

Unit 93: Aircraft Explosive Devices and Regulations

Unit code:	J/600/9070
QCF Level 3:	BTEC Nationals
Credit value:	10
Guided learning hours:	60

● Aim and purpose

This unit will give prospective aircraft weapons technicians the knowledge, understanding and practical skills associated with the safe handling, preparation and maintenance of aircraft explosive devices.

● Unit introduction

In this unit learners will gain a knowledge of the rules and regulations associated with various explosives and explosive devices. They will then be given an opportunity to prepare aircraft bombs for use and undertake maintenance on an aircraft bomb and its associated equipment. Learners will also be introduced to the principles and operation of aircraft bomb release mechanisms and will develop an understanding of the function and operation of a guided missile including the function of its major components.

This unit, together with *Unit 94: Operation and Maintenance of Aircraft Weapons Electrical Systems* and *Unit 95: Operation and Maintenance of Aircraft Assisted Escape Systems*, will provide the knowledge, understanding and practical skills needed to meet the requirements of the armed forces' initial training for those undergoing basic training as a weapons technician.

● Learning outcomes

On completion of this unit a learner should:

- 1 Know the rules and regulations associated with explosives and explosive devices
- 2 Be able to prepare an aircraft bomb for use and undertake maintenance on an aircraft bomb and its associated equipment
- 3 Understand the principles and operation of aircraft bomb release mechanisms
- 4 Understand the function and operation of a guided missile.

Unit content

1 Know the rules and regulations associated with explosives and explosive devices

Explosives: roles – passive (search and rescue flares and signals, aircraft assisted escape systems (AAES) equipment), aggressive (bombs, missiles, rockets); types – primary (detonators, initiators), secondary (bomb and shell main fillings); propellants eg rocket motors, gas producing cartridges; pyrotechnics eg flares, signals; explosive regulations eg compliance with rules as issued by the Chief Inspector of Explosives — building construction, fire regulations, security, licensing

Explosives storage areas: roles eg receipt and issue of explosives (on behalf of Officer Commanding (OC) Logistics, documentation), safe storage, packing/unpacking/maintenance areas, preparation/de-preparation under controlled conditions; types eg missile storage, explosives storage, explosives components storage; explosives storage regulations eg compliance with rules as issued by Chief Inspector of Explosives — safety distances, fires and smoking, radiation hazards, health and safety, mandatory training, licensing, control of entry and building standards; types of appliances used for explosive fires (hydrants, buckets, sand, water gas, emergency water supply tanks); fire class symbols (no water, radiation, breathing apparatus, full personal protective equipment (PPE) required)

Hazards: handling eg correct lifting, personnel training, safe use of equipment, when unpacking/packing, environment (radio frequencies (RF), storage conditions); transportation eg correct documentation, authorised representatives, vehicles (types, markings, loading, restraints, route planning), drivers and escorts eg explosives carriage trained and authorised, in date, familiarity training, carry certificates

2 Be able to prepare an aircraft bomb for use and undertake maintenance on an aircraft bomb and its associated equipment

Preparation for use/de-preparation on return: aircraft bomb eg suspension lugs, fit/remove exploders, proximity sensors fit/remove, harness fit/remove; fuse eg safety checks, programme, fit/remove; tail eg unpack, gauge, cock/de-cock, fit/remove; explosives storage area (ESA) documentation, transport, issue, issue documentation; safety precautions associated with aircraft bomb preparation eg procedures in accordance with relevant schedules and publications, area of assembly/disassembly, safe use of PPE, handling techniques, lifting operations, tools

Bomb maintenance operations: percentage of stock per annum; surface finish; extrusion/exudation checks; lug holes threads; identification markings; resealing exploder pockets; safety precautions associated with aircraft bomb maintenance eg approved maintenance areas, safe use of solvents and paints, mechanical tools, handling and clothing

Bomb handling equipment: lifting equipment eg gantries, straps, lugs; transportation equipment; safety precautions associated with aircraft bomb handling eg earthing (equipment and personnel), PPE, vehicle speeds, correct use of restraints and tools

3 Understand the principles and operation of aircraft bomb release mechanisms

Bomb release mechanisms: maintenance of aircraft ejector release units (ERU) eg heavy duty release units (HDRU), light duty release units (LDRU), 119, 122; maintenance of aircraft bomb fusing units eg testing (functioning, static and pull off); operation of aircraft bomb carriers, pylons and dispensers; safety precautions associated with aircraft bomb release mechanisms eg carrier bomb light stores (CBLS), pylons, chaf and flare

4 Understand the function and operation of a guided missile

Function and operation of guided missiles: function and operation (aircraft power-on to impact) eg guidance head operation, heaters, take off, weight-on-wheels (WOW), missile selection functions, master and late arm, trigger press, launch and impact functions; safety and protective devices eg dome protection, active optical target detector (AOTD) protectors, umbilical cap, umbilical profile, safe arm key, wing/fin covers, rolleron covers, venturi cover, forward hanger cover, earthing; safety precautions eg forward firing, exhaust, cook off times, approach angles

Components of a guided missile: guidance control system (GCS); thermal battery; gas grain generator (GGG); logic circuits; gas reservoir; umbilical; guidance head; AOTD; safe arming device (SAD); warhead; rocket motor; wings and fins

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P1 state the roles, rules and regulations associated with the handling of a primary and a secondary type of explosive	M1 compare the handling, storage and potential hazards associated with two different types of explosive	D1 justify the use of regulatory authority directives and other relevant air publications relating to the handling of two different explosive devices, both on and off the aircraft.
P2 state the roles, rules and regulations associated with an explosives storage area	M2 compare the preparation, maintenance and handling of two aircraft bombs	D2 evaluate how error management principles can reduce aviation accidents/incidents.
P3 describe the hazards associated with the handling and transportation of two different types of explosives	M3 select and use equipment to arm and disarm an explosive device.	
P4 prepare an aircraft bomb for use [SM3, SM4]		
P5 carry out a maintenance operation on an aircraft bomb [SM3, SM4]		
P6 carry out a maintenance operation on a piece of bomb handling equipment [SM3, SM4]		
P7 explain the function, operation and safety precautions associated with two different bomb release mechanisms		
P8 explain the function and principles of operation of a guided missile		

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:	To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:
P9 identify and describe the function of the major components of a guided missile.		

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers CT – creative thinkers	RL – reflective learners TW – team workers	SM – self-managers EP – effective participators
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Essential guidance for tutors

Delivery

The delivery strategy for this unit is likely to consist of a series of planned lectures, demonstrations and practical tasks. These should be designed to give learners as wide a range of opportunities to experience the use, care and maintenance of explosives and explosive devices as possible.

It is recommended that the delivery of this unit follows the order of the learning outcomes. This will enable learners to gain sufficient knowledge of the rules and regulations associated with an explosive or explosive device before it is actually handled and worked with.

Throughout the delivery of the unit, emphasis should be placed on the identification, care and use of explosive materials, rather than excessive theory devoted to the structure and properties of the explosive. It is expected however, that the safety aspects of explosives and explosive devices should be continually stressed.

The nature of the practical work will be very much dependent upon the resources available to the centre, but it must include the actual handling of both explosives and explosive devices, in addition to carrying out exercises on and off aircraft as required by the unit content. Where the resources required to meet any specific aspect of this content are not available on-site, coverage may be achieved through incorporating relevant visits/work experience.

During the delivery of this unit it is essential that information on the safety procedures, regulatory authority directives and other relevant air publications relating to the handling of the explosive devices being considered must be readily available at all times.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment

Whole-class teaching:

- introduction to unit content, scheme of work and assessment strategy
- explain the roles of passive and aggressive explosives and the differences between primary and secondary devices
- describe the different types of propellants and pyrotechnics
- explain the rules and regulations that must be adhered to when dealing with aircraft explosives
- explain the roles, rules and regulations associated with an explosives storage area
- explain the hazards associated with the handling and transportation of explosives
- supervised tour of explosives storage area.

Individual/small group activity:

- investigation and research into relevant rules and regulations associated with explosives.

Topic and suggested assignments/activities and/assessment

Whole-class teaching:

- explain safety precautions associated with aircraft bomb preparation
- explain the use of relevant documentation
- explain procedures and methods used for preparation and de-preparation of an aircraft bomb
- demonstration of aircraft bomb preparation/de-preparation.

Supervised practical activities:

- preparation and de-preparation of an aircraft bomb, adhering to relevant safety precautions.

Whole-class teaching:

- explain safety precautions associated with aircraft bomb maintenance
- explain procedures and methods used for aircraft bomb maintenance
- demonstration of bomb maintenance operations.

Supervised practical activities:

- carry out a range of bomb maintenance operations.

Whole-class teaching:

- explain safety precautions associated with aircraft bomb lifting and transportation equipment
- demonstration of procedures and methods used for bomb handling equipment maintenance operations.

Supervised practical activities:

- carry out maintenance operations on bomb handling equipment.

Prepare for and carry out **Assignment 1: Preparation and Maintenance of Aircraft Bombs** (P1, P2, P3, P4, P5, P6, M1, M2, M3, D1)

Whole-class teaching:

- explain maintenance of aircraft ejector release units and aircraft bomb fusing units
- explain operation of aircraft bomb carriers, pylons and dispensers
- explain the safety precautions associated with aircraft bomb release mechanisms
- supervised tour/visit to view maintenance of bomb release mechanisms.

Individual learner study:

- investigation and research into bomb release mechanisms.

Prepare for and carry out **Assignment 2: Function and Operation of Bomb Release Mechanisms** (P7)

Whole-class teaching:

- explain the operation and function of a guided missile
- explain the safety and protective devices used on a guided missile
- explain the safety precautions related to guided missile systems.

Individual learner study:

- case study research into guided missile systems.

Prepare for and carry out **Assignment 3: Function and Operation of Guided Missiles** (P8, P9)

Feedback on assessment and unit review

Assessment

Much of the assessment evidence for this unit could be achieved through tutor observation and oral questioning during learners' practical work with explosives, explosive devices and the related handling equipment (simulated or real). It is important however, that such process evidenced is planned and recorded appropriately.

The process evidence could be supplemented by additional written work through either assignments or in the form of notes and records that have been prepared by learners during the practical tasks. Whilst the evidence must only be that produced by each individual learner (group work would not be acceptable), it is expected that learners will carry out any assessment tasks (particularly associated with explosives or explosive devices) with an appropriate level of supervision.

The pass criteria P4, P5 and P6 are likely to provide the main focus for the assessment of the first three learning outcomes. During the preparation and maintenance of an aircraft bomb for use, learners should be able to address the requirements of P1, P2, P3, and P7 in part (for one device), with supplementary evidence being used for a second device where necessary.

P8 and P9 could be achieved through learner-led study and a written report, based on a specific guided missile or through other forms of assignment or practical work. It is important that the evidence for P8 includes sufficient detail from the point of aircraft 'power-on' to the impact of the missile being considered. The components identified and described for P9 will depend on the guided missile studied, but the evidence should cover the range of content or explain how specific aspects of content are not relevant to the missile, if appropriate.

The merit and distinction criterion could all be assessed through an extension of the practical work carried out for P4, P5 and P6. At least one explosive and bomb will have been covered for the pass criteria and a second could be considered for merit to show the learners' wider understanding of explosives and bombs. M3 could be an extension to P5, having maintained the aircraft bomb learners could then go on to select and use equipment to arm and disarm the device.

To achieve D1 learners should identify and justify the use of regulatory authority directives and other relevant air publications relating to the handling of two different explosive devices, both on and off the aircraft. Again, this is a natural extension to the work undertaken for the pass and merit criteria and should provide learners with an opportunity to demonstrate a greater understanding of relevant regulations, directives and publications.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, P3, P4, P5, P6, M1, M2, M3, D1	Preparation and Maintenance of Aircraft Bombs	A weapons technician must prepare a bomb for use and undertake maintenance on an aircraft bomb and associated equipment.	A practical preparation and maintenance task, supported by witness statements, plus records of oral questioning and/or written response to set tasks.

Criteria covered	Assignment title	Scenario	Assessment method
P7	Function and Operation of Bomb Release Mechanisms	A weapons technician must prepare a report on bomb release mechanisms.	Written assignment.
P8, P9	Function and Operation of Guided Missiles	A weapons technician must prepare a report on guided missiles.	Written assignment.

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Engineering sector suite. This unit has particular links with:

Level 1	Level 2	Level 3
		Operation and Maintenance of Aircraft Weapons Electrical Systems
		Operation and Maintenance of Aircraft Assisted Escape Systems

Essential resources

Learners must have access to official explosives and weapons data, textbooks and appropriate armament equipment including a selection of aircraft weapons, bombs, guns and guided missiles and associated equipment.

Employer engagement and vocational contexts

Much of the work for this unit can be set in the context of learners' work placements or be based on case studies of local employers. Further information on employer engagement is available from the organisations listed below:

- Work Experience/Workplace learning frameworks — Centre for Education and Industry (CEI -University of Warwick) — www.warwick.ac.uk/wie/cei/
- Learning and Skills Network — www.vocationallearning.org.uk
- Network for Science, Technology, Engineering and Maths Network Ambassadors Scheme — www.stemnet.org.uk
- National Education and Business Partnership Network — www.nebpn.org
- Local, regional Business links — www.businesslink.gov.uk
- Work-based learning guidance — www.aimhighersw.ac.uk/wbl.htm

Indicative reading for learners

Specialist manuals for relevant aircraft armament systems and devices, air publications and Statutory Regulations.

Delivery of personal, learning and thinking skills

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Self-managers	organising time and resources, prioritising actions and anticipating and managing risks when carrying out preparation and maintenance activities on aircraft bombs and associated equipment.

Although PLTS are identified within this unit as an inherent part of the assessment criteria, there are further opportunities to develop a range of PLTS through various approaches to teaching and learning.

Skill	When learners are ...
Reflective learners	setting goals with success criteria for their development and work.

● Functional Skills — Level 2

Skill	When learners are ...
English	
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	researching aircraft bombs, release mechanisms and guided missiles using and interpreting explosives and weapons data
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	preparing reports on the practical work undertaken and presenting information on the function and operation of a bomb release mechanism and guided missiles.