

air
cadets



the next generation

air cadet publication
ACP 34

aircraft operation
volume 4 - operational flying



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ACP 34

AIRCRAFT OPERATION

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Operational Flying

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Instructors' Guide

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FOREWORD

The information in this publication has been taken almost entirely from AP 3000 - presented in a much simplified form to aid understanding and hopefully enhance interest. As a consequence, this ACP is in no way to be used as an authoritative document on Air Strategy and Air Power Doctrine. The sole aim of this ACP is to give senior cadets an over-view of operational flying - to promote discussion and encourage individual thought about air power and its uses. Notwithstanding that, all examination questions will be taken directly from the text found in this publication - in line with the Training Objectives and Enabling Objectives set out in the Air Cadets Instructional Specification.

CHAPTER 1

AIR POWER

Definition of Air Power

1. In the early years of military aviation aircraft tended to be used solely to help ground and naval forces. They were never considered to be a totally independent military force. As time went by however, aircraft performances had improved to such an extent, that many people considered air power to be the solution to all military problems.

2. Today, most air power thinkers take a middle course, seeing air power as playing the significant part in any military operation when used in close harmony with both land and sea forces. The definition of air power recognised by the RAF is:

What is Air Power?

“the ability to use platforms operating in or passing through the air for military purposes”.

3. The word platform really means manned or unmanned aircraft (fixed and rotary wing), guided missiles and space vehicles.

Strengths of Air Power

7 strengths of Air Power

4. Air power has the unique ability to exploit the atmosphere above the surface of the Earth. As a result, air vehicles are far 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 effectively together to produce additional strengths which are discussed below.

a. Height. Aircraft can operate over a wide range of heights and so have the ability to observe and control activities on the ground.

b. Speed. The enormous speed of modern aircraft means that they can be deployed to any part of the world very quickly. Greater speed means that missions can be completed in shorter times and more missions can be carried out each day. It also means that aircraft spend less time over the target which reduces their exposure to hostile fire.

c. Reach. 70% of the world is covered by water and 30% by land. Air on the other hand covers 100% of the earth's surface. This means that air power has a much greater reach than either land or sea forces. It also means that air power is unaffected by features like mountains or large stretches of water. The reach of air power has been greatly increased in recent years with the introduction of air-to-air refuelling. This enables aircraft to not only strike at distant targets but also fly around countries that refuse them permission to overfly.

d. All-encompassing. Air power - thanks to its height, speed and reach - can counter or pose simultaneous threats across a far wider geographical area than either land or sea forces.

e. Flexibility. Modern aircraft can perform a wide variety of tasks and change from one task to another with comparative ease. For example, the Tornado GR1A can be used for reconnaissance, attacks against land or sea targets and air-to-air self defence - quite possibly all in the same mission. Similarly, large aircraft such as Hercules can be used for surveillance, air-to-air refuelling and search and rescue as well as its primary role of air transport.

f. Response. Aircraft can be scrambled and deployed to distant places in a very short period of time, in order to counter a threat to an ally or perhaps simply to deter aggression.

Fig 1-1 Aircraft scrambled quickly to intercept a possible threat



g. Concentration. Speed, reach and flexibility give air power the ability to concentrate military force where and when it is needed the most. To have the ability to focus massive fire power against crucial targets, may well achieve operational success very quickly.

Limitations of Air Power.

3 Main limitations

5. Air power can never be the complete answer to military problems, because there are several limitations to its use.

a. Airborne Time. Aircraft can not stay airborne for ever. Although air-to-air refuelling has increased the operating range of aircraft greatly, nobody has yet found a way to re-arm, re-crew or service an aircraft in flight. For this reason air power may be thought of as only a temporary military force which, if it is to have a lasting effect, means that missions have to be repeated. For example, a damaged runway could be repaired - to deny its use to an enemy for long periods of time, it would need to be attacked repeatedly.

b. Limited Payloads. The payloads that can be carried by aircraft are far smaller than those carried by ships or land vehicles. This obvious disadvantage can be somewhat compensated for by the high sortie rate fast aircraft can achieve and by the use of precision air-to-surface munitions.

c. Fragility. Because aircraft are built to be as light as possible, they carry little or no armour protection. This means that even low levels of battle damage could bring the aircraft down - a fact which limits the time they can be exposed to hostile fire. Aircraft can however take advantage of their height and speed to make them difficult targets to hit.

Other things to consider

6. Other Considerations. In addition to the strengths and limitations, there are other characteristics of air power that need to be considered when thinking about its role in the defense of the nation.

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 very costly.

b. Dependency on Bases. All forms of modern military power depend on the support provided by a base. Armies need field depots and navies need harbour facilities. Because most aircraft require a runway to take off and land, air power is often seen to be more dependent on its bases than either land power or sea power.

Fig 1-2 Aircraft operate from fixed bases



Aircraft need a high level of base support if they are to operate effectively, and if this base support is vulnerable to attack, this could fundamentally weaken the effectiveness of the air power. If however bases are well defended and difficult to find, then aircraft have an enormous advantage in being able to fight from their home base.

c. Sensitivity to Light and Weather. Bad weather can certainly make it difficult for aircraft to take-off and land. But the operation of all military forces are affected by the weather - ships cannot fight in rough seas and armies can get bogged down in mud. In recent years, however, advances in technology now mean that many aircraft are capable of operating in all weather and light conditions. Indeed, performing missions under the cover of darkness and in poor weather conditions is proving to be a distinct advantage of air power.

d. Sensitivity to Technology. Air power is extremely sensitive to technological change. For example, small advances in surface-to-air defence technology can have a major impact on the offensive operations of aircraft. Equally, aircraft can benefit enormously from technological advances such as "stealth". The situation will always be a balance determined by the rate of technological development and its overall direction.

Self Assessment Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.

1. One strength of Air Power is "Reach". This means that:
 - a. Aircraft can be turned round quickly, saving valuable time.
 - b. Aircraft can fly extremely high, to intercept long range missiles.
 - c. Aircraft can fly to any part of the world unhindered.
 - d. Aircraft can only fly in designated air corridors.

2. Most aircraft require a runway from which to operate and depend heavily on their bases for support. For air power this can be considered as:
 - a. A primary strength.
 - b. A secondary strength.
 - c. An inconvenience.
 - d. A limitation.

3. Which of the following lists 4 strengths of Air Power?
 - a. Flexibility, limited payloads, quick response and height.
 - b. All-encompassing, cost, speed and height.
 - c. Reach, flexibility, speed and height.
 - d. Reach, speed, airborne time and response.

4. The enormous speeds at which modern aircraft can fly is considered as:
 - a. A strength of Air Power because aircraft are exposed to hostile fire for short periods.
 - b. A limitation of Air Power because aircraft are over the target for such a short period of time that target acquisition is difficult.
 - c. A strength of Air Power because radars find it difficult to detect fast moving aircraft when flying low.
 - d. A limitation of Air Power because aircraft use a lot of fuel very quickly.

CHAPTER 2

APPLICATIONS OF AIR POWER

1. The rapid development of air power over the years has meant that the variety of tasks that can now be performed has increased significantly. As a result of this, air power has given those people who make the decisions concerning national security and defence a much wider range of options.

Preserving Peace

Air Power can help to preserve peace

2. Air power can be used to help preserve and strengthen international security, both by promoting international relations and by reassuring nations that they are not under threat from attack.

a. Promoting International Relations. When disaster strikes in whatever form - famine, flood or earthquake - speed of response is vital to save lives. Military transport aircraft can deliver rapid relief in the early stages of any natural disaster. They are designed to deliver loads into rough field strips and can operate with the minimum of ground equipment. For example, in the Ethiopian famine of 1984/85, the starving people isolated in the Ethiopian Highlands could only be supplied from the air.

Fig 2-1 Promoting international relations - An RAF Hercules dropping supplies during the Ethiopian famine of 1984/85



Open Skies agreement

b. Providing Reassurance. Air power can also be used to avert a possible threat to peace. It can provide surveillance and reconnaissance to reassure nations that potential aggressors are not about to attack. Furthermore, air power can be used to monitor arms control agreements and peace treaties.

The Open Skies agreement - which allows surveillance aircraft to roam freely over the territories of nations who have signed - will play an important part in fostering security and stability in Europe.

Managing International Crisis

7 ways to manage a crisis

3. If air power can make a useful contribution to preserving peace, it can also play a major part in managing a crisis situation. In times of international tension the ability of air power to project military power rapidly and over long distances makes it an ideal tool for managing an international crisis. It has several roles:

a. Warning. Air power can be used to give prior warning of an intended act of aggression and so allow preparations to take place that may prevent it. The detection of Soviet ballistic missiles in Cuba in 1962 allowed the USA to impose a naval blockade of the island - a measure that eventually led to removal of this potential threat. Advanced airborne surveillance systems such as E-3D Sentry Airborne Warning and Control System (AWACS) can provide vital information on the actions of potential aggressors.

b. Signalling. Air power can also be used to give clear political signals to other nations about your intentions. By increasing alert states and intensifying peacetime training missions, a nation can clearly indicate its willingness to fight.

c. Supporting Friends. Air power can provide prompt and long range physical support to friends and allies. For example the frequent flights by American F-4 Phantoms over rebel Filipino positions during the attempted coup of December 1989, demonstrated the USA's support for President Aquino's regime and played a large part in the failure of the coup.

d. International Rescue. There are many examples to demonstrate the ability of air power to mount rescue operations in crisis situations. In 1976 the Israelis freed the passengers and crew of a hijacked Air France A-300 airliner held at Entebbe in Uganda. Such operations however, tend to involve high risk and demand the most careful planning.

e. Inject Stability. Air power can be used to place land forces into regions

threatened with civil disorder, or into areas of local military conflict. For example, French and Belgian troops were rapidly airlifted into Zaire in September 1991 to bring stability into a situation of increasing violence.

f. Deterrence. With the deployment of air power to areas of high tension, a potential aggressor may well be deterred from further action. In 1990 for example, the rapid deployment of Coalition air power to Saudi Arabia in the days following Saddam Hussein's invasion of Kuwait, almost certainly prevented further Iraqi aggression.

Fig 2-2 *Deterrence - Jaguar Gr1s arrive in the Gulf in September 1990 to deter further Iraqi aggression.*



g. Punishment. If necessary, air power can be used for precise punishment operations, short of all-out war. One example of this type of operation may be as a response to an act of terrorism. It may not be possible to attack the terrorists themselves, but it may be feasible to punish those who support and encourage them.

Wartime Applications

4. Should the crisis management measures outlined above, fail and a situation deteriorate into one of armed conflict, then air power can make a very positive contribution. There are several types of operation to consider:

Air Power at war

a. Surveillance. In war, observation of the enemy is essential for the planning and successful execution of military operations. To discover an enemy's intentions means that effective counter measures can be taken to minimise risk and save lives. The lack of effective aerial reconnaissance during the Falkland Island conflict of 1982 was considered to be a major handicap for the British task force. In the Gulf war of 1991 however, air reconnaissance was vital to the success of the air campaign.

b. Destruction. Air power's most obvious wartime application is to destroy.

The ability to concentrate massive firepower gives air power enormous potential for destruction. For example in 1945 Allied air power destroyed the German 5th Panzer and 7th armies in the battle of the Falaise Gap in France - a total of 16 divisions including 9 Panzer divisions were destroyed. During the Gulf War, air power destroyed nearly half of the Iraqi tanks, artillery and armoured troop carriers used in the occupation of Kuwait, before the start of the Allied land offensive.

Fig 2-3 Destruction - Iraqi armoured vehicle destroyed by Coalition air attack during the Gulf War.



c. Control by Force. It is not only the destructive capability that gives air power its potential to win wars. Any state which faces an opponent with strong air power has to accept the fact that they are vulnerable to attack at any moment, and that any conflict can escalate into war very rapidly. Limited, but effective use of air power may be sufficient to force countries into negotiations to reach a settlement. For example, in December 1972 - when the North Vietnamese walked out of the Paris peace negotiations - the USA extended its bombing attacks to Hanoi and Haiphong. After 11 days of bombing, the North Vietnamese leaders agreed to resume the peace talks.

d. Denial. Air power can also be used to deny an enemy the ability to use its own air, land and sea power effectively. Perhaps the most well known example of an air-to-air denial battle, from Britain's point of view, is the Battle of Britain (1940). Early in World War II the RAF were the only practical means open to Britain of denying Germany the opportunity to launch a potentially war-winning invasion against the United Kingdom. An example of air-to-surface denial is the Golan Heights battle in the Yom Kippur War of 1973. Caught by surprise, the Israelis had to use air power to contain the Syrian army's offensive until the Israeli ground forces could be deployed in sufficient numbers. Throughout this operation the Israeli airforce suffered heavy losses, but the important

point to note is that air power denied the enemy effective use of its ground forces.

e. Diversion and Delay. By concentrating air attacks on sensitive targets, an enemy may be forced into using precious resources in defensive duties, instead of having these resources for use in offensive operations. Air attacks can also be used to slow down an enemy's advance, so that extra time can be given to organise defences. In a similar way, delaying an enemy's retreat could give attacking forces more time to press home the attack and prevent the enemy's escape.

f. Demoralisation. One important effect that air power can have is to demoralise the enemy. Air attacks have always had a particularly sapping effect on morale, almost irrespective of the damage done. In the Gulf War for example, almost constant aerial bombardment reduced the Iraqi army to a demoralised rabble, almost incapable of effective defence.

AIR STRATEGY

How is Air Power organised?

5. Each conflict will generate its own set of problems that need resolving. In order to plan the best course of action, the overall performance of air power can be considered as a series of air operations.

Categories of Air Operations

6. There are basically 3 categories of air operations:

a. Combat Air Operations. Combat air operations are those that use air power, in combat situations, to achieve specific objectives.

b. Combat-Support Air Operations. Combat-support air operations are non-combat, flying operations that support the effective fighting capability of air, land and sea forces.

c. Ground Combat-Support Operations. Ground combat-support operations are basically non-flying operations needed to support air operations.

7. We will examine each of these categories in more detail in the following chapters.

Self Assessment Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.

1. Using military transport aircraft to deliver relief in the early stages of a natural disaster would be an example of using Air Power to:
 - a. Promote international relations.
 - b. Promote equipment sales.
 - c. Provide training for air-crew.
 - d. Reinforce support for allies.

2. By deploying military aircraft to an region where aggression is threatened, a nation could be using Air Power to:
 - a. Punish the aggressor.
 - b. Inject stability on the ground.
 - c. Deter further aggression.
 - d. Demoralise the enemy.

3. Combat air operations can best be described as:
 - a. Using air power in combat situations.
 - b. Using air power in non-combat situations.
 - c. Using surface-to-air missiles in an offensive role.
 - d. Using surface-to-air missiles in a defensive role.

4. Which of the following best describes a wartime application of air power?
 - a. Preserving peace.
 - b. Destroying an enemy's war assets.
 - c. Supporting allies.
 - d. Deter aggression.

CHAPTER 3

COMBAT AIR OPERATIONS

1. There are 3 types of combat air operations that need to be considered, namely counter-air operations, anti-surface operations and strategic air offensive operations.

Counter-Air Operations

Operations against an enemy's Air Power

2. Counter-air operations are combat operations against an enemy's ability to wage war in the air. When facing an enemy who is capable of using air power against you, one priority must be to achieve some degree of control of the air. There are 3 basic levels of control of the air:

Control of the air

- a. Favourable Air Situation. A favourable air situation is reached when an enemy's air forces are unlikely to prevent the successful completion of your land, sea and air operations.
- b. Air Superiority. Air superiority is a situation reached when your air forces are notably more dominant than those of your enemy. In a situation of air superiority your land, sea and air operations will not be stopped by the enemy's air power.
- c. Air Supremacy. Air supremacy is basically the degree of air superiority that means that opposing air forces are incapable of offering effective interference.

The Offence-Defence Balance

Attack or defend?

3. There are 2 distinct aspects to counter-air operations, offensive and defensive - in practice however, the balance between the two is constantly changing.

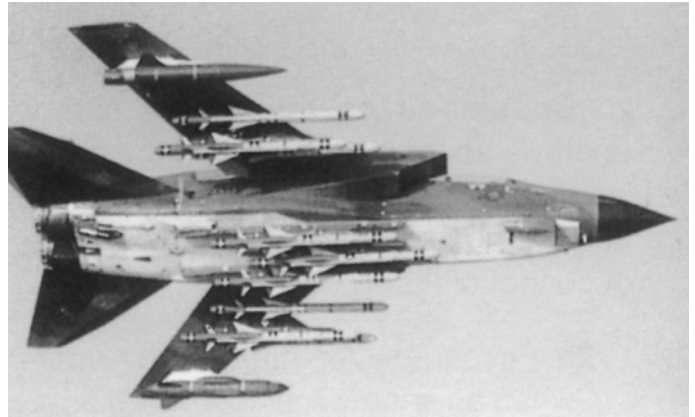
Offensive Counter-Air

Offensive operations

4. Offensive counter-air operations are mounted to destroy, disrupt or limit enemy air power as close to its home base as possible. Such operations would include:
 - a. Suppression of Enemy Air Defences. Physical attacks or electronic warfare would be used in an attempt to reduce the effectiveness of the enemy air defences. Targets would include radar installations, surface-to-air missiles

and anti-aircraft artillery batteries, often using specialised weapons and tactics. For example ALARM (Air-Launched Anti-Radar Missile) is a defence suppression weapon designed to destroy ground-based air defence radars. It does this by homing on to radar transmissions and following them down to their source.

Fig 3-1 ALARM defence suppression weapon follows radar transmissions down to their source



b. Fighter Sweep. Fighter sweeps involve offensive action by fighter aircraft to seek out and destroy enemy aircraft in an area of operation. Fighter sweeps are most effective when linked with air-to-surface attacks. The air-to-surface attack force will draw the enemy into the air where he can be destroyed by the fighter sweep force. Once again specialised weapons and tactics play an important role in this type of operation. The ASRAAM (Advanced Short Range Air-to-Air Missile) is a highly manoeuvrable air combat missile capable of engaging modern agile fighters. It has an advanced high-sensitivity infra-red seeker which can lock on to a target before or after launch, giving the pilot a fire-and-forget capability.

Fig 3-2 Harrier GR7 carrying ASRAAM

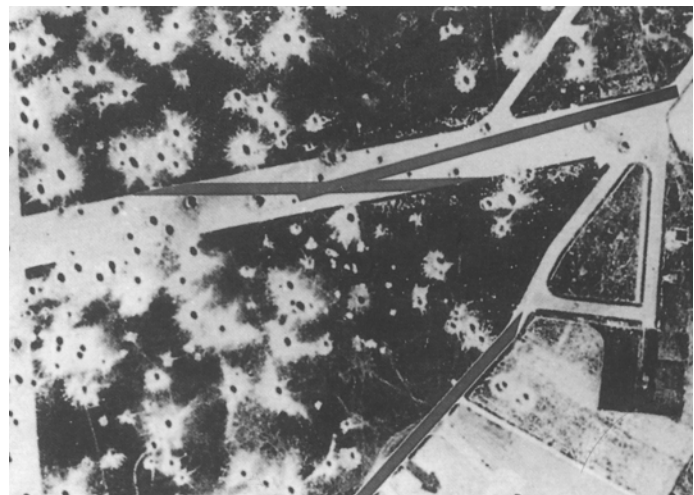


The sidewinder is another missile with a dog-fighting capability. It is an infra-red air-to-air missile which homes in on the heat emitted from the target aircraft.

c. 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.

d. Airfield Attack. Airfields are static and usually contain densely packed high-value targets. Harassing attacks can reduce the enemy's sortie rate to such an extent that he may no longer offer effective resistance. It must be borne in mind however, that attacks on operating strips can only be a temporary delay on an enemy's ability to get airborne, since runway surfaces are easily repaired.

Fig 3-3 The dark lines show how minimum operating strips for fighter-bomber aircraft can exist even on a badly damaged airfield



Defensive Counter-Air

Time to defend

5. Defensive counter-air or more commonly air defence operations include all measures taken to reduce the effectiveness of hostile air action. It often involves minimising the damage sustained by enemy action (passive air defence - covered in chapter 5) and inflicting the maximum damage to attacking forces (active air defence).

An active air defence system

6. Active Air Defence. An air defence system must consist of the following elements:

- a. A detection system which can identify and track the enemy. Detection of hostile aircraft can come from a number of sources including visual sightings, infra-red or acoustic monitoring, line-of-sight radars (land based, maritime and airborne), over-the-horizon radars and space-based systems.
- b. A command, control and information system to link the detection and weapons systems to make best use of available assets. The information from all the detection systems must be organised into a recognisable air picture so that decisions can be made about the correct level of response.
- c. A weapon system to destroy attacking enemy aircraft, consisting of both fighter aircraft and surface-to-air defences. Fighter aircraft have limited endurance but are flexible and re-usable. They are far better at identifying targets positively before engagement and can be switched to tasks other than air defence if necessary. Surface-to-air defences including both missiles and anti-aircraft artillery systems on the other hand, are single-role systems with very limited flexibility.

Anti-Surface Operations

4 types of anti-surface operations

7. Anti-surface operations involve the use of air power to deter, contain or defeat the enemy's land and sea forces. Anti-surface operations include the following activities:

- a. Air Interdiction. These are operations aimed at damaging or destroying an enemy's fighting capability before it can be used against you.

Fig 3-4 Air interdiction - A Jaguar armed with laser-guided bombs



Targets could be deep inside enemy territory, well away from the battle front and include things like rail yards, bridges, road junctions and waterway systems etc.

b. Battlefield Air Interdiction. The aim of battlefield air interdiction is to delay or destroy enemy forces in the battle area before they have a chance to attack friendly forces. For example this type of operation may be used to isolate the enemy from his reinforcements and supply lines.

c. Close Air Support. Similar to battlefield interdiction but aimed at destroying enemy forces that are very close to friendly forces. It is because of this close proximity to friendly forces that this type of operation requires very careful coordination with ground forces. Close air support can be used alongside surface weapons when concentrated firepower is needed.

d. Maritime Air Operations. Maritime air operations work in close co-operation with naval forces to detect and attack surface or sub-surface targets. The Sea Eagle missile is a computer controlled, fire-and-forget, sea skimming anti-ship weapon that allows the launch aircraft a long range, covert attack capability.

Fig 3-5 Tornado GR1B - Sea Eagle
is carried by the Tornado GR1B



Strategic Air Offensive.

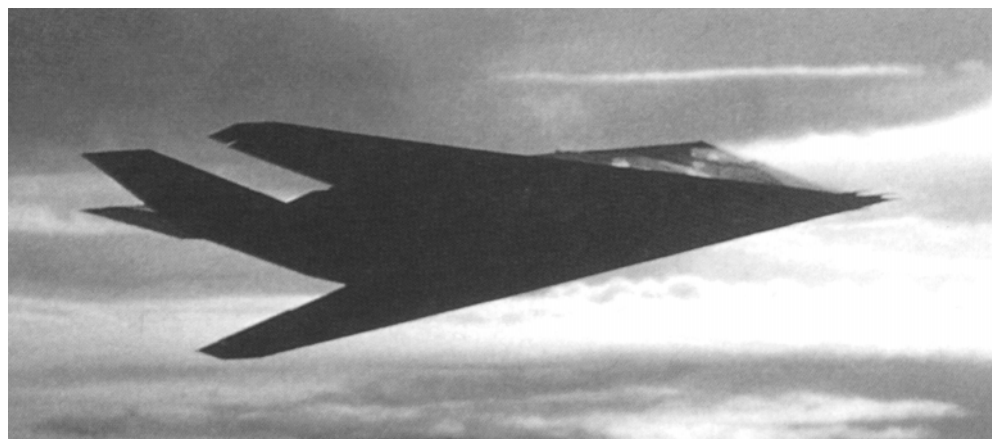
2 types of strategic air offensive operations

8. Strategic air offensive action is aimed at undermining the enemy's ability and will to continue fighting by attacking industrial, political and economical targets rather than direct action against an enemy's military forces. These operations can be divided into 2 basic types:

a. Nuclear Operations. All nuclear operations must be considered as strategic. NATO considers nuclear weapons as last resort weapons not war-fighting weapons. As such, the authority to decide when to use them rests not with the military but at the highest political level.

b. Conventional Operations. Conventional operations are all non-nuclear actions taken against an enemy to send signals about your willingness to fight, or to punish small-scale aggression, or as an integrated part of a planned campaign. The accuracy and destructive power of modern weapons allows significant results to be achieved with relatively few sorties. In the Gulf war, stealth technology proved extremely effective in strategic air offensive operations. F-117As flew hundreds of sorties against military command and control centres, nuclear research and production facilities and chemical and biological capabilities - without a single aircraft lost. As a result of these attacks, half of Iraq's oil-refining capacity was destroyed, the national grid system was broken and communications severely disrupted.

Fig 3-6 *F-117s strategic attacks during the Gulf War*



Self Assessment Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.

1. Counter Air operations can be defined as :
 - a. Non-combat operations in support of land/sea forces.
 - b. Combat operations in support of land/sea forces.
 - c. Combat operations against an enemy's land/sea forces.
 - d. Combat operations against an enemy's air power.

2. When an enemy is capable of using air power against you, there are 3 levels of control of the air. They are:
 - a. Favourable air situation, air dominance, air superiority.
 - b. Air supremacy, favourable air situation, air superiority.
 - c. Air supremacy, controlled air space, favourable air situation.
 - d. Favourable air situation, controlled air space, air dominance.

3. To suppress an enemy's air defences a specialist weapon such as ALARM may be used. ALARM stands for:
 - a. Air-Land-Air Radiation Missile.
 - b. Air Launched And Radar guided Missile.
 - c. Air Launched Anti-Radar Missile.
 - d. Air-Land And Radar Missile.

4. Suppression of an enemy's air defences is an important element in - which type of operation?
 - a. Offensive counter air.
 - b. Defensive counter air.
 - c. Offensive combat support.
 - d. Defensive combat support.

CHAPTER 4

COMBAT-SUPPORT AIR OPERATIONS

5 roles of combat support

1. Combat-support air operations are non-combat flying operations design to improve or support the effectiveness of air, surface and sub-surface forces. They fall into the following 5 main categories:

Air Transport

2. Mobility is essential for armed forces with world-wide commitments. Mobility can make up for lack of numbers by allowing available forces to be rapidly deployed, supplied or evacuated. Air transport is a vital element in this. The speed and high sortie rate of air transport aircraft mean that large volumes of cargo and large numbers of personnel can be deployed very quickly. In the early days of the Gulf war, during August 1991 alone US air transport forces flew 39,000 tons of cargo and 60,000 personnel to the region. Despite its far smaller size, RAF air transport had, by the end of the war carried over 45,000 personnel and nearly 53,000 tons of freight.

Fig 4-1 Mobility is a key requirement - A hercules formation prepares for take off



3. Air transport aircraft however tend to be unarmed, and are slower and less manoeuvrable than fighter aircraft. Consequently, they need a favourable air situation in which to operate. Air transport operations have 5 main roles.

a. Scheduled Services. Scheduled air transport services move both personnel and supplies normally along airways and when required, over long distances.

b. Airborne Operations. Airborne operations involve the movement of combat forces and their equipment into a specified area by air. They can employ both fixed-wing aircraft and helicopters, and they include parachute assaults, helicopter assault and air landings.

Fig 4-2 Airborne operations is a role of air transport



c. Special Air Operations. A special air operation may be conducted at any time during a conflict and involves clandestine, covert and psychological activities.

d. Air Logistic Support Operations. Air logistic support operation are air operations conducted to move personnel, equipment, fuel and ammunition into a war zone - in fact all the materials required to keep the war machine working.

e. Aeromedical Evacuation. Aeromedical evacuation involves the movement of patients to and between medical facilities by air transport.

Air-To-Air Refuelling (AAR)

4. Air-to-air refuelling operations are those which involve the transfer of fuel from one aircraft to another in flight. Air-to-air refuelling can be used to support virtually all types of aircraft in almost all air power situations. It can extend the range, payload, time-on-task, and flexibility of virtually all aircraft. There are 2 roles into which air-to-air refuelling operations are divided:

2 roles of AAR

a. Towline. In the towline role, tanker aircraft fly a set pattern (typically a racetrack) in a pre-arranged position. Aircraft needing fuel must plan their routes to pass this position and take on fuel as required.

Fig 4-3 AAR extending range and endurance



b. Trail. The trail role can be carried out either by the tankers escorting the receiver aircraft to their destination, transferring fuel as required, or by planning to meet aircraft at predetermined positions along the route.

AAR has limitations

5. While air-to-air refuelling offers greater flexibility and capability to most air operations, it nevertheless has important limitations. The process of in-flight refuelling takes a certain amount of time, during which both tanker and receiver aircraft are very vulnerable to enemy attack. Moreover, there is a limit to the number of aircraft that can be refuelled at one time, making the task of refuelling a multi-aircraft formation, long and potentially dangerous. Consequently, air-to-air refuelling operations should, whenever possible, take place outside hostile airspace.

Aerospace Reconnaissance Operations.

6. Aerospace reconnaissance operations involve the collection of information, from airborne, ground and space-based sensors, on the activities, forces and resources of an enemy or potential enemy. The gathering of this type of information is vital for the planning of military operations and for target identification. Long range reconnaissance aircraft can also be used to deter potential aggressors by letting them know that their moves are being monitored.

AEW / AWACS

7. Airborne Early Warning and Airborne Warning and Control. AEW and AWACS is defined as air surveillance and control provided by airborne vehicles equipped with search and height-finding radar and communications equipment for controlling weapon systems. AEW can provide valuable information about an enemy's air activity

and his potential to attack. AWACS can, in addition provide positive control and direction to both offensive and defensive air operations.

8. Interpretation. The usefulness of the picture built up by air reconnaissance will depend on the speed and skill with which the information is interpreted. Speed is essential because out-of-date information may do more harm than good, particularly if it is to be used for targeting purposes. Skill is equally important, for wrongly interpreted information could be worse than no information at all.

Search and Rescue Operations (SAR).

9. 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. In a war situation rescuing downed aircrew not only enables them to continue the fight, but it also denies the enemy a potential source of intelligence from captured aircrew.

Fig 4-4 Search and Rescue



Search and rescue helicopters and long-range rescue aircraft tend to be unarmed and therefore vulnerable to attack. In these circumstances it may be necessary to mount combat search and rescue operations, involving combat forces such as attack helicopters or fighter-bombers to provide covering fire for the rescue aircraft. Such operations can be costly, because the enemy may know the area in which the aircraft has crashed and deploy their own surface or air forces to that area, but they do help to promote high morale among aircrew.

The dangers of SAR

Electronic Warfare Operations.

10. Electronic warfare operations involve the military use of electronics both to prevent or interrupt hostile use of radio, radar and infra-red devices, and to ensure the effective use of similar devices by friendly forces. They can be used to confuse the enemy and to improve the success rate of friendly operations.

11. Electronic warfare not only involves the search, interception, identification of enemy transmissions, but also electronic countermeasures used to deceive and confuse the enemy. For example during the Falklands campaign the Argentineans used radar-guided anti-ship missiles such as Exocet against the task force. A counter to this was to fire clouds of "Chaff" from explosive canisters. Chaff consists of thousands of pieces of radar reflective strips which are designed to give strong radar reflections in an attempt confuse the missile's radar and hide the real target. Other techniques involve re-transmitting received radar signals to confuse enemy radar operators by giving the impression that there are several targets.

Chaff

Self Assessment Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.

1. Combat support air operations can be defined as:
 - a. Combat air operations to support friendly military forces.
 - b. Non-combat air operations to support friendly military forces.
 - c. Non-flying operations to support friendly military forces.
 - d. Defensive air operations to support friendly military forces.

2. Combat support air operations might include the following types of role.
 - a. Search and rescue.
 - b. Air interdiction.
 - c. Fighter sweeps.
 - d. Active air defence.

3. Aircraft used in the aeromedical evacuation role would be considered as performing:
 - a. Active air defence operations.
 - b. Combat air operations.
 - c. Combat support air operations.
 - d. Ground combat support operations.

4. Chaff may be used as a counter measure against radar guided missiles. It consists of:
 - a. A device that duplicates and re-transmits received radar signals to confuse hostile radars.
 - b. Strips of radar reflective material released into the air.
 - c. Radar reflective material attached to an aircraft's airframe.
 - d. Radar absorbing material attached to an aircraft's airframe.

CHAPTER 5

GROUND COMBAT-SUPPORT

Support for air operations is vital

1. Ground combat-support operations are non-flying operations required to provide direct support for air operations.

2. Any form of warfare is impossible without the means to sustain it. Bases must be defended and resupplied; personnel must be well organised and may require training; equipment must be repaired and maintained.

Active Defence

3. Active Air Defence. Active air defence not only involves the protection of air bases from air attack, but forms part of the counter-air campaign by inflicting as much damage as possible on the enemy air forces. These measures have already been discussed in chapter 3.

Active Ground Defence

Active ground defence

4. Active Ground Defence. The aim of active ground defence should be to prevent attack rather than respond to it. It would be the responsibility of all the people on a threatened air base to organise their own active ground defences. For this reason, all air force personnel should be trained and well practised in active ground defence procedures. Active ground defences should include creating a ground defence area that can be:

- a. Patrolled using military forces.
- b. Cleared of obstacles that may be used by an attacking force to provide cover.
- c. Protected with remote detection systems.
- d. Guarded by military forces operating from the protection of bunkers or sangars (defensive guard positions using sandbags or other materials).

Passive Defence

5. Passive defence measures are taken wherever possible, to reduce the effectiveness of hostile air attacks. These measures include:

***Passive defence
measures***

a. Dispersal. Generally, dispersal offers the best protection against air attack. In practice the greater the number of locations the greater the targeting difficulties faced by an attacker. Vital assets which cannot be adequately protected should be dispersed.

b. Deception. Concealment of installations and equipment can often confuse an enemy to such an extent that it makes it difficult of their weapon systems to acquire targets. Visual concealment may take the form of camouflage or applying tone-down techniques. Tactical deception would also include the deployment of decoys, varying unit procedures, obscuring the use of buildings and using radar reflectors to distort enemy navigational and bombing radars.

c. Physical Protection. All airfields contain key personnel, equipment and facilities which would need protection in a time of war. The level of protection is often decided by the unit commander and may range from hardened aircraft shelters to the sand bagging of windows and doors, depending on operational priorities.



Fig 5-1 Physical protection - inside a hardened aircraft shelter (HAS)

d. Resilience. Whatever the effectiveness of the defence measures adopted it is realistic to assume that a base will receive at least some damage. To

ensure that operations are not disrupted too much, each base must have the capability to restore essential services as rapidly as possible. Examples are:

- bomb disposal personnel, who must be able to remove unexploded ordnance after an air raid to avoid further damage.
- rapid repair capability, which is essential for runway and taxiway surfaces so that air operations are not disrupted.
- skilled personnel to restore essential base services (eg electricity, water, fuel supplies and communications) which if out of action for too long, would weaken defences and expose the base to further attacks.
- duplication of essential facilities and equipment, so that a single hit will not bring operations to a halt. Minimum operating strips can be identified on runways and taxiways; taxi tracks can be built to nearby stretches of straight road; and auxiliary runways can be built to minimum standards and reserved for wartime use only.

Training

Training is vital

6. Effective training is the key to successful completion of all military operations. This is especially true for air forces where the air is a particularly dangerous environment in which to operate. While technology is an important factor in the effectiveness of air power, it is of little use unless the aircrew have the necessary skills to be able to use the equipment properly. Similarly, ground branches involve highly demanding skills that can be critically important to air operations, both in peace and war. Training must therefore be both rigorous and realistic. This is generally achieved by conducting large-scale exercises which are designed as far as possible to replicate wartime conditions and are likely to include extra problems such as disrupted communications, degraded command and control and realistic opposing forces.

Logistics

7. Logistics is the science of planning and carrying out the movement and maintenance of all aspects of a fighting force. At all levels of war, logistics is a major concern of any commander. Lack of logistic capabilities may cause a commander

to delay or even cancel vital operations, which could lead ultimately to defeat.

8. The full scope of logistics includes:
 - a. The design and development, storage, transport, maintenance, evacuation and distribution of material.
 - b. The movement, evacuation and medical care of personnel.
-



Fig 5-2 Logistics - keeping the fuel flowing

- c. The construction, maintenance, operation of facilities.
9. Logistics will dictate the scale, pace, scope and effectiveness of any air operation. If men and equipment are not in the right place at the right time - if equipment is not properly maintained - if aircraft are not refuelled and rearmed - if wounded personnel do not receive appropriate medical care - then any military operation is doomed to fail.

Glossary of Terms

AAR - Air-to-Air refuelling. Transfer of fuel from one aircraft to another while in flight.

AEW - Airborne Early Warning. Long-range radar carried on board aircraft to give as much warning as possible of approaching aircraft.

ALARM - Air-Launched Anti-Radar Missile. Missile carried by aircraft to detect radar transmissions from ground based equipment and follow them down to their source.

ASRAAM - Advanced Short-Range Air-to-Air Missile. Heat seeking missile used against other aircraft in air combat.

AWACS - Airborne Warning And Control Systems.

Covert - Secret, disguised.

Command and Control - System of communication to enable information to be received, decisions to be made and instructions to be carried out.

Clandestine - Under-cover, secret.

Defence - Resistance against attack (protective, not aggressive).

Fire and Forget - Once fired, the weapon is fully autonomous, allowing the pilot and aircraft to carry out other activities.

HAS - Hardened Aircraft Shelter. Facility to store aircraft, built to withstand bomb blast.

Heat-seeking - The capability to detect and follow sources of heat - an aircraft's engines or airframe.

Maritime - Connected with the sea.

Offensive - Aggressive, intended for use in attack.

Over the horizon - Beyond the visible horizon; region only accessible to particular types of radar.

Overt - Openly-done, unconcealed.

Reconnaissance - Operations to discover an enemy's position and strength to help plan strategy.

Sortie - An operational flight by one aircraft.

Stand off - Capability to attack an enemy from a distance. An aircraft does not have to fly over the target.

Stealth - Technology to reduce radar reflections to make a craft more difficult to detect.

Strategic - Actions designed to disorganise the enemy's internal economy and warmaking potential.

Surveillance - Close observation.

Tactical - Actions in support of military or naval operations in a limited theatre of operations.

Self Assessment Questions

Do not mark the paper in any way - write your answers on a separate piece of paper, in the form of a sentence.


1. Ground combat support operations are defined as:
 - a. Flying operations to provide support for all air operations.
 - b. Non-flying operations to provide support for all ground operations.
 - c. Flying operations to provide support for all ground operations.
 - d. Non-flying operations to provide support for all air operations.

2. Building hardened aircraft shelters, bunkers and shelters are examples of:
 - a. Active air defence measures.
 - b. Passive defence measures.
 - c. Counter air measures.
 - d. Active ground defence measures.

3. In the passive defence role, the best definition of resilience would be:
 - a. Being able to withstand enemy attacks without suffering damage.
 - b. Having the capability to restore essential services as quickly as possible after an attack.
 - c. Protecting personnel in hardened shelters and dispersing aircraft.
 - d. Being able to operate effectively without essential services.

4. The science of moving and maintaining all aspects of a fighting force is better known as:
 - a. Logistics.
 - b. Statistics.
 - c. Air transport.
 - d. Air movements.

CHAPTER 1



INSTRUCTORS GUIDE

ARMED CONFLICT**Page 34.4.1-1 Para 1**

“Qui desiderat pacem, praeparet bellum” - Let him who desires peace, prepare for war.

1. General. Britain and her allies have long pursued 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. Thus, even the more 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 follows:

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 and 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 organised 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. Recognising this is essential if the damaging effects of war are to be minimised.

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.

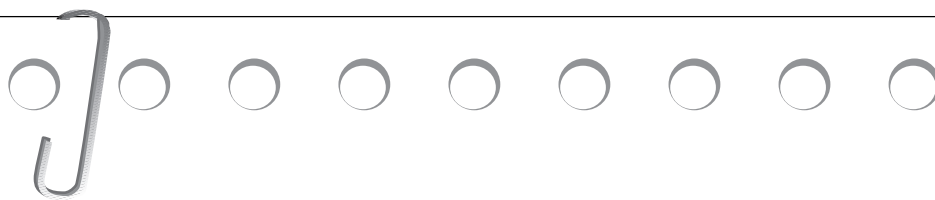
d. War is of the People. Groups of people wage war, and the conduct of war is affected by group passions, cohesion and determination. A significant war effort cannot be sustained by a democratic state in the face of public hostility or indifference.

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: 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.

CHAPTER 1



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 organised 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.

DEFENCE POLICY

Page 34.4.1-1 Para 4

1. 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 of security of its allies. United Kingdom defence policy is determined by the British Government, consulting where necessary with Britain's allies and UK military advisers. It is set out in Government White Papers updated annually by Statements of Defence Estimates.
 2. The Responsibilities of the Armed Services. The Armed Services provide joint advice to the Government on military strategy, force structure and the types of equipment needed. They are responsible to the Government for formulating operational art and military tactics, and for training and preparing the Armed Services for war.
 3. Joint Defence. The Royal Navy was formed during the reign of Elizabeth I, and the British Army traces its origins from the time of Cromwell. The Royal Flying Corps and the Royal Naval Air Service were formed in 1912, and on 1 April 1918 they amalgamated to form the Royal Air Force. Since then British military power has been organised on a tri-Service basis. The rapid march of technological progress has led to a growing integration in the capabilities and management responsibilities of the Royal Navy, the Army and the Royal Air Force. The surface and sub-surface forces have extended the reach and spectrum of their capabilities, while the air forces play an increasing part in surface/sub-surface battles. The Royal Navy and the British Army now operate considerable numbers of aircraft, while the Royal Air Force and the Royal Navy continue to field sizeable contingents of specialist fighting troops. In such circumstances the development and employment of national military power has become an increasingly integrated joint-Service responsibility.
 4. Control of the Armed Services. To be effective, the three Services must work together as a single integrated team. Central control is fundamental to this process, and the current arrangements for the control of the Armed Forces are described in ACP 31 Section 2 "Instructor's Guide".
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CHAPTER 2



INSTRUCTORS GUIDE

KEY PRINCIPLES OF COMMAND AND CONTROL

Page 34.4.2-2 Para 3

1. Introduction. 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. Centralise command and control.
- b. Exercise command and control from the highest practicable level.
- c. Decentralise execution.

2. Centralise Command and Control. Centralised command and control promotes an integrated effort and enables forces to be employed to meet the recognised 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.

3. 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 centralised control too high, as this will inhibit flexibility and create inefficiency.

4. Decentralise Execution. No single commander can direct personally all of the detailed actions of a large number of air units or individuals. Therefore, decentralised execution is essential, and it is accomplished by delegating appropriate authority to execute tasks and missions. Decentralised execution allows subordinate commanders to use their judgement and initiative within the overall pattern of employment laid down by their supervisors. It becomes especially important when command and control systems are lost through enemy action. Decentralised 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.

CHAPTER 3



INSTRUCTORS GUIDE

THE HISTORY OF COUNTER-AIR WARFARE

Page 34.4.3-1 Para 1

1. World War I. The origins of counter-air warfare date back to World War I. As the effectiveness of air power in the scouting role became apparent, so the need to contain enemy air power increased. In September 1914 the first direct attacks were made against airfields and other air power facilities, and the following month the first air-to-air combats took place between opposing scout aircraft. By early 1915 the first aircraft designed specifically to fight other aircraft (the Fokker Eindecker) appeared. Such aircraft were soon used in offensive sweeps not only to seek out enemy aircraft, but also to provide close protection for scout and bombing aircraft. By the end of World War I most of the counter-air roles had emerged, and the need to achieve control of the air was recognised as an important aim in its own right.
2. Inter-War. The importance of control of the air continued to be recognised throughout the inter-war period. However, major differences emerged about how this aim should be achieved. The predominant view within the RAF in the 1920s and early 1930s was that control of the air would be achieved through offensive action, and in particular by means of strategic air offensive action against the enemy's aircraft industry. However, German experience in the Spanish Civil War appeared to confirm the World War I lesson that it was necessary at least to contain the enemy air forces if strategic air offensive action was to be sustained.
3. World War II. In World War II the importance of control of the air and the need for a dedicated counter-air campaign soon became apparent. The air forces of Poland, Belgium, Holland, Yugoslavia and Greece were rapidly destroyed by German offensive counter-air action, while those of France and Russia were crippled. However, defensive counter-air action also proved effective, first by the Luftwaffe in the air battles of Heligoland Bight, then by the RAF in the Battle of Britain and subsequently - for a period - by the Luftwaffe during the Allied Strategic Bombing Offensive against Germany. In the Western Desert, the Atlantic and Western Europe, control of the air was again shown to be crucial to the success not only of air operations, but also of virtually all types of surface and sub-surface operations. Similarly, in the Far East, from the outset, it became clear that the first objective of all commanders, whether ground, sea or air, whether Allied or Japanese, was to ensure control of the air. Speaking in 1947, Lord Tedder remarked that "the outstanding lesson of the last war was that air superiority is the prerequisite for all war-winning operations, whether at sea, on land or in the air".
4. Post-World War II. The advent of nuclear weapons in 1945 and the apparent impossibility of providing an adequate defence against nuclear bombers seems to show that the established concepts of control of the air were no longer valid. However, the limited military utility of nuclear weapons soon became apparent, and the overriding importance of establishing control of the air re-asserted itself. During a series of post-war conflicts - particularly in Korea, Indo-China, the Arab-Israeli wars, Vietnam, and the Falklands - control of the air proved to be the key to the effective use of air power.
5. The Gulf War 1991. At the outset of the Gulf War the Iraqis possessed a very strong, integrated surface-to-air defence system, a large force of fighter aircraft and over 50 airfields, nearly half of which were very large and heavily fortified. Yet they were soon overwhelmed by the power of the Coalition counter-air offensive which destroyed the cohesion of their air defence system. In the first few hours of the conflict a relatively small number of "stealth" aircraft destroyed the Iraqi command and control structure and other aircraft inflicted heavy damage to the airfields. By the ninth day of the War, the enemy dispersed his surviving aircraft either to Iran or to the woods

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and villages around its bases, where they remained until the fighting ceased. Some 300 Iraqi aircraft were destroyed (mostly on the ground) and most of Iraq's airfields sustained very serious damage. The Gulf War was a graphic illustration of the potential power of offensive counter-air action.

Page 34.4.3-4 Para 7**THE HISTORY OF ANTI-SURFACE-FORCE****ACTION IN WAR**

1. World War I. Aircraft were first used to project military power against the surface forces in 1911, when Italian aircraft bombed Turkish troops. However, it was not until World War I that large scale air-to-ground attacks took place. Aircraft were used in the early weeks of the war to harass ground troops, and the first air interdiction attacks against land targets took place in early 1915. During the following year, air interdiction played a significant part in the Allied offensive on the Somme, and in the last 2 years of the War the scale and effectiveness of air attacks against land forces increased rapidly.

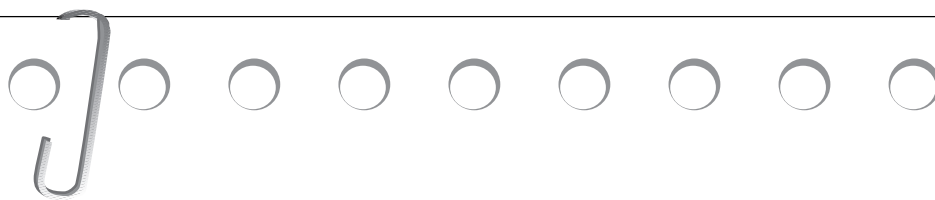
2. World War II. During World War II, the importance of anti-surface-force operations in military strategy soon became apparent. The Luftwaffe played a crucial part in the destruction of the armies of Poland in 1939, and those of Denmark, Belgium, Holland, France and particularly Norway in 1940. As General Jodl, Wehrmacht Chief of Operations, remarked "The Luftwaffe proved to be the decisive factor in the success of the operation [against Norway]". In 1941 German air power played an equally important role in the invasion of the Soviet Union. In each case, air attack dislocated the defending army, rendering it vulnerable to the follow-on land force armoured thrusts. In subsequent years, Allied air-to-ground action dominated the campaigns in North Africa, Italy and Western Europe. In August 1944, timely Allied air attack broke a German ground assault by 5 armoured and 3 infantry divisions, and during the subsequent Battle of the Falaise Gap, concentrated Allied air attack coupled with artillery fire destroyed the German 7th Army and 5th Panzer Army.

3. Post-World War II. After World War II, the relative importance of airborne firepower on surface operations continued to grow. The principles of land/air operations, evolved during World War II, were increasingly refined in a series of wars. In Korea, United Nations air power played a key role in securing the Pusan perimeter against North Korean attack and later in depriving the Chinese communist forces of their offensive potential. In the 1967 Six-Day War, Israeli air power effectively broke the Egyptian army at the Mitla and Giddi passes, destroying 7 Egyptian divisions with 19,000 vehicles (including 800 tanks). Six years later, in the Yom Kippur War, Israeli air power again played a key part, this time by containing the Syrian army's surprise attack on the Golan Heights while Israeli ground forces deployed. In Vietnam, United States air power provided constant fire support for friendly ground troops, broke the siege of Khe Sanh in 1968 and proved the key instrument in the defeat of the North Vietnamese invasion in the Spring of 1972; over 17,000 US and South Vietnamese sorties were launched during April alone.

4. Summary. 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 seaspace.
- b. Anti-surface-force air action works best when used in direction co-operation with friendly

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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).

d. 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.

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

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

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

Page 34.4.3-6 Para 8

THE HISTORY OF THE STRATEGIC AIR OFFENSIVE IN WAR


1. World War I. Strategic air offensive operations were first carried out in January 1915 when German Zeppelin airships attacked towns in Norfolk. A total of 20 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.

2. 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".

3. 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 not 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.

4. 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 signalling purposes

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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 Organisation 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.

CHAPTER 4



INSTRUCTORS GUIDE

HISTORY OF COMBAT-SUPPORT AIR OPERATIONS

Page 34.4.4-1 Para 1

1. Early Developments. The first use of air power in war was to provide combat-support for the surface forces. The Chinese used kites to observe their enemies some 2000 years ago, but it was not until the end of the 18th century that an aircraft was used for military purposes in Europe. This was in 1794 when the French used an observation balloon at the Battle of Fleurus. During the 19th century, balloons came to be used increasingly in land campaigns, most notably in the American Civil War and the Franco-Prussian War. Heavier-than-air craft were first used for observation in the Turkish-Italian War of 1911 and in this role made a key contribution throughout World War I. In October 1914, it was an aircraft that first detected the swing to the East of the German 1st and 2nd armies in Northern France and thus made possible the "Miracle of the Marne": the defeat of the German Schlieffen Plan. Throughout World War I the relative effectiveness of the opposing artillery - arguably the most decisive weapon of that war - depended heavily on aerial observation.

2. The Inter-War Period. The inter-War period witnessed a blossoming in the range of combat-support air activities. Air-to-air refuelling - first envisaged in 1909 - was experimented with in 1924, and 10 years later was used in the attempted non-stop flight from Britain to India. Air transport operations came to be of major importance and was used for an increasing diversity of tasks. These ranged from routine passenger movement, through air evacuation (for example of British citizens from Kabul in Afghanistan in 1928) to air assault (notably by Germany and the Soviet Union). In 1938, the first purpose-built search and rescue launches were introduced into the RAF.

3. World War II. During World War II, combat-support air operations developed rapidly. Air transport was used extensively by the Germans both for air assault (for example in Norway, Belgium and Holland in 1940 and for the invasion of Crete in 1941) and for re-supply (for example to sustain the Denmark pocket in 1942 and - less successfully - Stalingrad in 1943). As the War progressed, decreasing resources and increasing Allied air superiority steadily inhibited German air transport operations. In contrast, Allied air transport operations grew in scale and scope. Increasingly ambitious air assaults were carried out, most notably in support of the Allied D-Day invasion, Operation Market Garden (the Arnhem Operation) and the Rhine crossing. Moreover, the use of air transport operations for re-supply purposes came to form the linchpin of a number of operations and campaigns, particularly those in South East Asia. Although air transport operations were undoubtedly dominant, other types of combat-support air activity grew to importance in World War II. The Luftwaffe used flying boats for search and rescue in early 1940, and the loss during the first 2 months of the Battle of Britain of 200 British aircrew over the Channel forced the RAF to follow suit and greatly expand its search and rescue capabilities. Airborne surveillance and reconnaissance operations provided increasingly crucial support for all types of combat operations and became a highly specialised application of air power. The advent of radar and electronic navigation aids produced a rapid growth in air power electronic capabilities, and these proved a major factor in the outcome of The Allied Strategic Bombing Offensive against Germany, particularly in 1944 and 1945. Moreover, by 1945 the first AEW aircraft had begun to appear. Thus, by 1945 virtually all elements of modern combat-support air operations were in place.

4. The Post-World War II Period. The relative importance of combat-support air operations continued to grow in the post-War years as capabilities were expanded with rapidly developing technology. Air transport re-supply broke the blockade of Berlin in 1948 and may have saved Israel from defeat in 1973. By the late 1960s, it had replaced surface transport as the preferred means of moving personnel between theatres. Helicopters emerged as an increasingly important air transport asset, particularly in the Vietnam War and subsequent conflicts. Helicopters also came to take

CHAPTER 4



over search and rescue duties, not only from rescue launches, but also from seaplanes and flying boats. Electronic warfare, widely neglected in the late 1940s and early 1950s, returned to prominence as a result particularly of the experience in Vietnam and Yom Kippur Wars. By the mid-1980s, most combat aircraft of advanced nations possessed organic electric warfare capabilities and, in addition, many nations had deployed dedicated electronic warfare aircraft. The appearance in the 1970s of highly capable airborne warning and control systems and the rapid growth of air-to-air refuelling allowed far better use to be made of existing combat air assets than had hitherto been possible. In the Falklands Conflict, the British Task Force's lack of an AEW/AWACS proved to be a major disadvantage. In contrast, air-to-air refuelling allowed the projection of a wide spectrum of air power capabilities into the operational area. By the mid-1980s, virtually all RAF fixed-wing operational aircraft had been equipped to take on fuel in the air.

5. The Gulf War. From the outset of the Gulf Crisis, Coalition combat air support capabilities provided key contributions for crisis management. During August 1991 alone, US air transport forces flew in 39,000 tons of cargo and 60,000 personnel to the region, and by mid-December 1991 those figures had grown to 244,000 tons and 219,000 personnel respectively. Despite its far smaller size, the RAF air transport force had, by the end of the War, carried over 45,000 personnel and nearly 53,000 tons of freight. Airborne warning and control aircraft were used to monitor and record Iraqi air movements, while specialist reconnaissance aircraft plotted Iraqi ground dispositions and probed enemy capabilities. And supporting all this effort were the air-to-air refuelling aircraft which - because of the vast size of the theatre of operations - played a key enabling role. When crisis turned into conflict on 16 January 1991 combat air support had to be used on an unprecedented scale. Air transport was needed to re-supply the widely-separated Coalition air bases with spare parts, munitions and replacement air and ground crews. The great distances also meant that air-to-air refuelling had to be used to support most combat and many combat support missions, including those flown by carrier-based air power and B-52s operating from Britain and Diego Garcia. The intensity and complexity of air operations, and consequently the high level of co-ordination required, could only be achieved through the extensive use of Airborne Warning and Control aircraft, whilst the vast range of targets to be attacked, and the constant need for battle-damage assessment, placed unprecedented demands on reconnaissance capabilities. The Gulf War underlined how critical combat air support capabilities have become to air power effectiveness.

CHAPTER 5



INSTRUCTORS GUIDE

GROUND COMBAT-SUPPORT**Page 34.4.5-1 Para 1**

1. Historical Background. The successful German airborne assault on Crete in May 1941 prompted Winston Churchill to say: "Every airfield should be a stronghold of fighting air-groundmen, 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 2 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.
2. General. 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 can 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 alternative 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.

Self Assessment Questions - Answer Sheet

Chapter 1 Page 34.4.1-5

1. c
2. d
3. c
4. a

Chapter 2 Page 34.4.2-7

1. a
2. c
3. a
4. b

Chapter 3 Page 34.4.3-7

1. d
2. b
3. c
4. d

Chapter 4 Page 34.4.4-6

1. b
2. a
3. c
4. b

Chapter 5 Page 34.4.5-7

1. d
2. b
3. b
4. d