

LARGE PRINT GUIDE



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The RAF in an Age of Uncertainty



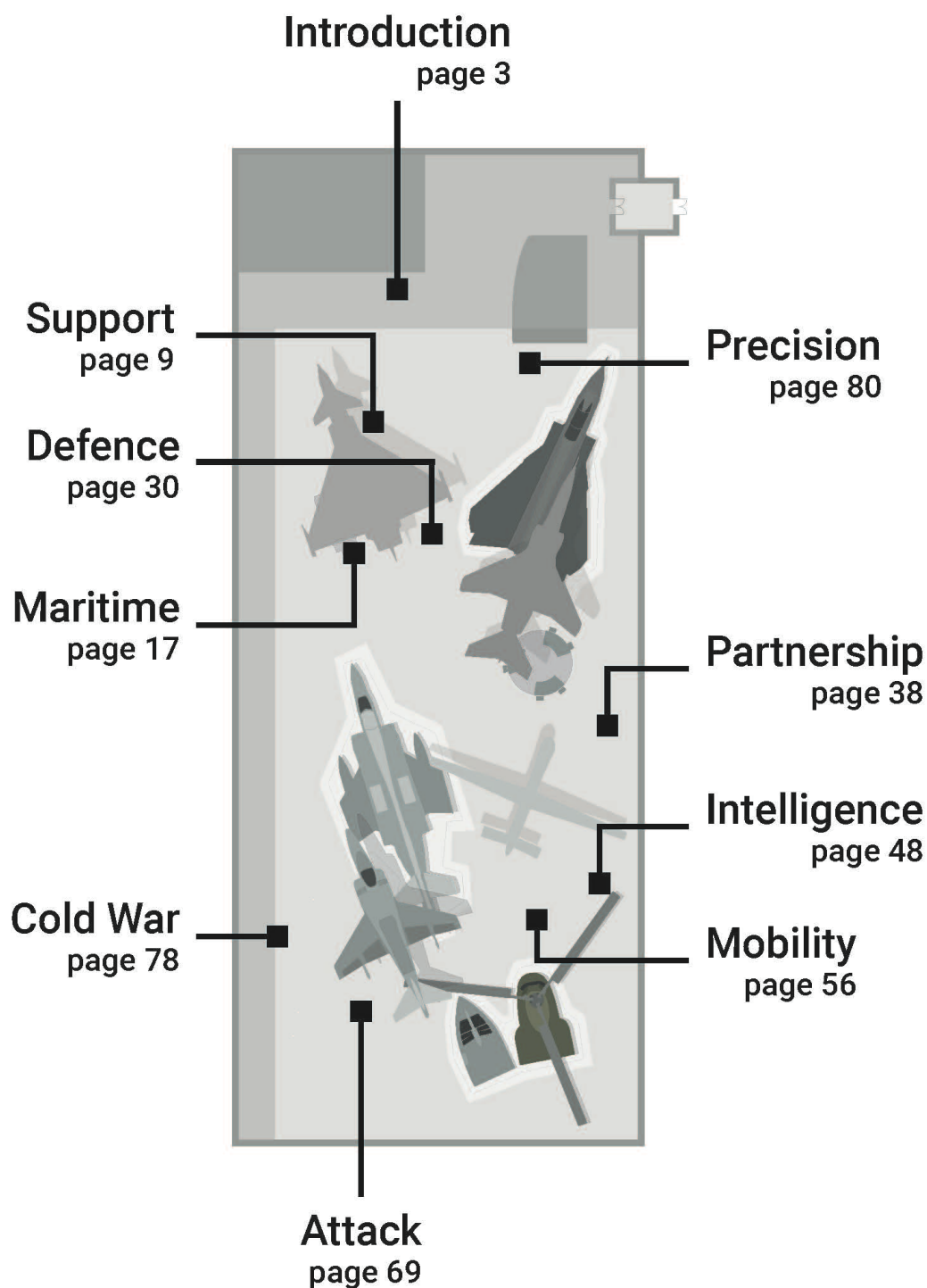
BAE SYSTEMS

Founding partner



HM Treasury

Map



THE RAF IN AN AGE OF UNCERTAINTY

The period 1980 to the present day is one of huge and rapid political, economic and technical change.

Britain's armed forces have been on almost continuous deployment with coalition partners since 1990.

Aircraft, weapons and tactics have been developed and modified to meet the demands of the new operating environment, enabling the RAF to continue to control the air and space in defence of the UK – its interests and allies.

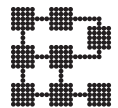
In this exhibition you will hear from the men and women of the RAF who served during this period of change. Objects and operations have been selected to illustrate the vital capabilities of the RAF in the late 20th and early 21st century. A digital timeline uses news media and cultural references to put the operations into context.

The RAF needs to work dynamically to deliver its mission: to defend the UK, to attack if required, to provide reconnaissance and intelligence, to support in times of humanitarian crisis and to move people and equipment across the world quickly.

Its diverse roles are explored through objects and stories through the exhibition. Each is represented by an icon:

INTELLIGENCE

The RAF gathers and analyses information to provide accurate, timely and relevant intelligence to decision makers.



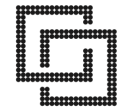
ATTACK

Attack can be used to force an adversary into changing their behaviour for the benefit of friendly forces. Increasing targeting precision reduces risks to friendly forces and civilians.



PARTNERSHIP

Close working relationships with other military services, international allies and industry are essential.



DEFENCE

Defence of air, cyber and outer space enables freedom of manoeuvre and action in the air, on land or at sea and denies these freedoms to the enemy.



MARITIME

As an island nation the UK relies on the RAF and the Royal Navy to monitor and secure its waters either on or below the sea.



MOBILITY

The RAF moves people and supplies rapidly anywhere in the world, supporting both military and humanitarian operations.



SUPPORT

The RAF's Regiment and network of other skilled trades is vital in maintaining and protecting the air force.



[Wall of quotations, left to right, top to bottom]

‘We live in an age of uncertainty ... air and space power is vital in providing exactly the kind of flexible, scaleable and affordable military force that’s required today.’

Chief of the Air Staff Sir Stephen Dalton, ‘Air Power in an Age of Uncertainty’ conference, July 2011

‘I am clear that the RAF makes a definable and unique contribution to Britain’s Defence ... The value of the RAF is not confined to history – far from it ...’

‘Air Power remains critical to the 21st century battle space.’

Rt Hon Dr Liam Fox MP, ‘Air Power in an Age of Uncertainty’ conference, 13 July 2011’

‘To have command of the air means to be in a position to wield offensive power so great it defies human imagination ... It means complete protection of one’s own country ... and peace of mind to live and work in safety.’

General Giulio Douhet, ‘Command of the Air’, 1921

‘What air power delivers is freedom of manoeuvre ...
Without control of the air, your operations are inevitably
constrained and compromised.’

Air Chief Marshal Sir Glenn Torpy, 2017

‘Not to have an adequate air force in the present state of
the world is to compromise the foundations of national
freedom and independence.’

Winston Churchill, House of Commons, 14 March 1933

‘If we lose the whole war in the air we lose the war and
lose it quickly.’

Field Marshal Bernard Montgomery, 1954

‘Air power will play the leading role in our response to the
security challenges of the un-charted future. It will in some
circumstances be the only engaging form of military power
and in others the form upon which successful surface
operations depend.’

Lieutenant General Charles G Boyd, 1991

SUPPORT



The successful delivery of air power missions requires the support of RAF personnel and partners from over 50 trades, whether at home or abroad.

Direct support comes from roles including engineering, air traffic control and intelligence. Nurses, chefs and chaplains provide equally important indirect support. The RAF Regiment plays a vital role in peacekeeping and humanitarian operations by protecting military personnel and airfields, often putting their own lives at risk.

AFGHANISTAN 2001–2014

Following the 9/11 terrorist attacks in New York and Washington in 2001, the US demanded that the Taliban leadership of Afghanistan hand over those who they believed were responsible. The Taliban refused and the US, supported by the UK and Canada, invaded Afghanistan.

In December 2001 a UN-supported security mission (ISAF) was established to train Afghan military forces and to support a democratic government. In response, Taliban forces conducted an insurgency.

RAF aircraft maintained the air-bridge between the UK and Afghanistan. Fast jets, intelligence aircraft, helicopters and transport aircraft supported coalition forces in their fight against the insurgents. RAF Regiment gunners provided security for coalition airfields.

ISAF operations in Afghanistan ceased in 2014. Afghan military forces continue to combat the Taliban while terrorist attacks abroad remain likely.

'Afghanistan is a land-centric war that couldn't be fought without air power and often the ground troops couldn't destroy the enemy with small arms or .50 cal's, so we'd call in air power to do the actual striking. It's a symbiotic relationship really; they both need each other.'

Squadron Leader Matt Carter MC, 'Blue Sky Warriors',
edited by Anthony Loveless

[Showcase labels]

MASTER AIR LOADMASTER DAVE NEALE

Joined the RAF in 1997

David Neale had his interest in aviation awakened when his father's boss suggested that he join the local Air Cadets. He was flying a glider solo before he could drive. Dave joined the RAF as an Air Loadmaster and was posted to helicopters – he has served on Chinooks in the Falklands, Iraq, Afghanistan and in the humanitarian aid relief effort following earthquakes in Pakistan in 2005. In 2015 he was awarded an MBE for his work with the Air Cadets.

'It was all about stabilisation initially, just trying to get the Taliban out and get us in, at which point we'd stabilise the area and then rebuild infrastructure. It took a number of years to achieve that but we got there in the end.'

Dave Neale, RAF Museum interview, 2018

[Image caption]

Dave Neale standing by the door of a Chinook, Afghanistan, 2007.

© RAF Museum I001-0112

**RAF Regiment Gunner Uniform Assembly:
Combat Multi-terrain Pattern (MPT) Trousers
Combat MTP Under Body Armour Meindl Desert Boots
MTP Bergen Rucksack
MK 7 Helmet with MPT Cover
MTP Gloves
MTP Camelback
Osprey MK IV Combat Body Armour
2014**

The RAF Regiment provides ground security for RAF operations. In Afghanistan, gunners were deployed on helicopters when casualties were being evacuated from the battlefield. They also cleared mines and Improvised Explosive Devices (IEDs) and conducted security patrols.

Sara Waymont's Diary 2014 1

Sara Waymont, a Reservist in the RAF, was given permission to visit Afghanistan as a war artist. Her diary records her vivid impressions of the men and women serving at Kandahar and Bastion.

Propaganda Leaflet 2010 **2**

Propaganda leaflets using slogans and imagery were dropped over remote areas of Afghanistan beyond the reach of NATO ground forces. They were designed to dissuade locals from supporting the insurgents.

Personal Mine Extraction Kit about 2010 **3**

As the majority of coalition casualties in Afghanistan were caused by IEDs, ground forces were issued with personal mine extraction kits to help deal with the danger. IEDs made road travel perilous and air transport became important in moving personnel around the country.

Raptor Pod Reconnaissance Imagery 2013 **4**

The RAPTOR reconnaissance pod produces high-resolution images of hundreds of targets in a single sortie. Information gathered from RAPTOR sorties was used in support of ground operations and counter IED intelligence in Afghanistan.

LAND ROVER REVISED WEAPONS MOUNTED INSTALLATION KIT

The RWMIK was designed as a fire support and reconnaissance vehicle and was introduced into service in 2009. It was used by the RAF Regiment to defend airfields from attack by insurgents in Afghanistan.

[Technical panel with illustration next to vehicle]

LAND ROVER RWMIK (REVISED WEAPONS MOUNTED INSTALLATION KIT)

The RWMIK is a lightly-armoured, highly-mobile fire support and reconnaissance vehicle which first entered service in 1999 as the WMIK. Based on the standard military Land Rover 110, it features a strengthened chassis, roll cage and a rear weapons mount that provides configuration flexibility.

The crew of three is comprised of a driver, commander and gunner. The RWMIK, with improved armour protection, entered service in 2009 and was used by the RAF Regiment in Afghanistan to defend airfields and protect air operations.

DIMENSIONS

Height: 2.13m / 6ft 10in. Length: 4.7m / 15ft 5in. Width: 2.19m / 7ft 2in.

DATE

1999–2018 and beyond

USE

Light protected patrol vehicle

ENGINE

Land Rover 2.5 litre Turbo diesel engine

TOP SPEED

56mph / 90km/h

ARMAMENT

7.62mm general purpose machine gun on Commander's mount

.50in. heavy machine gun or 40mm grenade machine gun or 7.62mm general purpose machine gun on rear mount

WHERE USED

Afghanistan and UK

MARITIME



Maritime operations are conducted on, under or over the sea. As an island nation, the UK relies on the RAF, in partnership with the Royal Navy, to monitor and secure its waters.

Maritime operations include anti-surface and anti-submarine patrols, the protection of shipping lanes, fisheries and intelligence gathering. Until 2015, RAF Sea King helicopters also provided military and civilian search and rescue services.

COLD WAR 1946–1991

The Cold War was a period of tension between western nations and communist countries of Eastern Europe. The Soviet fleets of submarines and ships represented a threat to the UK by interrupting trade on which the UK is dependant and, if war broke out, preventing reinforcements arriving from America to support NATO allies.

RAF aircraft in the maritime role conducted reconnaissance operations to monitor Soviet Navy manoeuvres. They were used to locate and track submarines and provide protection to Royal Navy vessels. If war broke out the RAF would have sought to prevent the Soviet Navy from entering the Atlantic by attacking their ships and submarines.

Although constantly monitoring Soviet naval activity, RAF aircraft were never called upon to strike.

'All the training was orientated towards fighting a hard maritime battle against the Warsaw Pact, with intelligence reports showing that the Soviet Navy was a significant threat.'

Squadron Leader Ian Coleman, RAF Historical Society
Journal No. 33

[Showcase labels]

FLIGHT LIEUTENANT GRAHAM ANDREWS

Joined the RAF in 1969

Graham Andrews began his RAF service as an Air Quartermaster. He soon transferred to helicopters where he saw extensive service with the Search and Rescue Force in the UK and overseas and with No. 72 Squadron supporting army operations in Northern Ireland. In 1988 Graham was involved in the grim task of recovering bodies from the Lockerbie disaster. After the Balkans Conflict, he provided search and rescue training to Croatian forces.

‘The seas were enormous ... I prepared my kit and slipped over the sill and commenced my descent. Looking down at the mountainous waves with their tops being whipped into a vicious mist of foam and spray I suddenly felt very small and alone as I fought to face forward. What the hell am I doing here?’

‘Airman Aircrew’ by Graham Andrews, April 2010

[Image caption]

Graham Andrews, while flying Support Helicopter operations with No. 72 Squadron in Northern Ireland, 1993

© Graham Andrews

Search and Rescue Winchman's Uniform

Winchman's Immersion Suit

Mk 4B/L Winchman's Helmet

Life Preserver

Cold Weather Boots

About 2014

The RAF ran search and rescue operations in the UK until 2015. Helicopters were used to reach and hover over inaccessible areas such as ships at sea, mountains and cliffs. Medically-qualified winchmen would be lowered to give aid or rescue casualties.

The Fincastle Trophy Programme and Badge 1, 2 1992

Several Commonwealth air forces contested the Fincastle Trophy, an anti-submarine competition, in which teams had to find and track a target submarine. It enabled them to observe and discuss differing operational practices as well as to participate in realistic training.

Search and Rescue Booklet 1992 3

The RAF operated helicopters and Nimrods in the search and rescue role to recover aircrew from crashed aircraft. However, over 90% of call outs were in response to civilian incidents.

Soviet Navy Recognition Guide about 1980 4

During the Cold War, Warsaw Pact countries posed a maritime threat to the UK. This guide was used to identify vessels and build up an intelligence picture of enemy fleets and operations.

Nimrod MRay First Delivery Medal 2010 5

Nimrod was used in anti-submarine, anti-surface vessel, communications, intelligence and search and rescue roles.

This medal commemorates the first delivery of the next generation of Nimrod in 2010 which were soon scrapped due to government cuts. The Nimrod will be replaced with the P8 Poseidon.

HAWKER SIDDELEY BUCCANEER S2B

Entering service in 1969, Buccaneers operated in the maritime strike role from the UK and as a low-level attack aircraft from bases in Germany. This aircraft saw combat service during the 1991 Gulf War.

[Technical panels with illustrations next to the aircraft]

HAWKER SIDDELEY BUCCANEER S2B

Designed as a low-level maritime strike aircraft, the Buccaneer was first used by the Royal Navy. The improved Buccaneer S2 entered RAF service in 1969. Buccaneers were later modified to carry laser-designator equipment for precision attacks.

This S2B variant was used to designate targets for Tornados during the Gulf War 1991.

DIMENSIONS

Span: 13.4m / 44ft Length: 19.3m / 63ft 5in.

DATE

1970–1994

USE

Two-seat, low-level strike and reconnaissance aircraft

ENGINE

Two 11,100 lb thrust Rolls-Royce Spey RB168-1A Mk 101 turbofans

TOP SPEED

645mph at 250ft 1038km/h at 76.2m

MAXIMUM ALTITUDE

12,190m / 40,000ft

ARMAMENT

7,300kg (16,000lb) of stores in internal weapons bay and on four underwing pylons

Combination of freefall nuclear weapons, iron or cluster bombs, Paveway laser-guided bombs or rocket pods

In the Maritime Strike Role: Four Martel or Sea Eagle anti-ship missiles

Two AIM-9 Sidewinder air-to-air missiles

WHERE USED

UK, Germany and Middle East

AIRCRAFT EVOLUTION: THE BUCCANEER

Designed for the Royal Navy's Fleet Air Arm as a carrier-borne attack aircraft, the Buccaneer S1 entered service in 1962. As it proved to be underpowered, new production aircraft were fitted with Rolls-Royce Spey engines. The RAF adopted the Buccaneer in 1969 after the cancellation of TSR2 and F111 long-range strike aircraft. First deliveries of RAF Buccaneers were Fleet Air Arm aircraft, later aircraft were built specially for the RAF with larger fuel tanks, a strengthened undercarriage and provision to carry Martel anti-ship missiles.

MARITIME OPERATIONS

The RAF developed tactics, aircraft and weapons dedicated to operations on or below the surface of the sea.

Nimrod maritime patrol aircraft used sonobuoys and torpedoes in anti-submarine operations. Passive sonobuoys detect and locate submarines by listening for the noises they make while they are underwater. Active sonobuoys, which emit a sonar pulse, accurately fix the depth, speed and bearing of a submarine prior to an attack using torpedoes such as Sting Ray.

Buccaneers and Tornados carried Sea Eagle, an air-launched 'fire-and-forget' missile for use against surface targets.

BAE Sting Ray 1986–2010

The Stingray is an air-launched, electrically powered, anti-submarine homing torpedo. Its computer is programmed with target information prior to launch. Once in the water, it locates and attacks its target using sonar and electrical sensors.

MBDA Sea Eagle 1985–1999

The Sea Eagle is an anti-surface vessel missile, pre-programmed with target information, which flies at extremely low levels over water. Shortly before impact its computer identifies and locks onto its target ignoring any counter measure deployed. It is designed to damage, rather than sink, a ship.

SSQ 981 Sonobuoy 1990–2010

The SSQ 981 is a passive sonobuoy. Once dropped, it descends to a pre-set depth where it deploys a number of underwater microphones (hydrophones) which can detect a submarine's range and bearing. Data is transmitted to a circling aircraft via a float and transmitter which remains on the surface.

DEFENCE



Defence has been one of the key roles of the RAF since its formation in 1918. Today the RAF's Quick Reaction Alert force is on standby 24/7, ready to intercept any unauthorised intruder into UK airspace. It can be airborne within a few minutes.

Fast jets and their pilots form part of a wider network of people, radar and supporting aircraft that defend UK airspace. The RAF can also deploy these capabilities overseas when supporting coalition, North Atlantic Treaty Organisation (NATO) or United Nations' operations.

LIBYA 2011

In 2011 a revolution against President Muammar Gaddafi swept across Libya. A UN resolution was passed enforcing a no-fly zone and permitting force to be used to prevent pro-Gaddafi forces attacking the civilian population. An Anglo-French led coalition was formed to implement the resolutions.

RAF Typhoons, operating initially in a fighter role, were deployed to counter the threat of Libyan aircraft attacking coalition aircraft, civilians and anti-Gaddafi ground forces. Coalition forces quickly achieved control of the air and Typhoons joined Tornados in the ground attack role supporting anti-Gaddafi forces. Although Gaddafi was quickly deposed, civil war continues in Libya.

'NATO's air strikes, the enforcement of the no-fly zone and the arms embargo succeeded in degrading Gaddafi's ability to attack or threaten civilians or civilian populated areas.'

Nick Harvey MP, Minister for the Armed Forces, House of Commons Defence Committee, Operations in Libya Ninth Report of Session 2010–12, October 2011

[Showcase labels]

WING COMMANDER RICHARD PATOUNAS

Joined the RAF in 1989

Richard (Dicky) Patounas received an RAF sixth form scholarship and was commissioned into the RAF after passing his A-Levels. On completion of his flying training he was posted to RAF Valley as a flying instructor. He was then posted to No. 54 Squadron flying Jaguars which he flew on operations over the Balkans.

In 1998 he joined the Red Arrows for three seasons and returned again in 2006 as their leader. Dicky commanded No. 3 Squadron when it deployed to Southern Italy flying Typhoons over Libya during the Typhoon's first operational deployment.

'The key thing in all of this is the Libyan people – we've been acting in support of them.'

Dicky Patounas, 'Typhoon Returns' RAF Website, 23 September 2011

Typhoon Pilot's Flying Clothes:

Typhoon Flying Jacket

Mk 10C Flying Helmet

Flying Boots

H/752 Mask

Anti-G Trousers

Typhoon Immersion Suit

About 2011

High-speed manoeuvres in modern aircraft can cause forces of up to 9G on the body – nine times the force of gravity – which divert blood away from the brain. Specialist Anti-G suits have been developed by the RAF's Centre of Aviation Medicine to protect pilots.

EUROFIGHTER TYPHOON DA2

The Typhoon was designed as a fighter aircraft, entering RAF service in 2007. It has since been upgraded and can be configured to be a fighter or bomber aircraft. It first saw operational service over Libya in 2011, helping to gain control of the air before moving to support anti-Gaddafi troops on the ground.

EUROFIGHTER TYPHOON

The Eurofighter Typhoon was a product of a partnership between the UK, Germany, Italy and Spain. Development began in 1988. It was initially employed in an air-to-air fighter role as the Typhoon F2 and RAF deliveries began in 2003. The upgraded Typhoon FGR4 is an extremely agile multi-role combat aircraft. Although the Typhoon's primary role is for air defence, it has been deployed in a wide range of air operations, including air policing and peace support. It has also been used against Daesh targets in Syria and Iraq.

This example is the second prototype Typhoon and first flew in 1994. The Typhoon will remain in service until 2040.

DIMENSIONS

Span: 10.95m /
35ft 11in.

Length: 15.96m /
52ft 4in.

DATE

2003–present

USE

Twin engine, canard delta wing multi-role fighter

ENGINE

Two Eurojet EJ200 turbo jets producing 20,000lb thrust each

TOP SPEED

1,550mph / 2,495km/h

MAXIMUM ALTITUDE

16,764m / 55,000ft

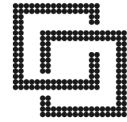
ARMAMENT

Six BVRAAM / AMRAAM air-to-air missiles on fuselage stations and two ASRAAM air-to-air missiles on outer pylons

WHERE USED

UK, Falkland Islands, Middle East, Libya

PARTNERSHIP



The RAF's strong relationships with a range of global partners – both military and civilian – enable it to operate successfully in an era of political, social and financial instability.

The RAF has increasingly operated, trained and shared resources with the British Army and the Royal Navy as well as coalition partners including the North Atlantic Treaty Organisation (NATO) and the United Nations. Partnerships with the defence industry mean the RAF can develop and use innovative technology to deliver a full range of capabilities as well as developing and delivering effective training.

GULF WAR 1991

The RAF first deployed to support the Kuwait government in 1920. This partnership was strengthened during the Second World War when the State of Kuwait supported the purchase of Spitfires for the service. In 1961, following Iraqi threats to annex Kuwait, Britain sent military support to its ally.

When Iraqi forces invaded Kuwait in August 1990 following a diplomatic dispute, the UK joined a US-led coalition of over 30 nations which formed to enforce United Nations' resolutions demanding that Iraq withdraw. RAF Tornado F3s in Cyprus were some of the first aircraft to deploy to the area. Nimrods patrolled the seas while RAF transport aircraft delivered personnel, weapons and equipment.

A 38-day air campaign involving RAF aircraft began prior to the ground invasion. The subsequent ground assault ended after only 100 hours as Iraqi forces were overwhelmed.

'As we came toward the target there was nothing. We were rushing into this black hole. Our first aircraft attacked the field and all of a sudden there was a wall of triple A (anti-aircraft artillery). It seemed that everyone on that airfield was firing at us.'

Flight Lieutenant Malcolm Hammans, 'Thunder & Lightning'
by Charles Allen,

[Showcase labels]

SQUADRON LEADER ROBBIE STEWART

Joined the RAF in 1965

Robbie Stewart trained as a navigator and served one tour on Buccaneers in Germany before converting to the Tornado. Deploying to the Gulf in 1991, Robbie and his pilot Dave Waddington were shot down by a surface-to-air missile during a low level night attack against Tallil Air Base, Iraq.

Robbie and Dave were captured by Iraqi forces and were badly beaten during their interrogation and six week imprisonment. They flew again one last time when Robbie retired from the RAF after 41 years.

‘Funny thing is I never felt scared. I felt a wee bit frightened going out to the aircraft first time but once I got in the aircraft, I never ever felt scared, I always thought we’d make it.’

Robbie Stewart, RAF Museum interview, 2017

[image caption]

Robbie Stewart seated in a Tornado GR1 on his first flight after his release from imprisonment, 1991.

© Robbie Stewart

Flight Lieutenant Robbie Stewart's

Prisoner-of-War Suit:

POW Trousers

POW Jacket

About 1991

Robbie Stewart was shot down during a night attack on Tallil airfield in Iraq. He was captured, interrogated and beaten. Stewart made the braces from a bandage on his broken arm.

Map of Northern Iraq 21 November 2002 1

Map used by Flight Lieutenant Jonathan Davy on a reconnaissance sortie over Mosul and Irbil enforcing the Northern no-fly zone to protect Kurds from repression and to monitor Iraqi compliance with UN resolutions.

S10 Respirator about 1990 2

Respirators and chemical warfare equipment were issued to military personnel and civilian populations as there were concerns that Iraqi forces would use chemical weapons.

Safe Conduct Pass 1991 **3**

The pass promised a reward if assistance was given to service personnel forced down behind enemy lines. Each pass has a unique serial number so that claims could be verified.

Letter from Sergeant Mike Fox to David Malleson

February 1991 **4**

Pro-forma letter sent during the early months of the First Gulf War. RAF Jaguar and Tornado aircraft flew over 2000 offensive sorties in support of coalition forces liberating Kuwait.

Sergeant Brian Dixon's RAF Survival Kit Wallet

About 1990 **5**

Brian Dixon was a medic on No. 7 Squadron Special Forces Flight which operated Chinooks supporting Special Forces operations behind enemy lines.

TORNADO GR1B

The Tornado has been the leading strike, or attack, aircraft of the RAF since entering service in 1982. Its first operational deployment was during the Gulf War 1990–1991 where it was used for low level and medium level attacks.

[Technical panels with illustrations]

PANAVIA TORNADO GR1B

The Panavia Tornado, developed jointly by the UK, West Germany and Italy, was designed for high-speed, low-level attack missions. The Tornado GR1 and GR1A were both capable of carrying a large number of bombs and missiles. They flew during the Gulf War 1991, attacking Iraqi airfields and using laser-guided bombs against bridges, fuel depots and weapon dumps.

This is the GR1B variant developed to carry the Sea Eagle missile while retaining the GR1's avionics and weapons capability.

DIMENSIONS

Span (fully extended): 13.9m / 45ft 7in.

Span (wings fully swept): 8.6m / 28ft 2in.

Length: 16.7m / 54ft 10in.

DATE

1982–2001

USE

Two-seat all-weather tactical strike aircraft

ENGINE

Two 16,920lb thrust Turbo-Union RB199 turbofans

TOP SPEED

1,490 mph at 30,000ft 2,400 km/h at 9,140m

MAXIMUM ALTITUDE

15,240m / 50,000ft

ARMAMENT

Two 27mm Mauser cannons

8,165kg (18,000lb) load including:

Eight 454kg (1,000lb) bombs, two JP233 airfield denial weapons, two Paveway laser-guided bombs, two Sidewinder air-to-air missiles

In the Maritime Strike Role: Two Sea Eagle anti-ship missiles

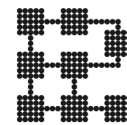
WHERE USED

UK, Germany, Middle East, and Balkans

AIRCRAFT EVOLUTION: THE TORNADO

The Tornado has been constantly modified and updated throughout its service. A major mid-life update began in 1996 involving 142 airframes. Each aircraft had over 3,000 items removed that were either scrapped or refurbished and an additional 500 new parts fitted. Continual upgrades mean that the GR4 of 2018 is a much more capable aircraft than the GR4 that returned to service in the late 1990s.

INTELLIGENCE



The RAF works with its allies to collect and analyse information about hostile forces and key targets. Advances in aircraft, including using Remotely Piloted Aircraft Systems, or drones, alongside satellite and digital technologies enable the RAF to collect, assess and use more information than ever before.

Data and images can now be shared securely and immediately and are processed by Intelligence Analysts in real time. This intelligence supports commanders to make quicker, more informed, decisions about potential threats or targets.

CONFLICT IN THE BALKANS 1991–1999

Following the death of President Tito in 1980, Yugoslavia experienced a wave of nationalism as different ethnic and religious groups sought independence. The largest state of the federation, Serbia, tried to suppress this move to independence and civil war broke out first with Bosnia and later with Kosovo.

NATO air forces were deployed to protect the civil populations and enforce United Nations resolutions and international peace agreements. In 1992 RAF aircraft contributed to the longest airlift in history to relieve the siege of Sarajevo.

RAF intelligence aircraft such as Sentry, Nimrod, Canberra and Jaguar monitored the activities of Serbian forces. The RAF continued to provide intelligence, ground attack and airlift support to NATO in their campaigns against Serbian forces in Bosnia and Kosovo.

‘We have all been affected by pictures of the refugees. We all have children and we have been touched. And frankly, it strengthened our resolve.’

Anonymous Tornado pilot, RAF News, 16 April 1999

[Showcase labels]

CORPORAL CLIFF MOON

Joined the RAF in 1985

Cliff Moon joined the RAF aged 16 and trained as a Survival Equipment Fitter, known in the service as a Squipper. During the Gulf War 1991, Cliff helped set up the nuclear-biological-chemical (NBC) protection and decontamination facilities at Dharhan in Saudi Arabia. He also deployed to Ploče in Croatia as part of the United Nations peacekeeping force and undertook tours in Northern Ireland and Saudi Arabia where he supported no-fly zone operations over Southern Iraq.

‘It was a great honour really, to be given a United Nations beret ... [to] go out there and protect people.’

Cliff Moon, RAF Museum interview, 2017

[Image caption]

Cliff Moon on deployment with United Nations peace keeping forces in Croatia, 1995

© Cliff Moon

Chief Technician Peter Morgan's Flight Deck Helmet,

Surcoat and Goggles:

Flight Deck, HGU-250/Helmet

Deck Shoes

Ear Defenders

Blue RN Overall

Scott Type/RAF/Goggles

Deck Surcoat

1997

Peter Morgan served as an RAF armourer on board HMS Invincible in 1997. RAF and Fleet Air Arm Harriers flew operations from the Mediterranean over Iraq and the Balkans.

Bomb Mission Stencils 1999

1

Stencils used on No.1 Squadron Harrier GR7s involved in Operation ALLIED FORCE. This was a NATO operation in which Serbian military targets were attacked to prevent their persecution of ethnic minorities in Kosovo.

RAF Aircraft Camera Type F95, Mk 7 **2**

1950s to 2000s

This F95 camera was used in Jaguar reconnaissance pods over the Balkans in the early 1990s – after this digital technology came into effect.

Corporal Cliff Moon's UN Beret and Brassard

1995 **3 and 4**

Cliff Moon served with No. 33 Squadron, deployed to Ploče in Croatia as part of an Anglo-French rapid reaction force in support of UN peacekeeping efforts.

Map of Yugoslavia 1991 **5**

Intelligence map showing the complex ethnic and religious make-up of the Republic of Yugoslavia prior to its civil war, ethnic cleansing and eventual break-up.

SEPECAT JAGUAR GR1

The Jaguar entered RAF service as a ground-attack and reconnaissance aircraft in 1974. Jaguars flew in strike and reconnaissance roles during the Gulf War 1991 and the Balkans conflicts. They were retired in 2007.

[Technical panel with illustration]

SEPECAT JAGUAR GR1

The Jaguar was conceived as an Anglo-French collaborative project to develop a combat trainer and tactical support aircraft. Jaguars participated in enforcing the United Nations no-fly zone over the former Yugoslavia. They were engaged in ground attack and reconnaissance operations with two Jaguars permanently configured to the reconnaissance role. Reconnaissance photographs taken by Jaguars of Udbina airfield in Croatia were used when NATO were planning a large strike against the airfield – in which RAF Jaguars also took part.

On loan from RAF Cosford.

DIMENSIONS

Span: 8.68m / 28ft 6in. Length: 16.8m / 55ft 2in.

DATE

1974–2007

USE

Single seat tactical support and ground attack aircraft

ENGINE

Two 7,140lb static thrust Rolls-Royce/Turbomeca RT 172
Adour 102 turbofans

TOP SPEED

1,057mph at 32,810ft 1,701km/h at 10,000m

MAXIMUM ALTITUDE

14,000m / 45,900ft

ARMAMENT

Two 30mm Aden guns

Provisions to carry combinations of:

1,000lb general-purpose bombs

BL-755 cluster bombs

CBU-87 cluster bombs

Missiles and rockets:

19 CRV-7 rockets in two under-wing mounted pods

Two AIM-9L Sidewinder missiles on over-wing pylons

WHERE USED

UK, Germany, Middle East, Balkans

MOBILITY



Air mobility enables the movement of people and supplies anywhere in the world to support a range of military and humanitarian operations.

Although greater loads can be carried by land or sea, the RAF's fleet of fixed and rotary wing aircraft can provide a rapid response over long distances and access to hard-to-reach or hostile locations.

FALKLANDS CONFLICT 1982

In 1982 Argentinian forces invaded the Falkland Islands. The UK government quickly determined that they would seek to liberate the islands by despatching an all-arms task force to the South Atlantic. The task force was hastily assembled and aircraft were modified to enable them to be air-to-air refuelled so that they could operate over the extreme distances involved – UK forces were largely based 8,000 miles away in Europe.

RAF Nimrod and Victor aircraft conducted anti-submarine warfare and maritime reconnaissance missions to protect the task force and C-130 Hercules air-dropped vital supplies to the fleet. RAF Harriers and a Chinook helicopter, operating from Royal Navy aircraft carriers and later from land, flew operations in support of the army.

After a short, intensive land campaign the Argentine forces surrendered. The RAF have maintained a presence on the islands ever since.

'We were lucky ... there is no question in my mind that the attempt to recover the Falklands was never going to be anything but very hazardous ... What made the difference was the skill and determination shown by everyone involved, in all three services.'

MRAF Sir Michael Beetham, RAF Historical Society

Journal No. 30

[Showcase labels]

GROUP CAPTAIN BOB IVESON

Joined the RAF in 1967

Bob Iveson's father was in the RAF and this inspired his interest to fly. He received an RAF flight scholarship and gained his private pilot's license before joining the service.

Bob converted to flying Harriers in the early 1970s and deployed to the South Atlantic flying operations over the Falklands from HMS Hermes in 1982.

Bob later converted to Tornados and commanded No. 617 Squadron during the 1991 Gulf War. He retired from the RAF in 1999.

'It was pretty hairy, because I'd never seen that much tracer and flak going off in the air. They had a lot of guns at Goose Green including some pretty sophisticated radar laid ones which I found out to my cost later.'

Bob Iveson, RAF Museum interview

[Image caption]

No. 1 Squadron pilots during the Falklands Conflict – Bob Iveson is standing on the far right.

© Crown Copyright

Bob Iveson's Mk 10 Immersion Suit 1982

Immersion suits were worn by pilots in case they had to eject over water. Bob Iveson was shot down during a low-level ground attack. He ejected from his aircraft and evaded capture before being rescued.

Air-to-Air Refuelling Plan, Marham News,

South Atlantic Special 1982

1

In Operation BLACK BUCK, one Vulcan bomber needed 18 tanker sorties to refuel it during a 6,800-mile roundtrip to attack Stanley Airfield on the Falkland Islands. At the time, these were the longest bombing missions ever flown.

Temporary Aircraft Servicing Form 1982 **2**

This form was created for the sole surviving Chinook (ZA718) after the container ship Atlantic Conveyor sank with three Chinooks and all specialist maintenance tools and spares on-board.

Task Force Ale 1982 **3**

Commissioned by The Sunday Mirror, about 8,500 bottles of Task Force Ale were distributed to personnel returning from the Falklands Conflict.

Falklands Victory Badges 1982 **4**

There was little public knowledge in the UK of the Falkland Islands before the Argentine invasion of 1982. However, the campaign received strong public support and many souvenir items were produced to reflect this and celebrate the victory.

BOEING CHINOOK HC2

The Chinook entered RAF Service in 1980. During the 1982 Falklands Conflict Bravo November – the sole surviving Chinook – carried 1,500 troops, 95 casualties, 650 prisoners and 500 tons of cargo. In its over 30 years of service, four of Bravo November's pilots have been awarded the Distinguished Flying Cross.

LOCKHEED C-130 HERCULES

The first Hercules was delivered in 1966. During the 1982 Falklands Conflict, Hercules aircraft were modified so that they could be refuelled in the air enabling them to deliver troops and supplies to the UK task force.

[Technical panel with illustration]

BOEING CHINOOK HC2

Originally developed for the US Army, the prototype Chinook first flew in 1961. It is an extremely versatile tandem rotor, heavy lift helicopter, and can carry up to 55 troops or ten tons of freight. The first RAF Chinooks were delivered in 1980 and are used for heliborne assault, carrying personnel, replenishing supplies, battlefield casualty evacuation and for transporting internal or underslung loads.

This Chinook has been modified to represent Bravo November, the only Chinook to survive the Falklands Conflict and which is still in service. Four of its pilots have been awarded the Distinguished Flying Cross.

DIMENSIONS

Rotor span: 18.3m / 60ft Length: 30.1m / 98ft 9in. (with rotors)

DATE

1980–present

USE

Tandem rotor heavy lift support helicopter

ENGINE

Two Textron Lycoming T55-712F turbo shafts, producing 3,148shp each

TOP SPEED

183mph / 295km/h

MAXIMUM ALTITUDE

4,572m / 15,000ft

ARMAMENT

Two M134 six-barrelled Miniguns, one in each front side window

One M60D machine gun on ramp

WHERE USED

Afghanistan, the Balkans, Iraq, Lebanon, Falkland Islands

AIRCRAFT EVOLUTION: THE CHINOOK

The RAF is the largest operator of the Chinook outside the United States. Its importance to military operations has seen continual modifications to existing airframes and additional purchases of new-build airframes. The Chinook Sustainment Programme aims to extend Chinook operations for at least another 20 years.

LOCKHEED WC-130E HERCULES

The American Lockheed C-130 Hercules has been a major part of the RAF and US Air Force's (USAF) tactical air transport fleets for over fifty years. The RAF's C-130K variant entered service in 1967 and has been used for troop-carrying, supply-dropping, aeromedical evacuation, disaster relief and humanitarian operations.

This nose section is from a USAF WC-130E weather reconnaissance Hercules, which was used to collect weather data used in research and planning.

On loan from the Pima Air and Space Museum.

DIMENSIONS

Span: 40.4m / 132ft 7in. Length: 30.1m / 98ft 9in.

DATE

1967–present

USE

Medium-range tactical transport

ENGINE

Four Allison T56-A-15 turboprop engines producing 4,910eshp

TOP SPEED

356mph / 572km/h

MAXIMUM ALTITUDE

Service Ceiling

9,753m / 32,000ft

ARMAMENT

None

WHERE USED

Worldwide, including the UK, Middle East and Afghanistan

AIRCRAFT EVOLUTION: THE HERCULES

The Hercules C-130 first entered service in the US Air Force in the 1950s. Outwardly, it has changed very little in over 50 years of service. However, the aircraft were constantly modified and repaired with most major structural parts being changed at least three to four times. It was estimated that when the aircraft came out of service only 10% of each aircraft was original.

ATTACK



Since the First World War the RAF has carried out bombing of both enemy forces and strategic targets. A new era of attack, or strike, began in 1982 with the RAF's first operational use of laser-guided bombs during the Falklands Conflict.

Since then, advances in technologies, such as Global Positioning Systems and the ability to control weapons after they are released, have enabled the RAF to strike targets with increasing precision. Aircrews can maintain a safer distance from a target while damage to the surrounding area and risk to civilians is reduced.

IRAQ 2003–2011

From 1991 coalition aircraft enforced no-fly zones over Iraq and monitored Iraqi compliance with United Nations' Resolutions. A coalition, led by the US, invaded Iraq in 2003 in the belief that Iraq's President, Saddam Hussein, had breached these resolutions and was developing weapons of mass destruction.

The invasion lasted five weeks before Hussein's regime fell. A bloody insurgency and civil war between differing religious groups brought chaos to the country. A large coalition of nations committed forces to bring stability to Iraq.

RAF aircraft flew in support of coalition operations during this period. Intelligence, attack, transport aircraft and helicopters remained in the region flying in support of ground forces combating the insurgency until their withdrawal in 2011.

'Being major contributors to the Second Gulf War in 2003 and latterly the stabilisation operations that taken place over the past six years ... there isn't a part of the RAF that has not been involved in one shape or form in these operations, be it in the air or on the ground.'

Air Chief Marshal Sir Glenn Torpy, RAF News, 22 May 2009

[Showcase lectern]

SQUADRON LEADER STEVE CARR DFC

Joined the RAF in 1983

During the 2003 invasion of Iraq, Steve Carr led a formation of five Chinooks to spearhead a joint forces assault with the US Marines on the Al Faw Oil refinery to prevent an act of environmental terrorism by Iraqi forces. Over the next three days the Chinooks averaged 19 flying hours a day. This was the largest helicopter assault in RAF history and the first opposed helicopter assault since the Suez Crisis in 1956. Steve was awarded the Distinguished Flying Cross for his contribution.

‘You know it’s for real when you are talking on the radio too two American AC-130 Spectre gunships in orbit above you, engaging some Iraqis who are firing at the Marines from entrenched positions ... It was quite exciting. It was a busy piece of air space.’

Steve Carr ‘Operation Telic: The British campaign in Iraq 2003–2009’, by Tim Ripley

[Image caption]

Steve Carr after flying passengers into the Brunei jungle in support of the development charity Rayleigh International, 1998

© Steve Carr

Air Traffic Controller, Basra

Body Combat Armour

Disruptive Pattern Material Shorts

Mk 6 Helmet

Sandals

Sand Goggles

T-Shirt

About 2007

Basra airport was a joint military and civilian airport and important for UK air operations in efforts to bring stability to the region. Control of the airport was gradually returned to the Iraqis as the situation around Basra stabilised.

Ground Crew Manoeuvring A Paveway Bomb

2003

1

Precision guided munitions such as Paveways, as represented in this painting by 'The Times' war artist Matthew Cook, formed 85% of the munitions delivered by the RAF during the invasion of Iraq in 2003. This was a significant increase on previous conflicts.

UK 4U Christmas Gift Box 2008

2

The charity UK4U began sending Christmas gift boxes to servicemen and women deployed overseas in 2005. The gifts raise morale and show national support. This is one of the 24,500 boxes sent in 2008.

Squadron Leader Steve Carr's Medal Bar 2003

3

Left to right: Distinguished Flying Cross, General Service Medal 1964, NATO Former Yugoslavia Service medal, NATO Kosovo Service medal, Iraq Medal, Golden Jubilee Medal 2002, Accumulated Campaign Service Medal.

On loan from Steve Carr

BRITISH AEROSPACE HARRIER GR9A

[Look up]

The Harrier GR5 entered service in 1995 and was modified to GR9 standard in 2006. Three squadrons of Harriers were deployed during the invasion of Iraq in 2003, performing ground attack operations. The Harrier was retired in 2010.

[Technical Panel with Illustration]

BRITISH AEROSPACE HARRIER GR9A

The Harrier GR9A resulted from a collaborative partnership between McDonnell Douglas and British Aerospace to produce a second-generation Harrier based on the McDonnell Douglas AV-8B. This incorporated an advanced wing design, improved avionics and increased bomb and missile-carrying capacity.

RAF variants started as the Harrier GR5, and were later upgraded as the GR7 and GR9. The RAF used them for attack and close air support duties in conflicts such as Kosovo, Iraq, and Afghanistan.

DIMENSIONS

Span: 9.25m / 30ft 4in. Length: 14.12m / 46ft 4in.

DATE

2006–2010

USE

Single seat V/STOL ground attack aircraft

ENGINE

One 21,750lb thrust Rolls-Royce Pegasus Mk 107 turbofan

TOP SPEED

661mph / 1,065km/h

MAXIMUM ALTITUDE

13,106m / 43,000ft

ARMAMENT

Combination of weapons including:

AIM-9L Sidewinder, Maverick, Paveway II, Paveway III, Enhanced Paveway, General Purpose Bombs, CRV-7

WHERE USED

UK, Middle East, Serbia, Bosnia, Kosovo and Afghanistan

COLD WAR WEAPONS

Following the Second World War and the creation of the Eastern Bloc, the United Kingdom played a significant role in countering this Soviet threat alongside NATO allies. The weapons displayed here were designed for use against Warsaw Pact countries.

Hunting JP233 Airfield Denial Weapon 1

JP233 was designed to make airfields unusable by scattering a large number of airfield cratering bombs and anti-personnel mines, damaging the airfield and delaying its rapid repair. It was used in the Gulf War 1991. However, this type of cluster munition was later banned by international treaties.

‘The second night, when we experienced [JP233] actually going off as it was designed to do, you definitely know, it’s like going over big rumble strips because you’re getting rid of a lot of sub-munitions and they’re all banging out of the canister so you definitely know. There’s no doubt when it has gone off.’

Andrew Walters, Tornado pilot, RAF Museum interview 2017

WE177C Nuclear Weapon

2

WE177 is a family of free-fall nuclear weapons designed for use by RAF and Royal Navy aircraft. It was intended to destroy tactical targets in Central Europe in the event of a Soviet invasion, with a blast radius of three miles. It was never used and came out of service in 1998.

‘I would have done it, my pilot would have done it I know, because somebody on the other side of the fence was coming to do the same to us. And so we had to retaliate. Armageddon. Thankfully it never took place.’

David Herriot, RAF navigator, RAF Museum interview 2017

PRECISION

Since the first aircraft dropped bombs, air forces have strived to improve targeting accuracy. The RAF works closely with defence industry partners to develop and test new technology to deliver these continued advances.

New systems including radar, infra-red, laser and Global Positioning Systems guidance have all helped to increase targeting precision. This has resulted in the reduction in size of explosive charges which, in turn, reduces damage beyond the intended target and minimises potential civilian casualties. Some modern munitions can also be released further from the conflict zone keeping service personnel and aircraft away from danger.

These technical developments have supported the fulfilment of the UK government's aim for zero civilian casualties.

Supported by



PRECISION

The weapons on display here demonstrate some of the advances in bombing technology since the 1980s.

Supported by



[Left to right, back to front]

1000LB General Purpose Bomb 1943–Today

The basic design of this unguided high-explosive bomb dates from the Second World War and has been in use with the RAF for decades. The bomb without its tail forms part of the RAF's Paveway II laser-guided bomb.

Raytheon Paveway II 1978–Today

Paveway II is a guidance kit which is fitted to a general-purpose bomb. Once released, the seeker head steers the bomb to the designated target using a laser. Later variants can be guided to their targets by GPS.

MBDA Air Launched Anti-Radiation Missile (ALARM)

1991–2013

The ALARM is designed to home in on the energy emitted by ground-based air-defence radar.

If the radar is then switched off to avoid detection, the missile can loiter until the radar is reactivated.

On loan from



MBDA Dual-Mode Brimstone 2005–Today

Brimstone is a ground attack missile designed for use against vehicles. It can be laser-designated to a target or used autonomously to identify its target on a busy battlefield.

Courtesy of



MBDA AIM-132 Advanced Short Range Air To Air Missile (ASRAAM) 2002–Today

ASRAAM detects the infra-red heat emitted by the engines of an opposing aircraft. It can lock onto its target before or after launch and can acquire its target even from behind the launch aircraft.

Raytheon AIM-120 Advanced Medium Range Air-To-Air Missile (AMRAAM) 2004–Today

With a range of up to 40 miles, AMRAAM is used beyond the visual range of the pilot. By using on-board navigation systems and updates from the launch aircraft, it closes in on a target where final guidance is given by its radar.

MBDA Meteor 2018

Designed to replace AMRAAM, Meteor is capable of extremely long-range engagements against fast manoeuvring targets. It is powered by a RAM jet and can reach speeds of Mach 4 (approximately 3,044mph / 4,900km/h).

Courtesy of  **MBDA**
MISSILE SYSTEMS