friendship and cooperation among the allies.
- (2) To cause a split between the enemy and his allies.

e. **Towards Neutral Groups.**

- (1) To build good will and friendship with neutral country.
- (2) To deny to the enemy the economic or political collaboration of neutral countries.

Planning and Conduct of Psyops

6. Psyops may be conducted by the various government organizations and military staff and organizations. Military psyops must always conform to national objectives and policies. Within this framework, military psyops will support the mission assigned to the military commander and reinforce all actions and programmes implemented by the military units. At the national level, psyops exploit the broad aspects of military operations and socio-political-economic development programmes. They are general in scope and deal primarily with national policy and programmes. Tactical and consolidation psyops are responsive to local intelligence and address more specific target audiences. In areas with large minority groups, psyops should employ appropriate languages, dialects, and symbols that can be readily understood by these groups. Military psyops and civilian information services planning must be closely co-ordinated and supervised at all levels to ensure effectiveness and credibility. Now for psychological operations to be effective, one must carefully plan his propaganda. One must make sure that he/she knows everything about the enemy and that he/she is targeting enemy's beliefs and not using his/her own. For example, at the very beginning of Desert Shield, just after Iraq invaded Kuwait, President Bush referred to Saddam Hussein as being *"just like Adolph Hitler"*. Military forces are representatives of the government and, in many cases, a major factor in the formation of attitudes and behaviour towards the government. For this reason, commanders must constantly be aware of the psychological effect of operations conducted in their areas of responsibility, as well as, the effect of general behaviours of troops. Military operations often have a psychological impact on the population and the success of an operation often may depend on the commander's awareness of the psychological and political implication of military actions. So commanders are responsible for ensuring that their psyops and military operations are consistent with the government policies and conform to any specific political guidance.

7. **Pre-requisites**. The basic requisites for an effective psyop plan include:

- a. An intimate knowledge of the history, background, current environment, and attitudes of potential target groups.
- b. An intimate knowledge of the insurgent's organisation, sources of men and material and how they are obtained.
- c. A knowledge of the strengths and weaknesses of ideological and political opponents.
- d. An assurance that psyop plans support national objectives.
- e. A knowledge of all means of communication available to carry out psyop.
- f. The ability to classify the population by audience type so that themes can be tailored to influence specific groups.
- g. The availability of continuous, timely, accurate, and detailed intelligence (including effect of current psychological operation.)

Methods

8. Propaganda can be applied by any of the following methods:
 - a. **The Written Word.** Leaflets, posters, pictures, pamphlets, safe conduct passes, books, special publications, and the press are good resources.
 - b. **The Spoken Word.** Radio broadcasts, ground loud speakers, voice aircraft, surrendered personnel, public address systems, rumours, films and television are some of the available sources.
 - c. **Good Deeds.** Well planned civil affairs.
9. **Military Resources.** Bangladesh Army/Navy/Air Force as of today does not have any dedicated psyop resources. The British Army's psyop organisation is as follows:
 - a. **Staff Officer.** This is available to only higher military Headquarter. It is responsible to the military commander for the conduct of psyops.
 - b. **Mass Communication Unit.** This is a small unit, which is equipped with loud speaker equipment, cinema projectors and tape recorders. The precise establishment varies according to the situation but includes locally provided translators, artists and cartoonists. The unit is capable of:
 - (1) Conducting propaganda activities among the population by means of film show, recorded broadcasts and direct appeals.
 - (2) Producing direct appeals in the vernacular for air or ground broadcast to specified insurgent groups. Such appeals usually based on timely intelligence.
 - (3) Preparation and distribution of leaflets either to the local population or insurgents.
 - c. **Voice Aircraft.** Aircraft can be equipped to broadcast short messages, live or on tape. Such aircraft are useful reaching remote or inaccessible areas. They can be directed against the insurgents or civil population. Some contingency tapes may be required to save reaction time.
 - d. **Printing Units.** Where possible, leaflets and news-sheets should be locally produced. The leaflets then can be air dropped or ground distributed.
10. **Civil Resources.**
 - a. **Radio and Television.** These are ideal for psyop, in that they can reach more people more quickly from one source than any other media. Radio propaganda can be put over in speeches by leading personalities, news

commentaries, interviews and even in such things as drama, musical, or religious programmes.

b. **Newspapers and Other Publications.** These should give accurate and encouraging news and counter any insurgent propaganda.

c. **Face to Face Persuasion.** Visits to towns and villages by government officials to address the people.

d. **Rumours.** These can be spread by local agents, for example, misleading and sometimes confusing reports of the deployment and intentions of the security forces. Rumours, however, can easily become distorted and cause results more far reaching than anticipated or desired. They should therefore be introduced with caution and local advice should be obtained whenever possible.

e. **Local Translators, Interpreters, Announcers, Artists and Printers.** These can be used for the production and dissemination of propaganda.

f. **Films.** These are particularly useful in under-developed areas where a film show always attracts a large attentive audience.

g. **Drama Troupe.** The traveling troupe presents a live play, which brings out the lies and deceptions practised by the insurgents. Inclusion of local topics/themes can also make great impact.

Types of Psyops

11. There are basically three types of Psyops i.e. tactical, strategic and consolidation Psyops:

a. Tactical PSYOP is addressed to a specific enemy combat group, to induce them to perform a specific action that will affect the current or short-range combat situation.

b. Aimed at a larger audience, Strategic PSYOP is put into effect by a carefully planned campaign against a larger target audience than that toward which Tactical PSYOP is directed.

c. Consolidation PSYOP's mission is to assist the civil and military authorities in consolidating their gains, by establishing and maintaining law and order, and by re-establishing civil government in an occupied or liberated area.

Conclusion

12. By the application of sound PSYOP techniques, through face-to-face communication and mass media communications, it is proved that one can appeal to the intelligence, reason, and emotions of the target audience to get them to think and act as desired. If the people are shooting, they can be persuaded to lay down their arms. If they are afraid, they can be convinced that they have nothing to fear. If they are belligerent and uncooperative, they can be shown the value of unity and cooperation. Lastly and most important, the utilization of PSYOP can prevent needless bloodshed, destruction and misery. That is why it is said, with conviction, that psychological operations, or PSYOP, are truly a humane weapon.

Ref:

1. DSCSC Précis
2. Psychological Operations/Warfare by Major Ed Rouse (Retd).

TOPIC-16

NUCLEAR BIOLOGICAL AND CHEMICAL WARFARE

Introduction

1. The introduction of gas warfare in World War I and nuclear warfare in the World War II has set off one of the most dreadful type of warfare i.e. Nuclear Biological And Chemical Warfare (NBCW). In World War I about 4.6 percent of the total casualties resulted from chemical weapons. The atomic bomb dropped by USA on Hiroshima and Nagasaki of Japan during World War II (06 and 09 Aug 1945) killed quarter a million people instantly and more than 90 percent of all the constructions were completely or partially destroyed and many more were maimed due to its effects.

Glossary of Terms

2. Some terminologies those are related to NBC Warfare are discussed below:
- a. **Active Material.** The material such as Plutonium and certain isotopes of Uranium, which is capable of supporting fission chain reaction. Also called fissionable and nuclear material.
 - b. **Chain Reaction.** A process in which some of the products of a step of the process are instrumental in causing a continuation or magnification of the process. Specially a fission chain reaction in active material is continued or magnified by the neutrons, which are one of the products of fission itself.
 - c. **Fission.** The process of splitting an atom into two major portions with the release of substantial amount of energy.
 - d. **Fusion.** The process whereby nuclei of light elements combine to form the nucleus of a heavier element; with the release of substantial amount of energy.
 - e. **Nuclear Weapon.** Any weapon in which the explosion results from the energy released by reaction involving atomic nuclei, they fission or fusion or both.
 - f. **Biological Agent.** A microorganism that causes diseases in human, plants, animals or causes deterioration of materials.
 - g. **Chemical Agent.** A chemical substance intended for use in military to kill, seriously injure, or incapacitate human through its physiological effects. Excluded are riot control agents, smoke, flames.
 - h. **Contamination.** The deposit and/absorption of radioactive material or biological or chemical agents on and by structures, areas, persons or objects.
 - j. **Fallout.** The descent to the earth of radioactive particulate matter from a nuclear cloud.
 - k. **Incubation Period.** The time between infection or exposure and onset of symptoms.

NBC Threat

3. The use of these NBCW weapons in the past two World Wars set off the development of these weapon systems by various countries and poses an increasing threat globally. Despite the 1925 Geneva Convention banning the use of chemical warfare (CW) agents, they have been used regularly and with an increasing frequency. In 1977, only 05 nations were thought to have possessed such weapons but recent estimates put the figure about 20 or more. Besides western military power many developing and under developed countries are also believed to be in possession of CW weapons.

4. Since the first use of nuclear weapons in Hiroshima and Nagasaki, although there has been no use of the same in any of the recent conflicts, but it is a known fact that the nuclear proliferation has taken place in many smaller countries besides the super powers. India and Pakistan also has acquired the capability at strategic level.

5. Although the threat from biological warfare (BW) agents are negligible but the possible impact of selective BW attack on key elements of our Armed Forces or on key areas in the mobilization chain cannot be overruled. It is therefore, imperative that all modern armies need to have defence capabilities against NBC attacks, if they are to survive in a future war.

Common Characteristics

6. Though the NBC weapons are different from each other, they share following common characteristics:

a. **Large Area of Coverage.** NBC weapons can kill over large areas. BW and CW agents can reach and find targets hidden from conventional weapons. CW agents find their way into bunkers. Diseases caused by BW agents can easily spread among troops in the battle area. Nuclear radiation may even penetrate armour. The areas of actual contamination cannot be precisely predicted, and that makes the situation more complex.

b. **Mass Casualties.** NBC weapons cause unimaginably mass casualties. The atomic bomb dropped at Hiroshima on 06 Aug 1945 caused about 1,44,000 casualties. A chemical attack in WW I killed 15,000 peoples.

c. **Persistent Danger.** These weapons can kill or injure long after they have been employed. How long they can produce casualties can never be precisely determined.

d. **Defence Measures.** NBC defence measures make an army heavy and slower. Even possible NBC threat could force armed forces to take time consuming defensive measures. Troops must disperse to reduce the effect of an attack. Fighting or working in protective gears is difficult and tiring. The overall fighting capability of a force in protective posture is greatly degraded.

e. **Complimentary.** NBC and conventional weapons complement one another. They can be used together to increase their effects.

Effects of NBC Weapons

7. The effects which may be resulted from a nuclear explosion are:
 - a. **Blast and Shock.** Due to this personnel will be pushed over and thrown about. They may suffer from internal organ injuries. Equipment may be fractured/compressed and turned over. Buildings or trees may be blown down. Earth surface may be cratered or collapsed.
 - b. **Thermal Radiation.** This may consist of tremendous amount of light heat and fire that will damage personnel, equipment and natural environment.
 - c. **Nuclear Radiation.** This will cause both external and internal damage on human and result in death.
 - d. **Electromagnetic Pulse.** This will affect radar and radio equipment, also produces threat to electrical and electronic systems.
8. The effects which may be resulted from chemical weapons are:
 - a. **On Human Body.** Nervous system of the body may be interfered and led to disruption of bodily functions. Lung tissues may be prevented from using oxygen in the blood. Breathing passages may be choked. Inflammation, blistering of skin, eyes and breathing tract is very common. These weapons may incapacitate the human body.
 - b. **On Materials.** Food and drinks may get contaminated. The functioning of equipment may be impaired
9. The effects of biological agents are delayed for varying periods of time after exposure. This delay may vary from 02 days to 03 weeks according to the organism employed. These agents may cause more than two dozens of different types of disease such as influenza, typhoid, small pox, plague, dysentery, cholera, pulmonary anthrax etc.

Methods of Delivery

10. Nuclear weapons can be delivered by guns, free-flight rockets, guided missiles and aircraft or by pre-positioning those on/under the surface. The chemical agents may be delivered by two methods like bursting munitions and spray equipment. Bursting munitions include artillery mortar shells, aerial bombs, guided missiles, rockets, chemical mines and grenades. Biological agents can be delivered as liquid droplets, aerosol, dry powder and insect vectors or by addition to water or food supplies.

NBC Protection

11. All soldiers and leaders must adhere to the principles of good health. This applies specially in NBC environment. Soldiers must continually follow some basic principles like up-to date immunization, good hygiene, area sanitation and physical condition so unit efficiency will not suffer severe degradation. Protection is divided into two broad categories. These are:

- a. **Individual.** It involves those measures each soldier must take to survive and continue the mission. It includes individual protective clothing and equipment called "Mission Oriented Protective Posture" (MOPP) gear.
- b. **Collective.** Collective protection should be an integral part of NBC countermeasures. It provides a contamination free working environment for selected personnel and it allows soldiers from continuous wearing of MOPP.

NBC Defence

12. If the NBC threat cannot be discounted completely, it is necessary to implement NBC defence measures through provision of equipment, modification of operation procedures and by training. They can be categorized as under:

- a. **Pre Attack Precaution.**
 - (1) NBC defence training.
 - (2) Provision and preparation of NBC equipment, including hardening of shelters and equipment against NBC weapons effect.
 - (3) Modification of operational procedures for use in NBC environment.
 - (4) Tactical dispersion, concealment of resources and use of cover.
 - (5) Medical precaution like vaccination and use of antibiotics, covering food and water.
- b. **Attack Protection Measures.**
 - (1) Detection of NBC attack.
 - (2) Alarm and adjustment of NBC threat.
 - (3) Individual and collective protection.
- c. **Post Attack Counter-Measures.**
 - (1) Warning and reporting of NBC weapons effects.
 - (2) NBC reconnaissance, monitoring/survey.
 - (3) Measures of control damage, exposure to radiation, disease and contamination of food and water.
 - (4) Contamination control by avoidance and decontamination.
 - (5) Medical treatment of casualties.

Reference:

1. JCSC Précis on NBC Warfare, School of Infantry and Tactics, BA.

TOPIC- 17

UNCONVENTIONAL WARFARE

“We are advocates of the abolition of war, we do not want war; but war can only be abolished through war, and in order to get rid of the gun it is necessary to take up the gun. If anyone attacks us and if the conditions are favourable for battle, we will certainly act in self-defence to wipe him out resolutely, thoroughly, wholly and completely. We do not strike rashly, but when we do strike, we must win.”

- Mao Tsetung

Introduction

1. The Oxford Dictionary defines ‘unconventional’ as ‘not based on or conforming to what is generally done or believed’. If interpreted militarily, Unconventional Warfare (UCW) would mean – employing capabilities other than weapon systems that produces traditional heat, blast and fragmentation to achieve the desired effect. It could equally mean the application of these traditional kinetic effects in unusual or innovative ways to upset, disorient, or weaken an enemy. By turning weaknesses into strength, they can compel an enemy to give up its political purpose. The UCW, more commonly known as ‘Guerrilla Warfare’, although had revolutionary connotation during its origin, has turned out to be a powerful fighting strategy over the years. The concept was mainly developed by Mao Tsetung in China and has been widely used as a fighting strategy by the freedom-seeking guerrillas in many countries of the world. Liberation of Bangladesh was no exception.

2. Guerrilla Warfare came to be known as UCW in the modern history, has originated in Spanish Civil War in 1808. The Spanish word ‘guerrilla’ means ‘little war’, but the opposing forces of Napoleon’s Army was then called ‘guerrilla’ bearing connotation of terrorists/bandits. The Guerrilla/UCW has its glorious history. The warfare was fought in different form and nature in the Boer War, the American Civil War and in the Spanish Civil War. The Cuban Revolution, the Algerian War and Indochina War are also famous for Guerrilla Warfare. Its Application was again witnessed in Burma, Greece, Russia, Malaya and Yugoslavia during 2nd World War. The method of UCW got further matured in the Chinese Revolution under Mao Tsetung. In the recent past Iraqis adopted unconventional methods during the war in Iraq against USA and her allies. Bangladesh has its own glorious history of fighting such warfare in the great War of Liberation in 1971.

Definitions

3. Following definitions are adopted related to unconventional warfare (UCW):

a. **UCW**. “UCW is operations conducted during war for military, political or economic purposes in designated area of operations having a pre-designated organisational framework making use of local population and resources.”

b. **Blending UCW with CW**. When both conventional and unconventional warfare are integrated together for achieving common objective, it is termed as

blending. To tie UCW with conventional efforts, two things are essential. First, there must be an organisational framework within which the unconventional forces must operate. Second, a chain of command must exist between the conventional and unconventional forces. Blending can be achieved only when the efforts of both the forces are synchronized to accomplish the overall mission.”

c. **Levee En Masse.** If the enemy approaches an area for the purpose of seizing it, the inhabitants, if they defend it, are entitled to the rights of regular combatants as a ‘levee en masse’, although they wear no distinctive sign. In such a case all the inhabitants of the area may be considered legitimate enemies until the area is taken. Should some inhabitants of a locality thus take part in its defence, it might be justifiable to treat all the males of military age as prisoners of war. Even if inhabitants who formed the ‘levee en masse’ lay down their arms and return to their normal activities, they may be made prisoners of war.

d. **Unconventional Warfare Force (UWF).** A force generated from local population (volunteers) and organised under a pre-designated organisational framework by the competent authority for conducting UCW.

Conduct of UCW Operations

4. Conduct of unconventional operations cannot be bounded by some fixed tactics/concept. The method of conduct may widely vary in different situation in different areas. However, method of conducting unconventional operations can be guided by the laid down procedures/guidelines prepared by the Armed Force Commanders. UCW does not necessarily mean daily combat or face-to-face struggle with the enemy; they will assume fighting forms more subtle and difficult for the individual fighter to endure physically and mentally. UWF are likely to be pursued and remain under constant security hazards from enemy. The forces may have to be on the move and avoid combat on a certain situation. Their forms of tactics will depend on judicious utilization of terrain to secure advantages that will upset the correlation of forces and degrade enemy’s moral and material. As long as UCW unit/subunit is not in a position to choose ‘how’ and ‘when’, no operation should be conducted.

Considerations for Conducting Unconventional Operations

5. Some points may be taken into consideration for conducting unconventional operations, which are discussed below:

a. **Adherence to Overall Operational Concept.** The concept of blending UCW with Conventional Warfare implies that Conventional Warfare is the main stay of warfare, with which UCW is blended to augment the conventional efforts. It is therefore, imperative for UWF to plan and conduct operations/actions remaining within overall operational concept of conventional force commander.

b. **Non-Linear Engagements.** Engagements of UWF should be of asymmetric pattern. By making the enemy feel insecure everywhere and always,

UWF can achieve to unnerve enemy's command cycle. UWF should be able to carry out non-linear engagements throughout the length and breadth of the battlefield at varying time, intensity and types of operations.

c. **Simultaneity of Multiple Operations.** Simultaneity of multiple operations conducted by both conventional and UWF throughout the battlefield can create fluidity and can increase fog and friction for the enemy commanders. Efforts should be made to engage enemy forces simultaneously, irrespective of enemy's location, employing either unconventional or both conventional and unconventional means.

d. **Targeting Enemy's Decision Making Cycle.** The objectives of UCW can best be achieved, if enemy's decision cycle can effectively be attacked. Unconventional operations should, therefore, be so planned and executed that their efforts are directed to enemy's decision making cycle.

e. **Surprise.** This can easily be achieved by the UWF for their ability of merging with local inhabitants. Achievement of surprise in successive operations by UWF can infuse insecurity and uncertainty into the minds of enemy contributing to creating fluidity in battlefield. UWF can achieve surprise by employing different tactics, methods, means and by selecting unexpected time and place.

f. **Use of Indigenous Resources.** UWF to generally plan and use indigenous resources ranging from equipment, transport, weapons to anything necessary for conducting UCW. Indigenous resources will mostly come into use in carrying out sabotage activities, conduct of special operations and in their logistics.

Basic Requirement

6. Basic requirements for conducting UCW operations are as following:

a. **Understanding of Purpose.** UWF must be adequately clear of the aim and purpose of unconventional operations that they have planned to undertake or have been instructed to undertake.

b. **Selection of Target.** Selection of target for unconventional operations should conform to the overall design of operation and conventional force commander's intent. Selected target should be within own capability and resources.

c. **Intelligence.** UWF mostly have to rely on their own means of collecting information. They may also seek information from conventional forces' headquarters, units, whenever possible.

d. **Ability to Merge.** UWF may have to live with local inhabitants in the enemy occupied/influenced areas. Ability of merging with populace without giving away their identity as UWF is important for their security and survival.

- e. **Security.** UCW environment makes UWF prone to unexpected and unknown threats. Therefore, commanders at all levels must be specially concern about their personnel, material and information security.
- f. **Tenacity of Survival.** UWF must be able to survive under all odds and challenges and continue to operate. They should have sound motivation to survive and strong will to fight.
- g. **Initiative.** The environment and nature of unconventional operations demand UWF to retain enough initiative.
- h. **Recurrent Engagement.** UWF should maintain the frequency of engagements to have better effects in achieving overall mission. Recurrence of engagements will seriously degrade enemy's fighting ability and morale.

Basic Tactics

7. Mao's great saying, "Withdraw when enemy advances; harass him when he stops; strike him when he is weary; pursue him when he withdraws" is still applicable UCW in modern days. Usually UWF will go for hit and run tactics, ambush/raid the opportunity targets and render enemy Lines of Communication unsafe and insecure. They will not engage themselves in any decisive engagements rather they will break clean to reorganise and strike elsewhere. But principles of war are equally applicable for UCW.

Possible Role of BAF in UCW

8. **Blending – During Initial Phase of Hostility.** BAF can conduct limited scale UCW during initial phase of hostilities. Following are few possible ways for BAF to blend conventional and UCW during such stage:

- a. Airborne operations for UWF.
- b. Clandestine operations.
- c. PSYOP.
- d. Logistic support to UWF.
- e. Integration of BAF intelligence network with UWF.

9. **Blending – During Later Phase of Hostility.** BAF conventional efforts are likely to be exhausted after a certain period of a conflict. It is therefore rational to explore the ways and means for BAF to blend conventional and UCW in such situation. In addition to the ways and means mentioned before, blending can be achieved by BAF in following ways:

- a. Utilization of BAF manpower and equipment in UCW.
- b. Utilization of communication expertise.
- c. Integration of second line of defence.
- d. Utilization of civil assets.

TOPIC-18
AERIAL MUNITIONS

Introduction

1. An air weapon is required to produce a desired effect on a target system viz: cause damages, effect neutralisation, produce destruction etc. Sometimes the damage required is expressed as a percentage, eg, 50% structural damage, 30% hospitalisation and so on. Damage caused by an air weapon depends upon the weight of the projectile; its shape and size, explosive contents, type of fuse fitted, terminal velocity and accuracy of delivery. Other factors remaining constant, the faster the projectile, the greater its accuracy. For this reason cannons are more accurate than RPs, and RPs are more accurate than free-fall bombs.

2. To achieve the desired effect, the correct weapon should be employed against a particular type of target. An aircraft is an excellent platform for delivery of a variety of mixed weapons to produce the right effect on a given target for optimum results. Some of the terminal effects are as following:

- a. **Penetration.** Penetration before explosion is the main requirement against hardened targets such as armour, RCC shelters, bunkers and the like. Hollow Charge (HC) RP are most effective for penetration.
- b. **Fragmentation.** A shotgun effect is produced by fragments of weapon casing flying off in all directions. Personnel and soft-skinned targets such as vehicles are vulnerable to this effect.
- c. **Blast.** Produced by detonation of high explosives; the greater the TNT content the greater the blast effect. Vertical structures are extremely vulnerable to HE bombs.
- d. **Crater.** This effect is produced by high explosives detonating after penetration. Forged steel bombs are weapons used against runways, highways, fortifications and other similar targets.
- e. **Fire.** This effect is produced by the incendiary contents of a weapon. Ideal against inflammable targets, incendiaries are most effective when combined with a quantity of high explosives, eg, Napalm or incendiary clusters. These are effective against built-up areas, personnel under shelter, POL dumps and other similar targets.
- f. **Shock.** Earth or under-water shock is produced by explosion of a large quantity of HE below the surface. 4000 lb or larger bombs should be used for heavy structures like dams or for causing landslides. Under-water shock against submarines is produced by depth charges.

Air Weapons Classification

3. Air weapons are divided into the following groups:
 - a. Guns.
 - b. Conventional bombs.
 - c. Rockets.
 - d. Air-to-air guided missiles.
 - e. Air-to-surface guided weapons.
 - f. Maritime weapons.
 - g. Strategic air-to-surface weapons.

Guns

4. The value of the guns in the offensive air support roles has been well recognised and developments have moved ahead in recent years culminating in the celebrated GAU-8 installed in the A-10 aircraft. The importance of the gun in air defence however declined sharply with the advent of the missile, but has resumed its importance in close combat and investment in air to air gun technology has sharply increased in the last decade. Some indication of the advances in firepower derived from modern guns with high rates of fire can be deduced by considering the following:

- a. **Aden Gun**. The Aden is a revolver action gun developed from the World War 2 Mouser. It fires a 30mm shell with a muzzle velocity of 2,600 ft/sec and has a practical rate of fire of 1,200 rpm. The HE round for the Aden contains 48 gm of HE and the Armour Penetrating (AP) round can penetrate up to 40mm of armour when it penetrates at normal angles.
- b. **GSU-23**. The standard Russian guns fire 23mm shells through twin barrels. A typical installation (MIG-21) carries 200 rounds. It has a muzzle velocity of 780 m/sec and has a rate of fire of 3000-3200 rpm.
- c. **Vulcan**. The Vulcan works on the Gatling principle. The barrels rotate, the gun in line with the chamber fires, meanwhile the others cool down. It fires 20mm shells. The muzzle velocity is 3,400 ft/sec and the maximum rate of fire is 6,000 rpm. However, the gun takes 0.4 sec to wind up to the maximum rate of fire and so for short bursts a more effective rate of fire is 3,500 rpm. The ammunition available is HE, containing about 10 gms of HE, or AP, which normally will penetrate up to 35mm of armour.
- d. **GAU 8**. The 6-barrelled "Gatling" gun fitted to the A-10 can fire at either 2100 or 4200 rpm. This guns fire 30mm shells. It is designed specifically for attacking tanks. It utilizes a depleted Uranium shell, which gives enhanced armour penetration.

Conventional Bombs

5. It is interesting to note that the conventional HE bomb is still the most common version in service although its effectiveness can now be greatly enhanced by using guidance equipment which enables the bomb to be directed more accurately onto the target. This application of guidance will be covered later under the heading of Air-to-Surface Guided Weapons.

6. Some examples of the range of unguided or ballistic bombs used by different nations are as follows:

a. **Fire Bomb.** The 300 Gallon firebomb consists of a container filled with gelled fuel and fitted with an M52b fuse. The firebomb is dropped short of the target from about 100 ft height, so that the target is enveloped in gel which, after ignition, burns for up to 4 minutes. The firebomb is not a very effective weapon. Furthermore, it is made live by the M52b fuse only 0.4 ft from the aircraft.

b. **Cluster Bomb BL755.** This CBU carries 147 bomblets in 7 tiers of 21 around a central gas tube. Each bomblet has a shaped charge that will penetrate up to 12 inches of armour and the outer casing of each bomb let is made up of helical wound, square notched, steel wire. This casing breaks up on detonation into over 2,000 small pieces of metal. The bomblet pattern from release at 200 ft and 450 kts is an elliptical pattern of about 450 ft X 150 ft in area along the flight path of the aircraft.

c. **Medium Capacity (MC) Bombs.** MC bombs are manufactured in different sizes by many nations and are not always interchangeable on the same aircraft, requiring special-to-type carriers. The main British sizes are 1000 lb and 540 lb; the main US sizes 3000 lb, 2000 lb, 680 lb and 500 lb. A charge to weight ratio of about 50% is used and either a cast steel case is employed for good fragmentation against soft targets or a forged steel case for penetration of resistant targets. MC bombs can be used in the following modes:

(1) **Retard Mode.** A retarded version is fitted with drag plates and a webbing parachute that deploys after drop. This retards the bomb, enabling the delivery aircraft to escape the effects of its own weapon when bombing from a low-level attack. The fuse that is used for the retarded bomb will not make it live until it has detected a retarding force for a certain length of time. However, from an average release the striking angle is only 70 degrees, and the striking velocity in the order of 300 ft/sec, which will not allow the bomb to penetrate even a grass surface. The bombs will therefore bounce and, if a delay was set could detonate in the air. To avoid this, only the impact setting should be used. As the retarded bomb will not penetrate, the crater size that can be achieved is only about 20% of the size of crater that is obtained by using the ballistic bomb with a delay fuse.

(3) **Delay/instantaneous Mode.** The MC bomb can be fused for long delay or instantaneous (or impact) burst. It can be dropped in a dive attack,

(4) (with the aircraft pulling up to avoid the debris zone), in level flight or using a toss manoeuvre. If a delay fuse setting is required, a toss delivery must be employed and should be sufficiently steep to ensure a striking angle at the target of greater than 30 degrees. If the striking angle is less than this, the bomb will not penetrate and will skip away from the target and will possibly detonate in the air, presenting a hazard to the delivery aircraft.

(3) **Air burst Mode.** MC bombs can be air burst at heights of 50 ft or so above the target. To achieve an air burst, but still allows the aircraft to clear the debris zone; the weapon must be dropped from over 2000 ft above ground level. Air burst fuses normally use radar energy to detect the height to burst.

d. **Fragmentation Bomb.** The fragmentation bomb has a case made up of notched steel rings braced together. This produces a powerful fragmenting effect. The bomb is used against soft skinned targets. It is proximity fused by the ground pressure wave acting on a diaphragm.

e. **Runway Crater Devices.** Due to the difficulties experienced in damaging runways and other aircraft operating surfaces, several countries have developed special runway crater devices. Examples of these are:

(1) **Durandal.** This is a French bomb, which uses a parachute to slow down the weapon, and when it has achieved a suitable angle, utilises a rocket to accelerate it into the runway surface. Up to 40 cm of concrete can be penetrated; the subsequent explosion from beneath the runway surface results in extensive damage over a wide area.

(2) **JP 233.** This is a British weapon employing several small runway crater bombs which are fired downwards into the runway surface in a pattern covering a large area. At the same time a number of mines with delay fuses are laid in the area to disrupt repair operations.

(3) **BAP 100.** Belonging to the retarded/accelerated weapons, it is actually a cross between a bomb and a sub munitions. Each bomb weighs 57 Kg; 18 of them are carried in each pylon. They are released from 5080 m and penetrate 40 cm of concrete. Variable time delay fuze (up to some hours) slows down runway repair.

Modern Bombs (Exotic Weapons)

7. The weaponry available today for bombing campaigns is truly awesome, with literally a bomb, a missile or a munition available for every possible type of conceivable scenario or so it would seem. For instance, these are:

a. The E-BOMB, so called because its microwave warhead generates millions of watts of electricity in a microsecond frying any electronic circuitry in its wake, such as those found in military computers, radar systems and weapons launchers.

RESTRICTED

- b. The BLACKOUT BOMB, which rains carbon filaments onto electrical grid systems-causing them to fry and cut out.
- c. The ETHNIC BOMB or BLUE CIRCLE CEMENT BOMB, as it is often called in the UK – on account of it being filled with concrete rather than high explosives – is designed to knock out tanks or fortifications in urban areas where collateral damage is an issue, as it does not explode on impact.
- d. The DAISY CUTTER is a 7.5 ton bomb that is so heavy that it has to be rolled out of a C-130 transport aircraft, rather than a bomber. Its original purpose was to clear jungles for helicopter landing zones during the Vietnam War, however it is equally effective against troops in open or confined areas, and was used operationally in Afghanistan against Al-Qaeda fighters who were holed up in mountain caves.
- e. The MOTHER OF ALL BOMBS or MOAB (MASSIVE ORDNANCE AIR BLAST BOMB) as it is officially known is the satellite-guided successor to the DAISY CUTTER but weighs in at a staggering 21,000 lbs making it virtually a mini-nuke.
- f. The T-BOMB, is a thermo-baric bomb that unleashes an expanding wall of fire that quite literally sucks the oxygen out of a building or an underground bunker making it a fearsome weapon as it incinerates everything in its path.
- g. The BUNKER BUSTER, is a precision guided 30,000 lbs bomb capable of piercing some sixty-five feet of concrete before exploding making it the ultimate leadership be capitation weapon.

Rockets

- 8. The rocket achieved great success as a weapon during the 1939-45 war. Not only against ground targets, but also against formations of slow flying aircraft. Equal successes against the high speed, manoeuvring aircraft in today's inventory are unlikely and, similarly, the dive delivery now renders the launching aircraft extremely vulnerable to modern day anti-aircraft weapons and thereby less likely to achieve success. You should note that most rockets have to be fired from a dive starting as high as 4000 ft from which the target must be tracked steadily until release at 2,000 ft. This disadvantage may have been overcome by the recent development of the high energy rocket which has excited renewed interest in this field of weaponry and embodies the capability to penetrate thick armour with a relatively light warhead.
- 9. Rockets in current use include:
 - a. **SNEB**. The 68mm SNEB unguided solid fuel rocket has flip out fins. It utilizes the shaped charge principle to penetrate armour. The jet produced from SNEB will penetrate up to 15 inches of armour and also has a secondary, anti personnel effect. The ballistic dispersion from SNEB gives a pattern on the ground of 110ft X 20 ft from a 10-degree dive. SNEB is the maker's name.

- b. **2-Inch Rocket.** The 2-inch rocket is also a solid fuel unguided missile with flip-out fins. It is carried in a 37 -tube launcher. The warhead can be tungsten carbide, AP or HE. This is a suitable weapon for use against Fortified Protected Bunkers (FPB's).
- c. **57mm.** Russian aircraft carry packs containing 16 X 57mm rockets for use in both air-to-air and air-to-ground attacks.

Air-To-Air Guided Missiles

10. Air to air guided missiles are designed primarily to overcome the shortcomings of the gun, which is a short range weapon, requiring accurate and visual aiming for a finite time. At first, radio command guidance was attempted but this was unsatisfactory because pilots were unable to concentrate on guidance the missile during air combat. A self-homing missile was clearly required. Three methods have been or are being developed:

- a. Infra-Red (IR) homing.
- b. Semi-active radar homing.
- c. Anti-radiation homing.

Infra-Red Homing Missiles

11. All targets emit some infrared radiation. As the IR emissions can be detected at some distance, and used to distinguish the target from its environment, it can be used to establish a sight line to the target and hence to guide a weapon.

12. Advantages of IR Guidance.

- a. **Accuracy.** An IR missile can discriminate between two sources a few yards apart at several miles range, and will generally home onto a particular engine of a multi-engine target. Accuracy improves as the target is approached.
- b. **Lethality.** With its good accuracy, an IR homing missile has high lethality for a given warhead and missile weight.
- c. **Simplicity.** The missile needs only one small and relatively simple receiver; no rear reference signals are required.
- d. **Security.** As it is a passive homing missile, it does not give away its presence by radiating any type of energy.
- e. **Tactical Freedom.** Once the missile is fired, it is independent of the delivery vehicles.
- f. **Countermeasures.** It is possible to counteract IR missiles by masking the IR source, or simulating it with decoys of the precise radiation characteristics sought by the missile. However, such countermeasures are difficult to achieve.

13. **Limitations of IR Guidance.**

- a. It is degraded by cloud.
- b. Steady target acquisition may be impossible pointing into sun or bright cloud edges.
- c. If the target is subsonic, most missiles can only attack from the rear, as target skin heating is minimal. However, more sensitive IR receivers now allow homing from any angle, including head on.
- d. An IR homing head does not indicate target range. An additional range finding system is required.

14. **Close-Combat Missiles.** Recent experience has shown the need for 'dog fight' or close-combat missiles. These missiles are short range and highly manoeuvrable and are therefore small and light. Examples are:

- a. The French Matra Magic which can be launched by a fighter pulling 6g and is itself stressed to 30g, and can intercept a target at heights up to 18,000m in a forward sector of 140 degrees. It weighs 90 kg.
- b. The American Raytheon AIM-9L Sidewinder is an all aspect missile. This is the most widely used IR missile in western countries. It weighs 85 kg.
- c. The Israeli Shafir which has been used successfully against Egyptian and Syrian MIG-21 s. It weighs 93 kg.
- d. The Russian AA-8 Aphid, thought to be a development of the AA-2 Atoll. It weighs only 55 kg.
- e. The American Hughes AIM-4D is only 61 lb.

15. **Medium-to-Short-Range Missiles.** A number of such missiles have been in service for many years:

- a. The British Firstbreak is a pursuit course weapon designed to destroy targets up to 55,000 ft. An improved version weighing 160 kg called Red Top allows interceptions from any angle.
- b. The French Matra Super has a snap up or down interception capability and can intercept targets at 23,000m when launched at 18,000m. It weighs 200 kg.
- c. The American Raytheon AIM-9 Sidewinder previously mentioned.
- d. The Russian AA-2 (K13A) Atoll and AA-22 Advanced Atoll were widely used in the Middle Eastern and Indo-Pakistani conflicts and in SE Asia. However, even the advanced version has a poor performance, the IR head not always achieving a lock on the target even when in the optimum firing position. It weighs 70 Kg.

e. The Russian AA-3 Anab. AA-5 Ash. AA-6 Acrid and AA-7 Apex and their developments use either IR or semi-active radar guidance which are probably fired together in ripple. Their ranges vary from 8 to 45 km but in their IR form are probably limited to 20 km. The Anab weighs 275 kg, Ash 200 kg, Acrid 800 kg and Apex 320 kg (all weights approximate) -they are all big missiles.

Semi-Active Radar (SAR) Homing Missiles

16. If a fighter illuminates the target with its radar, a SAR missile can use the reflected signals to home onto the target. Much greater ranges are possible than with IR homing, but this method has the disadvantage that the fighter must continuously illuminate the target while the missile is in flight. Examples of SAR missiles are:

a. The British Sky Flash which is a derivative of the US Sparrow, using a British auto-pilot, SAR head and fuse. It has been very successful in tests against targets at sea level and high altitude in snap down, snap up, level and manoeuvring attack under ECM conditions. It weighs 192 kg and has a range of 50km.

b. The American AIM 7 Sparrow widely used in various air forces. It has shortcomings in the presence of ground clutter or ECM. It weighs up to 230 kg and has a range of 50-100km, depending on the version used.

c. The Russian AA-1 Alkali which was the first Russian operational air-to-air missile. It uses an IJ Band SAR, homer, weighs 90 kg, has a range of 8 km.

d. The Russian AA-7 Apex, designed for low and medium altitudes, which weighs 320 kg and has range of 30 km.

e. The Russian AA-6 Acrid, which can achieve a range of 100 km, but is likely to be limited by the range of the aircraft radar with which it operates.

f. The US Hughes AIM-54 Phoenix which is a unique weapon and is the only truly long-range air-to-air missile (200 km+). It weighs only 380 kg and was extremely successful under test. It depends on the aircraft's radar for initial guidance but during the final phase of the attack uses its own radar to illuminate the target, thus partially overcoming one of the disadvantages of SAR homing. In tests, has intercepted a target 6 miles above the launch aircraft, and another simulating a cruise missile at low altitude in a clutter background. It has survived jamming trials. It is very expensive, at over \$ 200,000 a missile.

Anti-Radiation Homing Missiles

17. Current efforts are focusing on the development of missiles, which will home onto the fire control radar of aircraft.

Air-To-Surface Guided Weapons: Methods of Guidance

18. There are 7 main types of guidance:
- a. Anti-Radiation (AR) homing.
 - b. TV homing.
 - c. IR homing.
 - d. Active or semi-active radar homing.
 - e. Laser homing.
 - f. Command radio (visual).
 - g. Command wire (visual).

AR Homing

19. A missile with an AR head is designed for use against AD radar. These missiles home onto the radiated electromagnetic energy of radar. Early US examples were Shrike and Standard ARM. Shrike weighs 177 kg and has a range of 16 km; Standard ARM 81 kg and 2 5 km. Although Standard ARM has a memory mode, both are liable to be confused by the enemy switching frequencies or turning his radar off. A newer missile is the HARM, which has greater range and accuracy and is less susceptible to ECCM. It weighs 350 kg. The French version MARTEL (AS 37) has a range of 30 km but has frequency limitations. The German Kormoran missile also has active radar and IR seekers, and is intended primarily for use against ships. The Russian AS-5 Kelt, really a pilot less aircraft, has a range 320 km and is also fitted with an active radar seeker. British Aerospace Air Launched Anti-Radiation Missile (ALARM) is in service with the RAF fitted with Tornado IDS.

TV Homing

20. TV-fitted missiles either transmit the picture back to the launch aircraft and are then steered by command radio guidance to the target, or use the TV picture to guide themselves. The main disadvantage of TV is that camouflage, light, or poor visibility degrades it. Light enhancement techniques can reduce the latter limitations. Examples of TV missiles are:

- a. British version (AJ 168) of Martel, using command guidance.
- b. American Walleye glide-bomb, in 500 kg and 1000 kg versions, using command guidance.
- c. American Hughes Maverick, designed primarily for use against tanks, weighs 210 kg and has a range of 22 km.

- d. American Rockwell Hellfire, helicopter-launched ATGM currently fitted with the Apaches.
- e. American Rockwell Hobo, a bolt-on guidance system used with standard US 900 kg and 1360 kg bombs using command guidance or self-homing, and with a CEP which is reported to be 1 metre.
- f. Russian TV guided missile named AS-X-10. Its range is 10 km. This missile is for the use on helicopters.

IR Homing

21. Some air-to-surface missiles can be fitted with IR heads and will home onto the target emissions. Ships produce strong and distinctive emissions, but promising results have been obtained against land targets such as tanks, vehicles and parked aircraft. IR homing has the advantage that it can detect camouflaged targets and can be used by day or night. However, it is degraded at dawn and dusk, and after rain. It can be used with an imaging system, and in conjunction with an aircraft-mounted target acquisition and designating IR set. Examples of missiles using IR homing include:

- a. The West German Kormoran, designed for low level and high speed launch (30m and Mach 6) against shipping. It has a range of 37 km.
- b. The Norwegian Penguin is another type of anti-ship missile. Its range is 16-24 km.
- c. The American Maverick and Hellfire missiles and Hobo guided bomb previously mentioned which can all be fitted with IR heads.

Active or Semi-Active Radar Homing

22. Semi-active radar homing requires the launch aircraft to illuminate the target; the missile homes onto the reflected energy. This system has the disadvantage that the launch aircraft must illuminate the target until missile strike. An active homer, however, carries its own radar. Both suffer limitations imposed by ECM and ground clutter, and for the latter reason this type of missile is best used against ships. The following missiles utilise active or semi-active radar homing:

- a. The West German Kormoran, which reduces the ECM problem by using its radar to update the target position, the initial position having been fed to it by the launch aircraft.
- b. The Italian Marte Project using Sea Killer semi-active missiles launched from SH-30 helicopters.
- c. The British Sea Skua using a semi-active homer with a range around 20 km. This is launched from Lynx helicopters.

- d. The American Harpoon, which uses inertial guidance during cruise and active radar homing during attack. Its range is 110 km.
- e. The Swedish Rb04E and Rb08A, both use active seekers. The latter can achieve a 150-km range.
- f. The Russian AS-1 Kennel, which uses beam-riding or radar command in cruise and passive or active radar during the attack.

Laser Homing

23. Laser guidance is probably the most accurate of guidance systems, but has limitations in mist or industrial haze. Laser illumination of the target is either by the launch aircraft or by a ground or airborne observer (Forward Air Controller). The FAC target marker overcomes the problems of late acquisition by the pilot.

Command Radio (Visual or TV)

24. Command radio guidance involves the visual alignment of the weapon with the target, the weapon being guided to the target using a data link. Command radio guidance missiles include:

- a. The American Bullpup with a range of 11 km (Bullpup B: 17 km).
- b. The French AS20 with a range of 8 km. It uses an optical tracking device.
- c. The French AS30 with a range of 12 km, utilising optical or IR tracking.
- d. The Swedish Rb05 with a range of 12 km, uses visual tracking and is mainly employed against ships. It can also be used against land targets and slow-flying aircraft or helicopters.

Command Wire (Visual)

25. Most anti-tank missiles use wire-guidance and many can be carried by helicopters. Ranges are around the 2 to 4 km mark. Examples are:

- a. AS11 (French).
- b. HOT and Milan (Franco-German).
- c. TOW (American).
- d. Swing fire (British).

Maritime Weapons

26. Many of the weapons discussed so far can also be used against surface ships or surfaced submarine, some more effective than others. However, the principal aircraft weapons used against submerged submarines are still torpedoes and depth charges. Mines are also effective against both surface ships and submarines in shallow waters, and

can be used to seal ports and harbours, as the Americans did successfully in Vietnam. Nuclear, as well as conventional explosive warheads can be fitted to torpedoes, and also to depth charges.

Torpedoes

27. The American MK 46 torpedo is deep diving and has a high speed. It uses passive or active sonar homing. It is quite small and weighs only 258 kg, and thus can be carried by helicopters as well as long range maritime patrol aircraft.

28. The French L4 is larger than the MK 46 and has active homing only. The Italian A244 is the American MK44 (no longer in service with the US Navy) with updated electronics.

Mines

29. Mining can be carried out by air and in water up to 60 m deep. It can prove a most effective form of maritime warfare. Mines have 4 or 5 types of fusing, several of which can be combined:

- a. **Acoustic**. The mine is actuated by the noise of a ship passing through the water. It can be programmed to respond only to a particular ship's "signature" (water, propeller and machinery noises).
- b. **Magnetic**. The mine is fired by detecting the change in the earth's magnetic field caused by a passing.
- c. **Pressure**. The mine is fired by sensing the change in water pressure caused by a ship passing over it.
- d. **Contact**. The mine explodes when contacted by the ship's hull.
- e. **Counting**. The mine is set to explode when the second (or later, as required) ship passes overhead.

30. One novel device is worthy of special mention. The American MK 60 CAPTOR mine is a deep-moored acoustic mines which, when activated, launches a MK 46 torpedo.

Strategic Air-To-Surface Weapons

31. Strategic air-to-surface weapons include:

- a. **American Boeing SRAM**. Carried by the B-52, FB-111A and the B-1. It uses an inertial navigation (IN) system plus terrain avoidance radar. It can carry a 200 kt weapon, weighs 1000 kg has a range of 100 km.
- b. **American Boeing ALCM**. It uses IN plus terrain comparison. It has a nuclear warhead a range of 1200 km and weighs 860 kg.

c. **American GD Tomahawk.** It uses IN plus terrain comparison. It has a nuclear warhead, a range of 3600 km and weighs 1000-kg. There is an anti-ship variant using the Harpoon active radar and a HE warhead. This has a range of 600 km. There is also a surface-launched version.

d. **Russian AS-4 Kitchen.** This uses IN. It has a range of 300 km and weighs 600 kg approximately.

e. **Russian AS-5 Kilt.** This uses active and passive radar seekers. range is 320 km.

f. **Russian AS-6 Kingfish.** It has a range of 220 km and weighs 5000-kg.

Reference:

1. DSCSC Précis on AIR WEAPON & VULNERABILITY OF TARGET.
2. A Review Of Current Weapon Systems By Brian Walters