Unit 29: Aviation Meteorology for Ground Staff

Unit code: A/602/5685

QCF Level 3: BTEC National

Credit value: 3

Guided learning hours: 27

● Aim and purpose

The aim of this unit is to increase the understanding of weather reporting and forecasting for airport and airline ground staff. On completion of this unit, learners should be able to understand and interpret the information gleaned from the Meteorological Office weather charts and reports.

● Unit introduction

The aviation industry is unique in its vulnerability to adverse weather conditions. Modern technology and highly trained flight crews have helped to reduce the impact of weather on flight operations, but weather conditions must still always be considered when planning flights.

Non-experts will observe current weather conditions by simply watching the rain, snow or high winds and will think 'I'm glad I'm inside!'. The trained observer, pilot or ground crew needs to know precisely: How much rain? How heavy is the snow? Has it reduced visibility? What is the air temperature? How strong is the wind and which direction is it blowing from? How long will it last?

The aim of this unit is to enable learners to move from considering changes in weather to be only a slight inconvenience, to considering in some detail the causes and consequences of weather patterns that affect the UK.

Those who work as ground staff for airlines, ground handling agents or airport authorities may be aware of weather charts and reports produced by the UK Meteorological Office (Met Office) specifically for the aviation industry. Frequently, printed copies of weather charts and textual reports are carried from briefing offices to aircraft to allow the flight crew to execute their flights safely. Weather information is not only of interest to air crew – airports and ground operations must also be able to predict the extent and severity of forecast weather in order to plan staffing, equipment and operational strategies. Understanding the Met Office documents can help learners to become part of that decision-making process.

● Learning outcomes

On completion of this unit a learner should:

1   Understand the characteristics of air masses and weather patterns that affect UK airports

2   Be able to interpret aviation weather charts and reports.

Unit content

1 Understand the characteristics of air masses and weather patterns that affect UK airports

Air masses that affect the UK:

- polar maritime (cold, moist air)
- arctic maritime (cold, moist air)
- polar continental (cold, dry air)
- tropical continental (warm, dry air)
- tropical maritime (warm, moist air)

Significant weather features that affect the UK:

- causes of unstable air (warming air, orographic lifting, frontal lifting, low pressure systems)
- effects of unstable air (cumulous clouds, thunder, hail, rain showers, snow showers, gusty, clear air)
- causes of stable air (cooling air, high pressure systems)
- effects of stable air (stratus clouds, persistent rain/drizzle/snow, light winds, haze, fog)
- local heating
- sea breeze

2 Be able to interpret aviation weather charts and reports

Synoptic charts:

- access charts from Met Office website
- interpret symbols, e.g. milibars, high/low pressure areas, warm front, cold front
- interpret charts, e.g. wind direction, wind speed, significant weather, cloud cover
- 60-hour synoptic chart
- form F215 (UK low level chart)

Weather reports:

- types (Meteorological Area Report (METAR), Terminal Area Forecast (TAF))
- decode reports, e.g. airfield, validity, wind velocity, cloud base and cover, horizontal visibility, air pressure, forecast changes
- form F214 (UK spot wind chart)

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 Describe the air masses that affect the UK, their origins and routes	**M1** Discuss the types of adverse weather that may affect aviation operations in the UK	**D1** Produce a coordinated severe weather awareness guide for an airport or airline
P2 Explain how significant weather features affect the UK as a result of air masses and local influences		
P3 Interpret synoptic weather charts and aviation weather reports produced by the Met Office [SM]	**M2** Present a detailed weather forecast based on Met Office data	

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

Learners who have regular exposure to Met Office charts will become familiar with the formats and protocols used in weather reports. It will be possible to compare personal observations, BBC weather bulletins and official Met Office reports and forecasts. For delivery in the classroom, finding published Met Office documents is not difficult. Every learner should be encouraged to set up a basic account on the Met Office website at: http://www.metoffice.gov.uk/aviation/ga. At the time of writing, this service is offered free of charge. Full decode lists and explanations are included. A more advanced service, giving access to enhanced data, is available from the same site on payment of a subscription.

Frequent and regular reading, interpreting and forecasting from Met Office reports and charts is by far the best way to become comfortable and confident with the codes used. This process can be introduced at the beginning of the unit and group briefings can become a regular feature in each session.

It is important that learners are aware of the causes and effects of weather that affects the UK. A good starting point is to explain how the five main air masses arrive and how the characteristics of the air within them significantly determines our weather. Many well-known Private Pilot Licence training manuals contain clear descriptions of the air masses. Once the origin and route of air masses are established, learners should be able to predict if the air is likely to be moist or dry, warm or cold. It will probably be necessary to introduce the concept of cooling air tending to create atmospheric stability, with warming air leading to potential instability.

Many learners will be aware of the principles of evaporation and condensation. However, this knowledge should not be assumed. It is important that a sound understanding of how clouds form is in place before moving to the next sections.

While the factors governing the creation of areas of high and low pressure may be too complex for this unit, it is important that learners appreciate the impact they have on the weather experienced in the UK. The fact that wind tends to rotate anti-clockwise around a centre of low pressure (in the northern hemisphere) may be a new concept to many learners, but with that knowledge predicting wind directions from pressure charts should be possible.

Moving pressure systems bring with them warm and cold fronts. It is difficult for learners to grasp the mechanics of these phenomena unless the cause and structure of the front principle is explained. Once this is understood, cloud types and associated precipitation can be explored.

While some weather patterns are relatively benign, others may have a severe impact on aviation operations. Learners must become aware of the more significant types (for example strong winds, low visibility, freezing, heavy precipitation).

To link the theoretical topics covered above to the workplace, it would be useful for learners to discuss (although they would not be assessed in this unit) precautions and preparations that must be in place to ensure that aviation ground operations take place with minimal weather-related disruption.

As previously suggested, it would be useful for learners to look at current Met Office weather charts and reports regularly from the outset. Progressive explanations of symbols and coding may prove easier for learners to absorb than simply being asked to memorise a decode list. Using this method, it is possible to compare what is found in the reports to what is actually happening on the day. For learners based at airports, charts, TAFs and METARs appropriate to that airport would be perfect as a resource. For classroom-based learners, choosing charts for nearby airports would be adequate. Once familiar with the terminology, learners should be able to read and translate the charts and reports for any airport in the world into plain English with confidence. To progress from simply reporting current conditions, learners should also be encouraged to predict weather patterns based on forecast data.

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 of planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction to the unit. This should include creating awareness that weather has a significant effect on aviation activities (ranging from inconvenience to severe hazard). Explain what an 'air mass' is.
Tutor input – using graphics and maps. Describe the movements and characteristics of air masses that affect the UK. This must include rotation around low and high pressure areas. Learners could be invited to bring example charts from newspaper weather forecasts to illustrate this.
Class-based discussion. Learners could be invited to suggest how the air masses influence the weather in the UK based on their origin and trajectory. Viewing examples of detailed weather reports (from TV) and reading forecasts (from newspapers) should help learners see emerging patterns. Tutor clarification will be needed.
Preparation for assignment **Assignment 1: Part A – Characteristics of Air Masses** (P1, P2) **Feedback on assignment**
Using the knowledge gained in P1 and P2, learners should discuss the types of weather that may have an adverse effect on UK aviation activities. Researching incidents of airport closures (due to snow or low visibility) and diversions (due to high winds and heavy rain) could provide a good basis for the report.
Preparation for assignment **Assignment 1: Part B – Characteristics of Air Masses** (M1) **Feedback on assignment**
Tutor input – learners are introduced to the standard charts produced by the Met Office for aviation consumers (synoptic chart, forms F214 and F215, TAF and METAR). Learners must be provided with decode booklets (GetMet – available from the Met Office website) in order to decipher the documents.
Tutor-led class discussion – learners must be able to interpret current Met Office data to produce and present a weather forecast. This should involve graphics (e.g. 60 hour synoptic charts), printed charts (e.g. forms F214, F215) and textual (e.g. TAF and METAR). Understanding of weather and the timescales involved is essential.
Preparation for assignment **Assignment 2: Part A – Interpret Weather Reports** (P3, M2) **Feedback on assignment**
Class discussion – using M1 and M2 as the foundation, learners should be able to anticipate the kind of weather that is associated with particular combinations of air mass and low/high air pressure systems. These discussions should be extended to decide how to put this knowledge into quick-access guidance for aviation staff.
Preparation for assignment **Assignment 2: Part B – Interpret Weather Reports** (D1) **Feedback on assignment**

Assessment

This unit can be assessed through a learner presentation, supported by graphics and charts, or as a written report. In either case, the work must show confidence and clarity.

P1 – P2 – M1

To achieve P1, learners must provide a clear description of the five main air masses that affect the UK, correctly identifying their areas of origin and path over the surface of the Earth, together with their physical characteristics.

To achieve P2, learners must explain significant weather, and its causes, affecting the UK, as a result of air masses or local influences. The unit content should be used as a guide.

To achieve M1, learners must discuss the effects of adverse weather on aviation activities in the UK. This must be based on a range that includes strong wind, precipitation, reduced visibility and low temperatures.

P3 – M2 – D1

To achieve P3, learners must interpret weather charts and reports clearly and accurately for at least three different days at an airport of their choice. The chosen charts and reports must contain enough activity to cover the unit content. This can be presented in the format of an air crew briefing.

To achieve M2, learners must present a detailed weather forecast using data from the Met Office, including synoptic charts and forms F214 and F215. The forecast must provide details of expected weather types, wind direction and strength and anticipated timescales.

To achieve D1, learners must combine previously gained knowledge to produce a coordinated severe weather awareness guide for airport or airline staff. This should be in the form of a reference booklet, providing a guide to anticipated severe weather based on forecast conditions.

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	Assignment 1: Characteristics of Air Masses	Working for an airport, produce an introductory guide to the type of weather that affects UK aviation, its causes and effects.	Portfolio
P3, M2, D1	Assignment 2: Interpreting Weather Reports	Working for an airport, produce a practical demonstration of weather reporting and forecasting together with a guide to anticipated severe weather.	Weather report Weather forecast Booklet

Links to other BTEC units

This unit forms part of the BTEC aviation sector suite. This unit has particular links with the following unit titles in the aviation suite.

Level 2	Level 3	Level 4
n/a	Unit 20: Ramp Handling Unit 26: Flight Operations Unit 27: Airfield Operations	n/a

Essential resources

Learners must have access to library and research facilities, and current trade publications. Learners should also have access to a Met Office account and decode lists.

Employer engagement and vocational contexts

Visits are highly recommended as are guest speakers from industry. Learners should have access to accurate and up-to-date industry case studies.

Indicative reading for learners

Textbooks

Cosgrove B – *Pilot's Weather: A Commonsense Approach to Meteorology* (Airlife Publishing Ltd, 1999) ISBN 978-1882663415

Dunlop S – *Philip's Guide to Weather Forecasting* (Philip's, 2008) ISBN 978-0540090266

Met Office – *The MET Office Book of the British Weather: UK Weather Month by Month* (David & Charles PLC, 2010) ISBN 978-0715336403

Website

www.metoffice.gov.uk   Meteorological Office

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 to clearly and accurately interpret weather charts and reports for at least three different days at an airport.

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 …
Independent enquirers	exploring air masses and weather patterns that affect the UK
Reflective learners	developing knowledge and understanding of aviation meteorology and working towards the aim of interpreting different weather charts and reports
Team workers	working in a team to give a weather briefing to air crew
Self-managers	managing the workload of the unit.

● Functional Skills — Level 2

Skill	When learners are ...
ICT — Use ICT systems	
Select, interact with and use ICT systems independently for a complex task to meet a variety of needs	accessing online weather reports and forecasts to provide weather information to ground staff
Use ICT to effectively plan work and evaluate the effectiveness of the ICT system they have used	presenting weather information and code information
Manage information storage to enable efficient retrieval	storing notes, research findings and assignments in a logical order in folders
Follow and understand the need for safety and security practices	using passwords and trusted internet sites
Troubleshoot	as required.
ICT — Find and select information	
Select and use a variety of sources of information independently for a complex task	sourcing weather reports and charts
Access, search for, select and use ICT-based information and evaluate its fitness for purpose	using appropriate search criteria to locate weather reports and charts.
ICT — Develop, present and communicate information	
Enter, develop and format information independently to suit its meaning and purpose including: • text and tables • images • numbers • records	interpreting and communicating weather information through a variety of images, text, number and tables
Bring together information to suit content and purpose	presenting weather information clearly and accurately
Present information in ways that are fit for purpose and audience	presenting weather information clearly and accurately to ground staff
Evaluate the selection and use of ICT tools and facilities used to present information	choosing the most appropriate ICT tool to present the weather information.

Skill	When learners are ...
Mathematics	
Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations	interpreting weather charts.
Identify the situation or problem and the mathematical methods needed to tackle it	
Select and apply a range of skills to find solutions	
Use appropriate checking procedures and evaluate their effectiveness at each stage	
Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations	
Draw conclusions and provide mathematical justifications	
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	delivering a weather briefing to air crew
Reading – compare, select, read and understand texts and use them to gather information, ideas, arguments and opinions	reading and interpreting weather reports and charts
Writing – write documents, including extended writing pieces, communicating information, ideas and opinions, effectively and persuasively	writing a document to explain types of air masses and weather features.