Exercises 18-21 (Dual)
General flight training before first solo flight

Aim of the exercises

- To be able to carry out a flight on your own, according to given instructions.

Before the flight

You are now approaching the time for your first solo flight. The following four flights involve practising before this flight. Before you fly solo, you must be very familiar with flight traffic rules.

Pilot-in-command responsibilities
The pilot-in-command always has the final responsibility for the safe flight of his aircraft. When an aircraft is being flown in uncontrolled airspace, it is always the responsibility of the pilot-in-command to avoid collision. This naturally demands a good look out during the flight.

In order to avoid collisions, there are some rules laid down. Generally speaking, you are not supposed to fly your machine in such a careless way that this creates a danger to others. For instance, you must not do formation flying with another machine, unless this has been agreed upon beforehand.

Right-of-way
If two machine are flying on converging courses, at the same or almost at the same height, the one coming from the left shall give way. See Figure 19.1. The other one shall keep course and speed. Therefore, in the air, right-hand traffic rules apply. Further, the following rules apply:

- A power plane gives way to air-ships, gliders and balloons.
- Air-ships give way to gliders and balloons.
- Power planes give way to towing tow-planes.

Landing
When several machines are approaching an airfield for landing, the lowest one has right-of-way. This does not apply when one machine is on finals. This machine always has right-of-way, even if it is somewhat higher. However, a glider always has right-of-way when landing. Machines on finals have right of way before starting machines and "other machines in the air".

Start
A machine on the manoeuvering areas of an airfield (runways and taxiways) shall give way to machines starting or just about to start.

a)

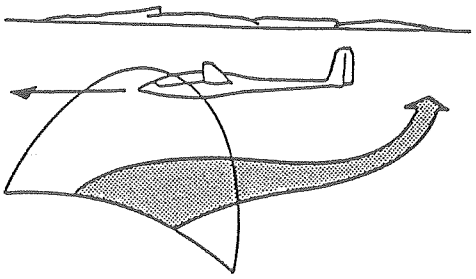


FIG 19.1 Giving way on converging courses

b)

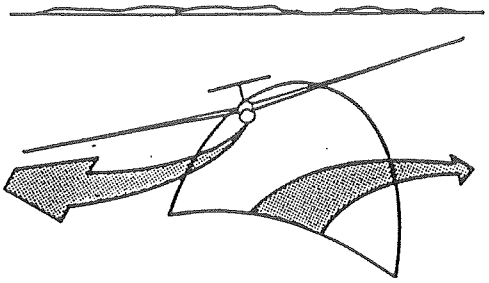


FIG 19.2 Giving way, oncoming traffic

c)

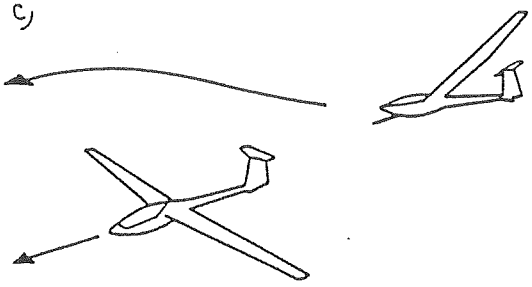


FIG 19.3 Giving way, overtaking

Emergency
Irrespective of what has been said previously, a machine in an emergency situation always has right of way!

Comments
As can be seen, gliders have right of way before power planes. In practice, this chiefly applies when coming in to land. Also when taxiing on the ground, these rules apply, thus in principle there are right-hand traffic rules.

During the flight

You release not lower than 500 metres. After release you make two 360 degree turns, both left and right. After each full turn you go on a straight course. The bank in the turns should be constant and about 35 degrees. After that you fly to the KP-sector and plan and fly the landing circuit, with due considering taken to prevailing weather conditions. The landing should be made within a predetermined area. During the flight, you handle all the radio traffic.

Remember

- to keep a good look out for other machines
- that speed and bank should be constant in the turns
- that you should arrive in the KP-sector not lower than 300 metres.

Instruction

We will now be towed up to about 500 metres. You will be given the release sign from the tow-pilot by firm wing waggling. After release you turn left and after one full turn you go straight upwind. Pick out a landmark. Stabilize the machine on a straight course.

Look around - then make a 360 degree turn left. The bank should be about 35 degrees. Go straight out towards the landmark - stabilize the machine and make a full turn right. In the same way, make one more turn each way and fly suitable flight paths to the KP-sector and carry out a normal landing, 2 x 90.

Check the altimeter and the variometer. Do not stay and turn in sink areas. The lowest height opposite the landing area, on the downwind leg, is 150 metres. Lowest height, when you finish turning finals, is 50 metres.

Exercises 22-24 (Solo)
Solo flying

Aim of the exercises

- To do your first solo flights.

During the flight

Remember

- that the position of the trim is a little different
- to keep a good look out for other machines
- to fly with precision
- that control movements should be gentle but firm
- to be in the KP-sector at the correct height
- to enjoy the flight!

Instruction

You are now about to carry out your first solo flight and it should be done in the same way as you have done the last few dual flights. You get towed up to about 600 metres, where you will get the release sign. You release and turn left. You practise turns in the same way as during the earlier dual flights. When you are down to 300 metres, you should be in the KP-sector.

Report your position when starting the downwind leg. After that you make a normal landing. I will be in the landing area and I am supervising the whole flight. I will not say anything on the radio, unless something happens which makes radio contact necessary. You may now do the checks according to the checklist. Before you start we make a radio check. After that you may start.

Exercise 25 (Dual)
Interrupted start, general practising

Aim of the exercise

- To cope with an interrupted start between 100 and 200 metres.

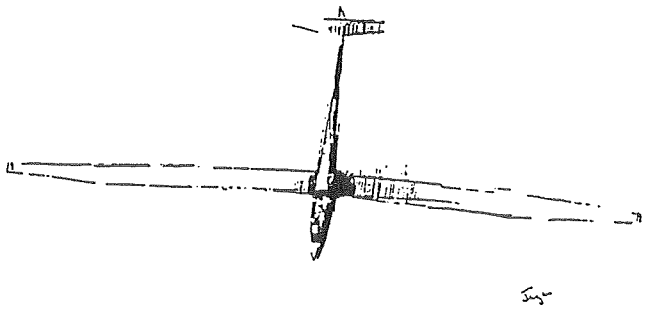
During the flight

If the start has to be interrupted (e.g. because of line break), then remember:

- to release the tow-line and immediately lower the nose
- to check the reading of the altimeter
- to decide - turn back or not?
- Turn back (turning upwind), correct flying, check your air speed.
- Do not open the air brakes until the turn is finished.

Instruction

Tow-line break - lower the nose - release - read the altimeter - turn back towards the field - correct flying - wings level - open air brakes as required.



Exercise 26 (Dual)
Turns, changing turns, wing waggling

Aim of the exercise

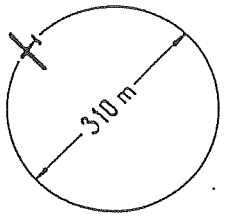
You will be practising

- normal turns. 360-degree turns. left and right
- changing turns, wing waggling
- steep turns

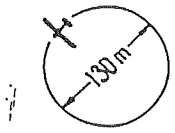
During the flight

Remember:

- Always apply rudder at the same time as you apply ailerons.
- Speed and bank must always be constant in a turn.
- The steeper you make a turn, the more you control the speed with the rudder.



20° bank
speed 85 km/h
time for one turn 41 sec.
sink rate 1 m/s



40° bank
speed 85 km/h
time for one turn 16 sec.
sink rate 1.4 m/s

60° bank
speed 100 km/h
time for one turn 10 sec.
sink rate 2.5 m/s

r = radius
V_k = air speed
t = time for one turn

$$r = \frac{V_k^2}{g \cdot \tan\theta}$$

$$t = \frac{2\pi r}{V_k}$$

r = radie
V_k = flyghastighet
t = tiden för ett varv

FIG 30.1 Examples of how the bank affects sink rate, turn radius and the time for one turn

Exercise 27 (Dual) Thermal flying, stalls and full stalls, landings

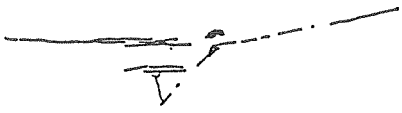
Aim of the exercise

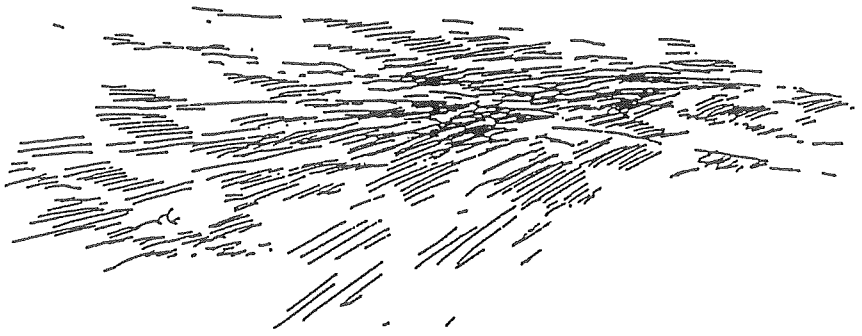
- To learn the basics of thermal flying
- To practise again stalls and full stalls
- To practise again landings from a low downwind height

Before flying

Thermal flying
When you have learnt to control the glider, to fly straight, to turn, start and land, then the time has come to do some serious gliding, which means to fly in thermals.

A thermal is warm air rising, either in the form of bubbles or canals.





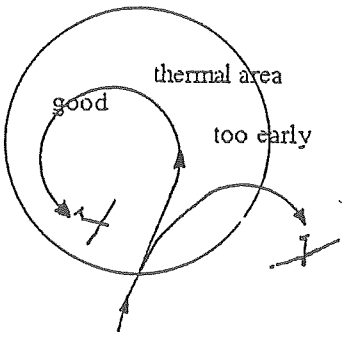


FIG 30.2 Turning in a thermal area.
a) is good, turns the right way and finishes up completely within the area
b) turns too early and in the wrong direction

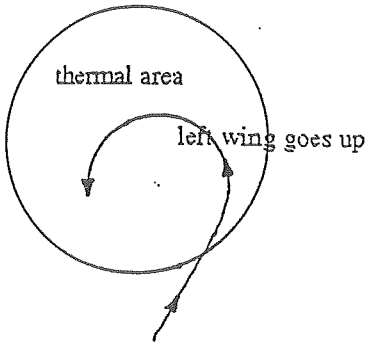


FIG 30.3 If one wing goes up, it often means that the thermal is stronger on that side

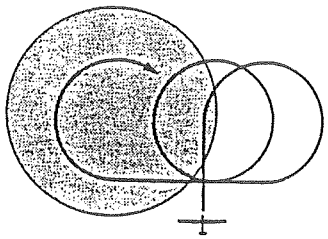


FIG 30.4 The principle for adjusting. You move your circles so that you finish up in the centre of the thermal area.

In order to get as high a rate of climb as possible, it is important that the sink rate of the glider is as low as possible. In order to stay in the thermal area, we must fly full turns. The sink rate of the glider is lowest when we fly straight. When we turn, the sink rate increases. The steeper we turn, the higher the sink rate will be. But, at the same time, the climb rate of the thermal is greatest near the centre and gets less outwards. The result is, that the steeper we turn, the higher the sink of the glider gets, but, at the same time, our circle radius gets smaller and we are nearer to the centre of the thermal. See Figure 30.1. The flatter we make the turn, the greater will the circle radius be, we are further away from the centre of the thermal, but instead we have a lower sink rate. The trick is to find the optimum, and this optimum varies from day to day, from thermal to thermal.

A general rule of thumb is that a proper bank in a thermal turn is 30–45 degrees. The proper speed to keep depends on the type of glider and how turbulent the thermals are.

The turn should always be correct, with the wool string in the middle.

Finding a thermal centre
You are seldom lucky enough to get into the centre of a thermal straight away. Most often you get in at an angle. You must get centred in the thermal or "adjust". Already when you get into the thermal, you must decide whether to turn left or right, and also when to start

turning. Figure 30.2 shows one example. The pilot in a) waits a little and then turns left. The pilot in b) turns right too early and gets outside the thermal after less than half a turn.

If one wing goes up, this usually means that the climb is stronger in that direction. Figure 30.3 shows how this can happen. We get into the thermal. The variometer shows UP and the left wing goes up. We turn left and get well into the thermal, but on the edge. Figure 30.4 shows the principle for adjusting. You must move your circles towards the centre of the thermal.

There are lots of methods of adjusting but the important thing is that it must go fast. The method described here is simple and it can be refined as you get more experienced.

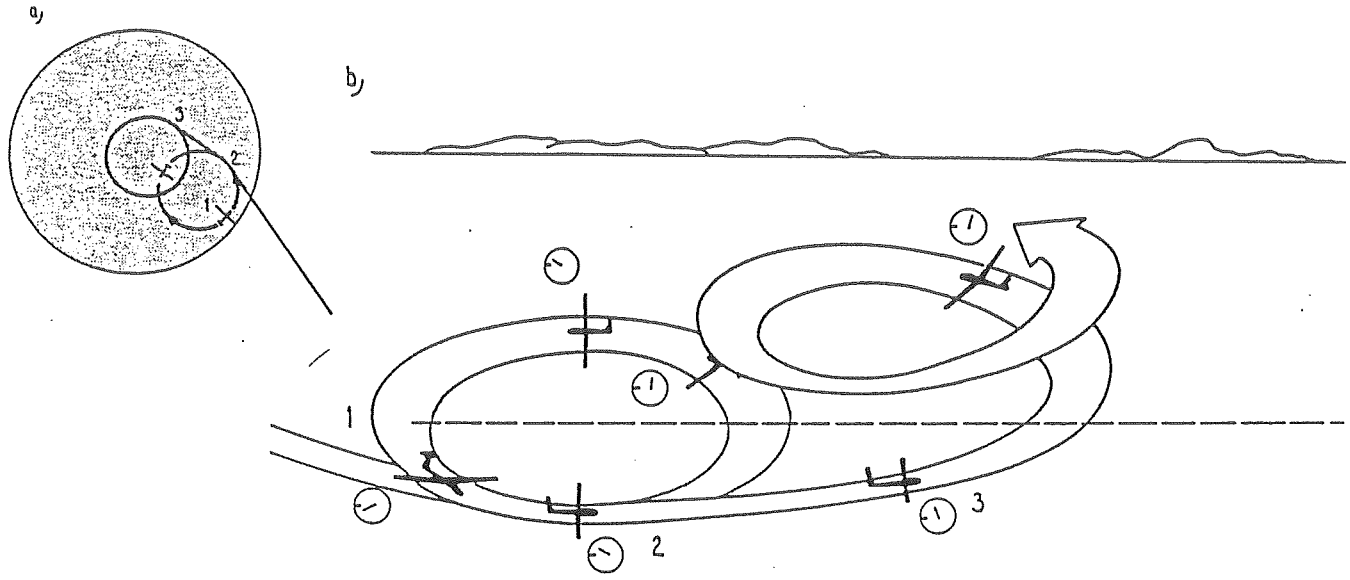


FIG 30.5 Method of adjusting a) seen from above b) in perspective
The variometer shows least clime at 1. Pick out a landmark along the inner wing. When the nose points towards this, go straight (2).
The variometer shows increasing climb, before the maximum is reached, so enter a turn again. Repeat this procedure until the climb is good during the whole turn.

We get into the thermal (Figure 30.5), find that we should turn left, and enter a turn. We watch the variometer and fly one full turn. We had the least climb at 1. Next time we are back at 1, we pick out a landmark (2), we level out and fly straight for a short while. Watch the variometer. Immediately before it reaches its best climb, we enter a left-hand turn again (3). It might be enough only to reduce the bank a little while, and then continue the turn. In this way, we move our flight path towards the centre of the thermal. As a rule you have to make this adjustment a few times before you have got into the centre.

To sum up:

1) Turn one full circle and notice where the climb is least.
2) At the same time, pick out a landmark along the inner wing.
3) When the nose is on that landmark, go straight.
4) Enter the turn again immediately before the variometer shows maximum climb.
5) You may have to do the whole manoeuvre again.

Every thermal is unique and must be dealt with in its own particular way. It is not unusual that you have to adjust more or less continously during a climb. Do not sit watching the variometer the whole time! The whole flight may suffer from this! The horizon is an important reference, and you will be a safety hazard if you watch the instruments all the time.

When several gliders are in one thermal, some unwritten rules must be observed. The most important one is that all the gliders in one thermal must curve in the same direction. The one who is the first in the thermal decides the direction. Also, you must never fly in such a way that you disturb one of the others.

If there are many gliders in one thermal, you must keep a watching eye on the others! Do not trust them to keep a good look out - they may be trusting you!

How do we find the thermals?
If it is a good day, the probability is that we find thermals with no great effort. You can hardly walk through a forest blindfolded without hitting a tree!.

It is always easier if thermals are shown by the presence of cumulus clouds. An old rule of thumb says: "Get high and stay high". The higher you are, the easier it is to find thermals. Choose clouds with a straight, dark underside and firm contours.

Where do you find the thermals under a cloud? This is something that varies from day to day, sometimes also from cloud to cloud. The most usual situation is that you find the climb either on the windward side of the cloud or on the sunny side. Try there first.

When we leave the thermal, which we should do before we have got up to cloud base (so that we can see where we should go), it is a good hint, to leave the thermal upwind. That is where the sink is usually least.

If you are flying at a height less than half cloud-base height, it usually pays to look at the ground. That is where the thermal source is. The same thing goes for flying in "dry thermals", which means that there are no cumulus clouds. What you are looking for on the ground is areas which are likely to be better heated, e.g. sandpits, wood clearings, south slopes, etc.

During the flight

Remember

- A stall is caused by too high an angle of attack.
- Keep a good look out for other machines.
- When flying in thermals, turns should be made with constant speed and bank.
- Try to find thermals upwind!
- Base leg should not be too short.

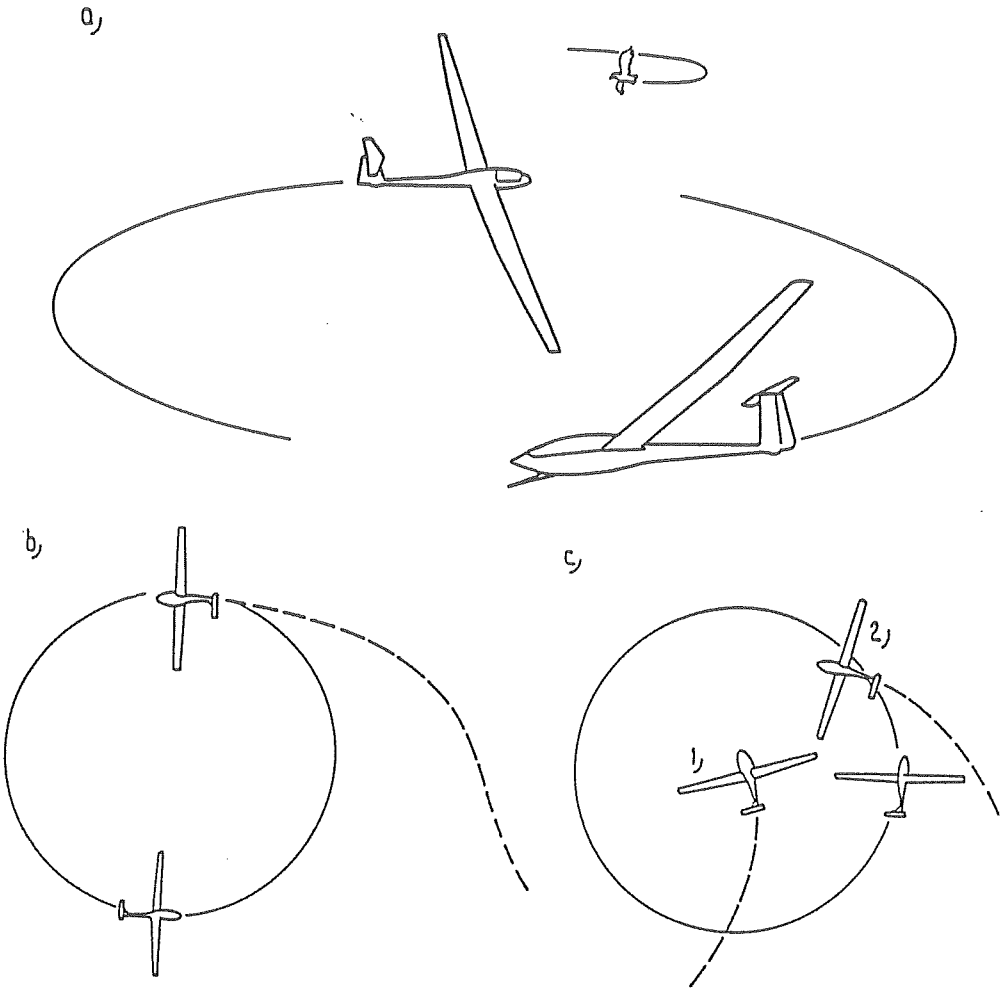


FIG 30.6 Rules when flying in thermals.

a) Place yourself so that other pilots can see you. If there are only two gliders in the thermal. try to fly right opposite the other one. The one first in the thermal decides the direction of circling.

b) Enter the thermal in such a way that you do not disturb a pilot who is already there.

c) Examples of wrong methods: 1) turns too early. gets into the thermal at an angle and is also in the way of the other one.
2) gets into the thermal right in front of the other one. Dangerous!

Exercises 28-31 (Solo) Thermal flying, precision landing

Aim of the exercises

- To practise thermal flying
- To practise precision landings within a certain area

During the flight

Remember

- Turns in thermals must be done with constant speed and bank.
- Look for thermals actively, do the adjusting actively!
- Keep a good look out for other machines!

Exercise 32 (Dual) Thermal flying and flying between thermals

Aim of the exercise

- To build up your knowledge about thermal flying
- To learn to keep the right speed between thermal areas

Before the flight

Right speed between thermals
The glide is equipped with a McCready ring, a ring which can be turned and sits outside the variometer and which helps you to achieve the best glide angle, see Figure 35.1. The scale of the ring depends on the type of glider. Sometimes the McCready ring is built into an electrical variometer or a glider computer.

You get the speed for the best glide angle by turning the ring so that the arrow of the scale is pointing to the zero of the variometer (see Figure 35.1). Adjust the speed so that it is about the same as the variometer hand shows on the ring scale. In still air, the speed will be the same as speed for best glide angle. In sink, the ring scale will show that the speed should be increased. If you fly against wind, you put the arrow of the ring scale at between 0.5 and 1 m/s, depending on wind strength.

Common mistakes:

- You circle too fast and then fly straight through a sink area too slow.

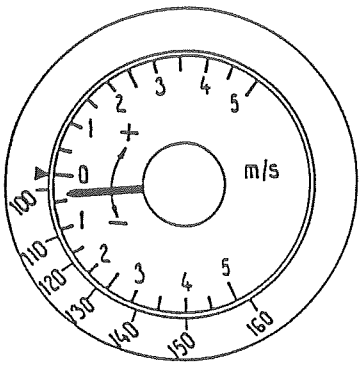


FIG 35.1 The McCready ring. In order to get the best glide angle, put the ring arrow at zero and then fly at the speed shown by the variometer hand, in this case slightly above 100 km/h.

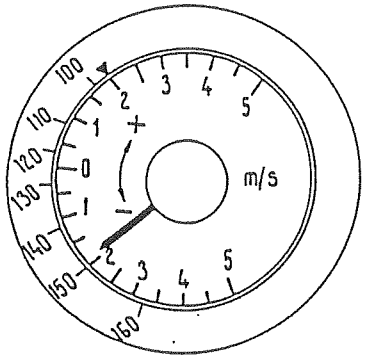


FIG 35.2 Example of the McCready ring in use. The chosen setting is 2 m/s, which is high and means very good weather with a high cloud base. The ring shows that, in this case, we should fly at slightly below 150 km/h.

- You fly too slow in sink areas. It is better to fly 20 km/h too fast than 5 km/h too slow!
- You reduce your speed in order to try to get back home against a headwind.

The thought behind "best speed between thermals" is that the better the thermal strength is, the faster you can fly between the thermal areas. The person who first created a practical aid to find the best speed was the Americal Paul McCready.

The McCready theory is based on the knowledge of the up-current strength in the next thermal area. This decides the setting of the ring. Figure 35.2 shows the ring with a setting of 2 m/s. It is true that we do not know exactly the strength of the next up-currents, but most often the rate of climb is rather similar from thermal to thermal and you can judge from the weather if big changes are expected.

When you are a beginner, you have to build up your experience first, so that you know how much you can "steam it up" in different situations. To begin with it is a good thing to fly with a low setting, even if the weather is good. Therefore, use a setting of 1 m/s until you have done your first cross-country flights.

During the flight

Remember

- Keep a good look out for other machines.
- If you want to get as far as possible, the ring setting should be zero in still air or a tail wind and 0.5 - 1 m/s in a headwind.
- If you want to fly at an optimum, set the ring at 1 m/s.
- It does not matter much if the speed varies by about 10 km/h from what the ring shows.
- The most important message from the McCready ring is that you should fly fast in sink and slow in up areas.
- Study the weather further ahead and go for those clouds or areas that can give good thermals.

Exercise 33 (Dual)
Thermal flying, high performance flying, flying together with other machines

---

Aim of the exercise

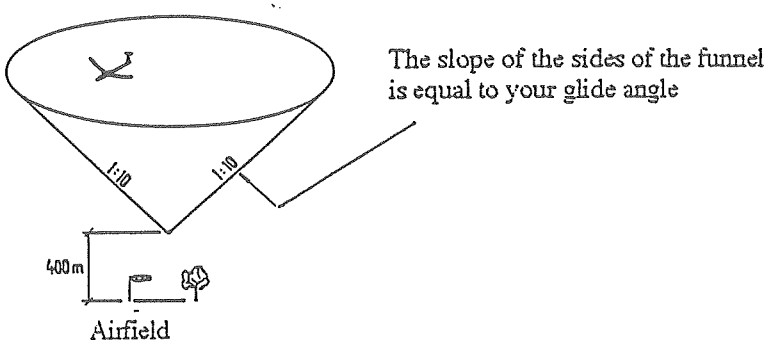
- To practise flying upwind and downwind in the funnel.
- To practise thermal flying together with other machines

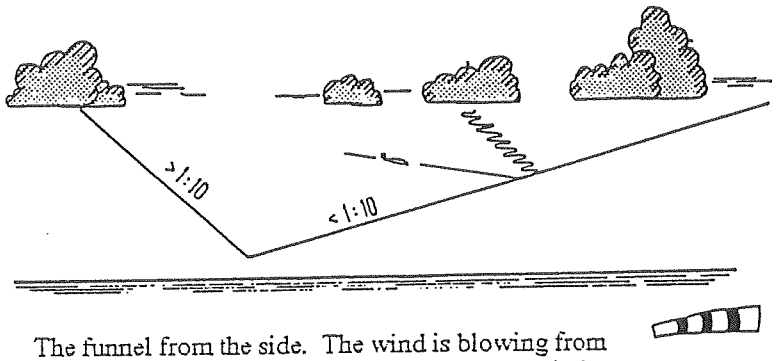
Before the flight

Flying in the funnel
As a beginner you should fly in the vicinity of the airfield, always within reach of the KP-sector. The space in which you are flying looks like a funnel where the slope of the cone

corresponds to the glide angle of the glider and where the tip of the cone is at 400 metres. see Figure 36.1.

A high-performance glider has a wide funnel, whereas a low-performance glider has a narrower funnel. The funnel slopes up against the wind. The glide angle is not so good when flying upwind.





The funnel from the side. The wind is blowing from the right and the funnel is sloping against the wind.

FIG 36.1 The funnel

During the flight

Remember

- to keep a good look out for other machines
- to fly fast in sink areas and slow in up areas
- that the funnel is sloping against the wind
- that the glide angle is not so good in a headwind
- that you should fly faster in a headwind to get the best range
- to look for thermals upwind
- to get into the centre of the thermal
- that you should be in the KP-sector not lower than 300 metres.

Exercises 34 -36 (Solo)
Thermal flying,
flying in the funnel

Aim of the exercise

- To practise thermal flying in the funnel.

During the flight

Remember

- to keep a good look out for other machines
- to fly fast in sink areas and slow in up areas
- that the funnel is sloping against the wind
- that the glide angle is not so good in a headwind
- that you should fly faster in a headwind to get the best range
- to search for thermals upwind
- to get into the centre of the thermals
- that you must be in the KP-sector not lower than 300 metres.

Exercise 37 (Dual)
Low-speed flying,
Spiral dive

Aim of the exercise

. To learn low-speed flying and a spiral dive.

A spiral dive is a turn with a height loss, which means a turn with a very low nose and a high speed. You can get into a spiral dive if you allow the bank to increase in a turn without taking corrective action. To get out of a spiral dive you act in the same way as leaving a turn.

During the flight

Remember

. A spiral dive begins like a turn where the bank is allowed to increase.

. In a spiral dive the speed is high.

. At low speed the effect of the controls is poor.

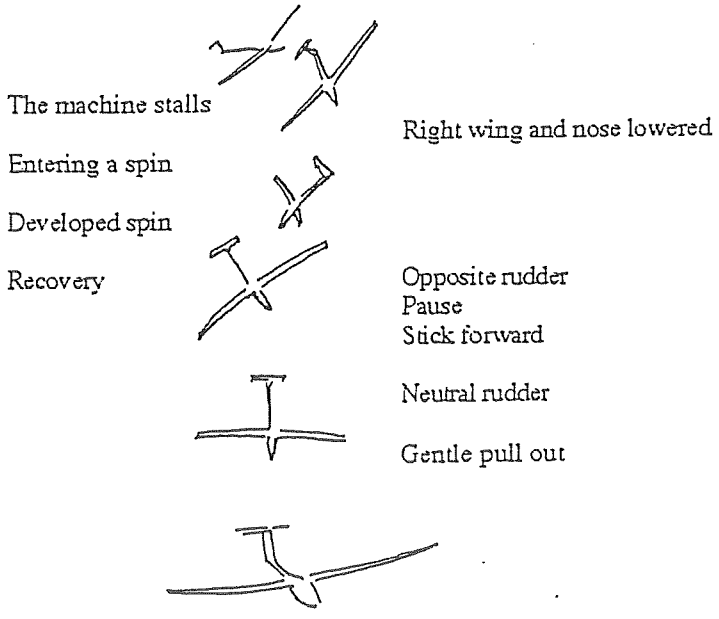


FIG 42.1 Standard method of recovering from a fully developed spin

Exercise 38 (Dual)
Spinning exercises

Aim of the exercise

- Learning how to recover from a spin and how to avoid getting into a spin!

Before the flight

Spin

A stall can result in a spin. A spin is a dangerous manoeuvre if it occurs at a low height. During a spin, the machine is in a stalled condition and is rotating around a vertical axis (but not around the length axis of the machine) and, at the same time, it loses height rapidly, maybe 100 metres per turn. Most trainers, and also most modern gliders, are difficult to put into a spin at normal centre of gravity positions. Therefore it may be difficult to practise spinning. Sooner or later, however, you will sit in a machine that can spin, and then you have got to know how to recover from a spin.

The theory behind the spin movement, which is a combined roll and yaw movement, is complicated. The principle is that if a machine stalls and at the same time drops a wing, or alternatively if you stall in a turn, then you have the beginning of a spin. The wing going down gets a higher angle of attack, stalls even more, and drops even more. At the same time, the nose also drops because of the stall. If this movement is not stopped now, we get an "autorotation", a movement that keeps itself going and which we call spin. To try to level up the machine with the ailerons only makes the situation worse.

The way to get out of a spin which is just beginning is exactly the same as has been described for a stall in a turn. If you get into a spin, you use the standard method. See Figure 42.1.

The spin characteristics differ from machine to machine. Study very carefully what the type manual says about spinning. Some machines are almost impossible to get into a spin, others spin very easily.

A general rule is that the more tail-heavy a machine is, the more easily it will spin. There is even a risk that a machine with the centre of gravity behind the permitted centre of gravity area may be impossible to get out of a spin. This is one of the reasons why it is important not to have a cockpit load less than the lowest allowed load.

The classic way of entering a spin intentionally is to cross the controls, i.e. to stall the machine and, at the same time, give full rudder in the direction you want to spin and full opposite ailerons. This control combination is therefore dangerous. The risk of flying with crossed controls, unintentionally, is greatest in the landing circuit. It is therefore extremely important to fly with correct control combinations in all turns at a low height.

During the flight

Remember

- that crossed controls are dangerous controls
- that if you stall over one wing, the first action to be taken is always rudder opposite to the rotation.

Exercise 39 (Dual)
High-speed flying, landing from an unusual position

Aim of the exercise

- To fly the machine at a high speed.
- To learn how to carry out an unplanned landing.

Before the flight

Maximum manoeuvering speed
In the type manual and on the instrument boad, the "maximum manoeuvering speed" is given. This is the highest speed permitted with full control movements. Full elevator deflection means that we get maximum angle of attack and the wing stalls. The load on the machine will also at the same time be the highest permitted.

You should not exceed max. manoeuvering speed in strong turbulence. One example of where you can find strong turbulence is below cumulo-nimbus clouds. You should never make sudden manoeuvres at speeds over the maximum manoeuvering speed.

If the speed is over "max. manoeuvering speed" the machine will get over-stressed at big control movements. The type manual gives the "max. speed" and that means the highest speed allowed under any conditions. The biggest control deflection at max. speed in absolutely still air is 1/3 of full deflection, in order not to overstress the machine. Therefore, when you fly at speeds over max. manoeuvering speed, you should only make small gentle corrections and flat turns, as there is a risk that the machine can be overstressed. Flying at speeds over max. manoeuvering speed, you should hold the stick with both hands.

Unplanned landing
During this flight, the instructor will let you plan the landing from another initial position than the KP-sector. It is important to be able to improvise a landing if you should be in such a situation that you cannot reach the KP-sector. The reason may be, for example, that you have got into a strong sink area.

There may be several different alternatives to plan a landing. Maybe you should go straight for the final or straight on to the base leg. If you have the possibility, you may choose to

make a 2 x 90 landing, even if you have to make it in a wrong-hand circuit (e.g. in a right-hand circuit when normally a left-hand circuit applies). Also, imagine the situation where you consider it unlikely or only marginally possible to reach the field at all. Then it is always better to interrupt the approach and make a field landing somewhere outside the airfield.

During the flight

Remember

- At a high speed you should make only small control deflections.
- Hold the stick with both hands when you fly at speeds over max. manoeuvering speed.

Exercise 40 (Dual)
Check flight before flying single-seater

Aim of the exercise

- Checking pilot standard before converting to single-seater.

Before the flight

Together with your instructor you go through the planned flight, bearing in mind what type of single-seater you are going to fly. During this flight you will practise again the basics, such as turns, changing turns, etc.

During the flight

Try to fly as correctly as possible, with constant speed and bank in the turns.