Unit 95: Operation and Maintenance of Aircraft Assisted Escape Systems

Unit code: M/600/9077

QCF Level 3: BTEC Nationals

Credit value: 10

Guided learning hours: 60

Aim and purpose

This unit has been designed to give prospective aircraft weapons technicians the underpinning knowledge and practical skills associated with the function, operation and maintenance of Aircraft Assisted Escape Systems (AAES) fitted to modern military aircraft.

Unit introduction

In this unit learners will consider aircraft assisted escape systems including a range of types (eg type 10b, Tornado canopy system) the required safety precautions, their specific functions, operation, tests and associated documentation. Learners will also need to use and maintain an aircraft ejection seat stand and remove and refit an aircraft ejection seat in an aeronautical engineering environment.

The unit, together with *Unit 93: Aircraft Explosive Devices and Regulations* and *Unit 94: Operation and Maintenance of Aircraft Weapons Electrical Systems*, provides all of the underpinning knowledge necessary to meet the requirements of the armed forces initial training requirements for those undergoing basic training as weapons technicians.

Learning outcomes

On completion of this unit a learner should:

1 Understand the function and operation of an aircraft assisted escape system

2 Be able to use and maintain an aircraft ejection seat stand

3 Be able to remove an aircraft ejection seat

4 Be able to refit an aircraft ejection seat.

Unit content

1 Understand the function and operation of an aircraft assisted escape system

Aircraft assisted escape system (AAES): types of AAES eg type 10b, history of evolution to present day, Tornado canopy system; safety precautions to be observed when working with AAES eg explosives handling, fitting and transportation, compressed gas (EO2 and Nitrogen) component intricacies and handling, bulk manual handling; function of AAES eg components, pilot release, cartridges, drogue chute, survival equipment, oxygen system, canopy system, manual separation, full AAES operation; operation of AAES eg complete operation of AAES system, canopy system and manual separation; functional tests eg Instrument timing tests, pull off checks (handle, sears, firing rack, main beam, EO2), leak checks, seat actuator, altitude and G tests

AAES safety devices and documentation: pin sets, tell tale ties, cart lock-wire systems, cart transit boxes; documentation for specific maintenance procedure, equipment labels, timing sheets, log cards, aircraft and bay maintenance cards

2 Be able to use and maintain an aircraft ejection seat stand

Aircraft ejection seat stands: construction and function of ejection seat stands; use of the stand for maintenance purposes; association of the stand to the type/MK of ejection seat

Stand maintenance: procedures eg tyre inflation pressures, lubrication, before and after use procedures; documentation (item log card)

3 Be able to remove an aircraft ejection seat

Ejection seat removal: safety precautions to be observed when removing an ejection seat eg explosives handling, fitting and transportation, compressed gas (EO2 and Nitrogen) component intricacies and handling, bulk manual handling, height, seat safety devices, general aircraft safety (in vicinity of) power on/off , cockpit entry/exit, switch checks; disarm procedure eg cart removal, disconnect components, removal of survival equipment; removal procedure eg seat removal, removal of carts, checks for serviceability; documentation eg aircraft maintenance procedure, aircraft maintenance cards, 700 entries

4 Be able to refit an aircraft ejection seat

Ejection seat refitting: safety precautions to be observed when refitting an ejection seat eg explosives handling, fitting and transportation, compressed gas (EO2 and Nitrogen) component intricacies and handling, bulk manual handling, height, seat safety devices, general aircraft safety (in vicinity of) power on/off, cockpit entry/exit, switch checks; refit procedure eg seat fit, fitment of carts, checks for serviceability; re-arm procedure eg cart fitment, connect components, fitment of survival equipment; documentation eg aircraft maintenance procedure, aircraft maintenance cards, 700 entries

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 explain the function and operation of an AAES for a given aircraft	**M1** explain the evolution and need for an AAES	**D1** select and justify the use of the correct documentation for all work undertaken on an aircraft's AAES
P2 position the safety devices on an aircraft's AAES and complete the related documentation	**M2** compare the methods and specialist tools used to disarm and remove two different types of aircraft ejection seats	**D2** evaluate the condition of an aircraft's AAES and recommend the appropriate maintenance procedure, components and equipment required to carry out a repair.
P3 select and use an ejection seat stand during an ejection seat maintenance procedure [SM3, SM4]	**M3** compare the methods and specialist tools used to rearm and refit two different types of aircraft ejection seats.	
P4 carry out a maintenance procedure on an ejection seat stand [SM3, SM4]		
P5 identify and describe the relevant safety procedures to be followed when removing an aircraft's ejection seat		
P6 disarm and remove an aircraft's ejection seat and complete documentation [SM3, SM4]		
P7 identify and describe the relevant safety procedures to be followed when refitting an aircraft's ejection seat		
P8 refit and rearm an aircraft's ejection seat and complete documentation [SM3, SM4].		

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	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

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 provide the learner with as wide a range of experience in the use, care and maintenance of aircraft assisted escape systems (AAES) as possible. Emphasis should be placed on the identification, care and use of AAES, rather than excessive theory on AAES. Throughout the delivery of the unit, the safety aspects of working with AAES should be continually stressed.

It is recommended that the delivery of this unit follow the order of the learning outcomes. This will enable the learner to gain a sufficient knowledge of the function and operation of AAES before they are required to handle equipment and systems to effect a removal and replacement of an aircraft ejection seat.

The nature of the practical work will be very much dependent on centre resources but must include identification and handling of both AAES and associated safety devices, in addition to carrying out supervised exercises both on and off aircraft. Where the resources required to meet any specific aspect of this content are not available on-site, experience may be achieved by incorporating relevant visits/ work experience for the learner into the learning support time for them to gain this 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 AAES 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 evolution of escape systems and the different types in use • explain the safety precautions relevant to working with escape systems • explain the function and operation of AAES • explain the functional tests to be carried out on an AAES • explain the use of AAES safety devices and maintenance documentation. *Workshop activities:* • practical investigation of two types of AAES.
Prepare for and carry out **Assignment 1: Aircraft Assisted Escape Systems and Safety Devices** (P1, P2, M1)

Topic and suggested assignments/activities and/assessment
Whole-class teaching: • explain the construction, function and use of ejection seat stands • demonstrate the use and correct maintenance of an ejection seat stand. *Workshop activities:* • carry out a range of stand maintenance procedures and complete related documentation.
Whole-class teaching: • explain the safety precautions to be observed when removing an ejection seat • explain the disarm and removal procedures to be used and related documentation • demonstrate the safe and correct removal of an aircraft ejection seat. *Workshop activities:* • remove an aircraft ejection seat and complete documentation.
Whole-class teaching: • explain the safety precautions to be observed when refitting an ejection seat • explain the refit and rearm procedures to be used and related documentation • demonstrate the safe and correct refitting of an aircraft ejection seat. *Workshop activities:* • refit an aircraft ejection seat and complete documentation.
Prepare for and carry out **Assignment 2: Removing and Refitting an Aircraft Ejection Seat** (P3, P4, P5, P6, P7, P8, M3, M2, D1)
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 practical activities. It is important however, that such processes evidenced are 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 the learner during the practical tasks. Whilst the evidence must only be that produced by the individual learner (group work would not be acceptable), it is expected that the learner will carry out any assessment tasks (particularly associated with explosives and AAES safety devices) with an appropriate level of supervision.

All the assessment evidence for pass can be based upon the learner's work with a single AAES and related equipment. However, to achieve a merit the learner will need to have demonstrated their understanding through the comparison of two different types of AAES.

The assessment evidence for P1 and P2 could be produced through a written assignment or time constrained test. The focus for the assessment for P1 will be on a specific type of AAES, its related safety precautions, function, operation, testing and documentation. To achieve P2 the learner is required to describe the safety devices on an aircraft's AAES (pin sets, tell-tale ties, cart lock-wire systems, cart transit boxes) and related documentation required for specific maintenance procedures eg, equipment labels, timing sheets, log cards, aircraft and bay maintenance cards. A further extension task could be set for M1, explain the evolution and need for an AAES within the same assessment instrument.

The remaining pass criteria will require practical work and as such, the evidence is likely to be collected through tutor observation, oral questioning and associated notes/documentation produced by the learner.

Once again, to achieve the related merit criteria (M2 and M3) the learner will need to be able to compare two different types of aircraft ejection seats. The implications of this are that the learner will have gained the additional experience by working to a satisfactory level of competence on two seats to enable them to carry out the comparisons.

For P3, the learner is required to select and use an appropriate ejection seat stand to enable them to carry out an ejection seat maintenance procedure and so this criterion could be linked with either the removal or refitting task associated with P6 and P8, respectively. It would also make sense to link this work with P4. That is, to carry out a maintenance procedure on an ejection seat stand before or after the removal or fitting task.

The criteria P5 and P6 relating to the removal of an aircraft's ejection seat are clearly linked and likewise, P7 and P8 relating to the refitting of an aircraft's ejection seat. It is acceptable for this to be the same seat that is removed (possibly linked with D2) and replaced. Note that, for this unit the learner is not required to carry out a repair. To meet D2 however, the learner should be able to evaluate the condition of the aircraft's AAES and recommend the appropriate maintenance procedure, components and equipment required for its repair.

All the practical work (during delivery and assessment) should be carried out in line with the relevant specialist manuals, air publications, diagrams, drawings and statutory regulations. These must be available to the learner at all times. The required documentation for each task must be completed and 'signed-off' as appropriate by a supervisor. Where rectification work is required, the assessor needs to consider whether their input actually invalidates achievement of the criteria. If this is the case, reassessment on a different seat may be required to ensure the validity of the assessment. As far as possible, the assessed practical work undertaken by the learner should be to industry standard or a simulation of such standards where it is impractical to allow the learner to work on real aircraft.

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, M1	Aircraft Assisted Escape Systems and Safety Devices	A technician needs to report on the function and operation of an AAES and the process for positioning the safety devices on an aircraft's AAES.	Responses to written tasks.
P3, P4, P5, P6, P7, P8, M3, M2, D1	Removing and Refitting an Aircraft Ejection Seat	A technician needs to remove and refit an aircraft ejection seat.	Records of practical activities supported by observation records and records of oral questioning.
D2	Evaluating the Condition of an Aircraft Assisted Escape System	A technician needs to evaluate the condition of an aircraft's AAES and recommend the appropriate maintenance procedure, components and equipment needed.	Records of practical activities supported by observation records and records of oral questioning.

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
		Aircraft Explosive Devices and Regulations
		Operation and Maintenance of Aircraft Weapons' Electrical Systems

Essential resources

Learners will need access to ejection seat data books, manuals and appropriate equipment. Centres will also require the use of a selection of aircraft ejection seats and associated equipment (particularly seat stands) and specialist tools.

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:

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

Indicative reading for learners

Specialist manuals for relevant aircraft assisted escape systems, 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 removing and refitting aircraft ejection seats.

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 ...
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	researching information on the types of aircraft assisted escape systems and their associated documentation
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 aircraft assisted escape systems