Gliding Australia Training Manual

Pilot Guide

Unit 38
Meteorology and Flight planning

Unit 38 – Meteorology and Flight Planning

WHAT THIS UNIT IS ABOUT

To develop your knowledge and skills in determining the suitability of the forecast weather for cross country flight and in setting an appropriate task for the expected conditions.

WHAT ARE THE PRE-REQUISITES FOR THIS UNIT?

- GPC Unit 33 Thermal sources and structure
- GPC Unit 34 Outlanding planning, demonstration and execution
- GPC Unit 36 Navigation and airspace

COMPLEMENTARY UNITS

This unit should be read in conjunction with:

- GPC Unit 40 Cruising, speed to fly, height bands and thermal selection

KEY MESSAGES

- How to access and use weather information relevant to planning a flight.
- Weather threats such as wind, rain, thunderstorms, and dust/smoke and effect on flight planning.
- The concept of the soaring window.
- The likely cross-country speed that can be achieved based on predicted thermal strength, wind and other conditions.
- Selection of a suitable task.

PILOT GUIDE FOR THIS UNIT

Meteorology and flight planning is a very large subject – this unit is only an introduction to allow you to predict basic soaring weather for flight planning purposes. Further detail is covered in the advanced training syllabus and beyond. You'll never stop learning!

You should start conservatively – if in doubt don't fly cross country or speak with an instructor or coach. You'll also find that daily club weather briefings are a valuable resource - this is a great learning environment. Also talk with experienced pilots on the day.

Weather predictions

Weather information is available from multiple sources (including looking outside). You'll need to be familiar with these sources and have the appropriate registration and login where required.

A brief list of weather sources is:

- Looking outside!
- Bureau of Meteorology – General forecast, synoptic chart, prognostic chart, satellite images
- NAIPS area forecast (requires a free login through the Air Services website or there are apps available) – Terminal Area Forecasts, Meteorology Aerodrome Reports, Graphical Area Forecasts
- Atmospheric soundings (search BOM for "Aerological Diagrams")

- Gliding weather models (such as GFAMet (free) or subscription services Skysight and XCSkies)

Gliding weather models are seductive and not always correct. You should learn to interpret and use general weather forecasts and not rely solely on gliding weather models.

For task planning and assessment of weather hazards you'll need to predict such things as:

- Weather events and timing (fronts, wind, rain, thunderstorms, dust/smoke etc)
- Wind speed and direction during the day (at surface and selected altitudes)
- Cloud – cumulus cloud base and high cloud over the day
- Maximum temperatures over the task area
- Thermal heights
- Thermal strength
- Soaring window

Predicted versus actual. It is important to compare information from general and gliding forecasts with actual observations such as local temperatures and satellite images – look outside and don't get seduced by computer models. Are fronts/troughs/cumulus development progressing as expected?

Cumulus cloud is formed from condensation of rising water vapour forming water droplets (condensing when the dew point is reached). A useful rule of thumb is that cumulous cloud base in feet (where present) is the difference between the observed dew point and temperature multiplied by 400 – for example if the temperature is 30 degrees and the dew point is 15 degrees then cloud base will be approximately 6000 feet above the ground.

At this level predicting thermal heights and strengths from modelled and observed atmospheric soundings is not covered. This information can be found in the gliding weather models, or from talking with experienced pilots. The rule of thumb generally applies that the higher the thermals go, the stronger they are – for example often 3 to 4 knots for 4000 foot thermals, and 6 to 7 knots for 10000 foot thermals.

Similarly predicting the time when thermals start and stop (the soaring window) from first principles is not covered in this unit – this information is available from gliding weather models.

Wind has a big impact on cross country flight. In particular:

- Wind gradient and gust fronts make outlanding more hazardous;
- Your achieved cross-country speed will be lower;
- Thermals are likely to be broken and so harder to use, so slower average climb rate is achieved; and
- Increased danger in using thermals low due to turbulent gusts, wind shear and outlanding risks.

Flight Planning

Flight planning in the context of this unit is the process of using the weather predictions to plan an appropriate task. You'll need to develop an understanding of achievable cross-country speeds under various conditions and other considerations for planning a task including safety.

MacCready theory can be used to calculate achievable cross-country speed given the performance of the glider and the strength of the thermals, however for inexperienced pilots it is not necessary to understand the theory or its limitations. In any case, inexperienced pilots can only be expected to achieve speeds much lower than theoretically possible – generally due to average climb rates

significantly lower than for experienced pilots. MacCready theory is covered in the post-GPC syllabus and numerous references (google MacCready theory).

What is important is to gain an understanding of what average cross-country speed you might expect given the conditions of the day. The simple task planner table at the end of this section is a tool that can be used for planning a task. The task planner provides guidance on typical achievable speeds for an inexperienced pilot flying an unballasted glider such as an LS4. The speeds indicated are good for task planning purposes – your challenge is to better those speeds on task! If there is any significant wind, then cross country speed will be reduced. A rule of thumb that can be applied is that if predicted winds are above 5 knots at flying heights, reduce the predicted average speed by about 1 kph per knot of wind speed.

Some considerations for task planning are:

1. Task time. This should be shorter than the soaring window as predicted from the weather analysis and should take into account time to climb in the first thermal and before leaving on task. You should not be too ambitious with task time. Consider landing well before significant weather events.
2. Task distance. Calculated from the predicted cross-country speed in the task time available.
3. Task waypoints. The following should be considered:
    - Airspace restrictions.
    - Areas of adverse weather.
    - If possible, fly down wind on 1st and last legs - into wind during the peak of the day.
    - Avoid flying west at the end of the day (visibility is poor).
    - Placing the airfield mid-leg minimises any retrieve.
    - Silver Distance requires flying to at least 50km from the tow release point and launch point. Be aware of other geometry requirements for badge flights.
    - Choose a task that avoids difficult outlanding terrain (or make sure enough height is available to cross) or choose a task that remains within range of suitable airfields.
    - What is the longest retrieve you are comfortable with (if needed)?

The main weather threats include wind, rain, thunderstorms, and dust/smoke. Ensure that you assess the likelihood of these weather events and consider appropriate actions to minimise associated risks. Actions may be not to fly, task in a different direction, task for a shorter part of the day, abandon the task, or simply increased vigilance. Be aware of the dangers of outlanding in difficult conditions such as strong winds or gust fronts. At all times it's always a good idea for pilots to seek advice from experienced instructors.

Ensure that you know areas of unlandable terrain in the local tasking area – speak with an experienced cross-country pilot or take a look at the terrain with Google Maps. At some sites it is advisable to fly with a database of airfields and always keep at least one within glide at all times.

Use a map or use a program such as SeeYou to plan a task within the constraints.

Review your flights

It is useful to review the cross-country speeds you actually achieved under the conditions for each cross country flight you fly. You may wish to keep the completed planner for each day to use for future reference and add some notes on what speed you achieved and how the conditions compared to the forecast.

Flight analysis applications such as SeeYou, and an increasing number of online analysis tools such as WeGlide and Online Contest (OLC), provide details of speeds on each leg of the flight, average achieved climb rate, percentage time spent thermalling etc. Flight analysis is covered under the post-GPC syllabus. If you'd like to do this earlier speak with a coach or experienced pilot to speed up your learning.

Example Task Planning Form

Simple Task Planner			Date	12/01/2019
Wind	Surface	2,000 ft	5,000 ft	10,000 ft
	350 / 4	345/8	290 / 12	N / A
Thermal Height	6000	Average achieved climb		3 kt
Cloud	Cu + Cirrus	(This will be less than the average thermal strength)		
Key Events	No fronts expected.			
Notes	Max temp 31. More cu to north			
Expected XC Speed			60 km/h	
Planned Task Time (allow for longer flight time)			1400 - 1700	3 hours
Task Length			180 km	
Task				
Flight review				

NOVICE XC Speeds (LS4)	
AVERAGE CLIMB	**KM/HR**
2KT	**50**
3KT	**60**
4KT	**70**
5KT	**80**

FLIGHT EXERCISES FOR THIS UNIT

Flight

You will conduct the planned flight, most likely in conjunction with flight exercises from Navigation and Airspace or Advanced soaring instruments and flight computers.

As the flight progresses, you'll be queried on your perception of the conditions encountered relative to the predicted conditions. You'll need to watch for changes such as the progression of a front, cloud and changes in wind direction and strength.

How is your task progressing relative to what you planned? Replan the remainder of the flight as necessary?

Debrief

Your flight will be recorded using a flight recorder and your coach will review the flight data. You'll look at individual thermals and the climb rate achieved for the duration of the thermal. You'll review parameters like average thermal climb rate, percentage of the time spent thermalling and achieved cross country speed.

The achieved heights, thermal strengths and weather will be reviewed against the forecasts for the day and possible reasons for variations will be discussed.

THINGS YOU MIGHT HAVE DIFFICULTY WITH

COMMON PROBLEMS	
Problem	**Probable Cause**
Incorrectly setting task distance	Incorrectly predicting the wind and or thermal strengths/heights over the soaring window Incorrectly estimating likely task speed with your experience in the predicted conditions Not factoring in the time from launch to leaving on task
Choosing an inappropriate task	Unfamiliarity with local conditions, terrain and airspace

HOW DO YOU DEMONSTRATE COMPETENCE?

- Demonstrate accessing relevant weather information for the local area
- Predict
  - Wind speed and direction at different times and heights
  - Cloud layers
  - Thermal heights, strengths and the soaring window
- Describe weather threats and mitigation strategies
- Predict cross country speed
- Plan suitable task distance and suitable waypoints

SELF-CHECK QUESTIONS

Use these questions to test your knowledge of the unit.

1. Why is it important to compare observed conditions with predictions?
2. If the observed ground temperature is 27 degrees and the observed dew point is 11 degrees, at what approximate height above the ground is cloud base (assuming clouds will form)?
3. What is a soaring window?
4. What average cross-country speed would you expect to achieve in an LS4 with 4 knot average climbs with 15 knots of wind?
5. If the soaring window is from 11am to 4pm, what would be a reasonable task distance in an LS4 with the above conditions?
6. What average cross-country speed would you expect to achieve with the above conditions in the glider you normally fly?

TASK PLANNER

Simple Task Planner			Date	
Wind	Surface	2,000 ft	5,000 ft	10,000 ft
Thermal Height		Average achieved climb		
Cloud		(This will be less than the average thermal strength)		
Key Events				
Notes				
		Expected XC Speed		
		Planned Task Time (allow for longer flight time)		
		Task Length		
Task				
Flight review				

Novice XC speeds (LS4)	
Avg Climb	km/h
2 kt	50
3 kt	60
4 kt	70
5 kt	80