



THE PARACHUTE

by Michael Rogg



PREFACE

Dear modelers, this report is the second one out of a series of four I wrote for MODELLFLUG INTERNATIONAL. The reports cover various aspects of rc-skydiving. They were published in MODELLFLUG INTERNATIONAL by Modellsport Verlag June 2007 - September 2007.

By courtesy of Modellsport Verlag-Verlag Baden-Baden I translated the reports into English to provide the information involved to a wider range of readers. RC-parachuting is a fantastic sport and in my opinion information should readily available for anyone seeking for it - so it's worth the effort.

YES, I translated my reports myself, yet, as you will easily notice, NO, English is not my mother tongue. So if you come across any miscellaneous points, just send an e-mail to: rgkestrel@t-online.de

Michael Rogg, Okt 2010

The first one of these reports dealt with the two most successful German model jumpers.

Now we focus on the parachutes available on the German market. To start with, there is some basic information on aerodynamics. Then we have a brief look at the history of the parachute. Both is meant to give you an idea of the basic design principles.

At last you will learn about the most successful and therefore widely-used model accuracy parachutes in Germany.

Gliding And Rate of Descent

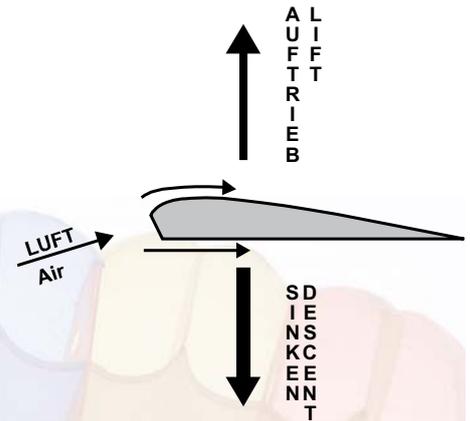
Let's imagine the following:

We let a fly model areoplane. Before we launch it, we take off the wings and the tail unit. Now we take what is left over, throw it up into the air and - THUMB! Almost immediately after releasing our model there is a heavy impact on the ground.

The fuselage is crumbled, the undercarriage torn off...

Now let's have a second go with the wings, the rudder and the elevator in place. We hand-launch the model and - there is a totally different result. The aircraft starts to glide, slowly descends and, after about twenty seconds and at a considerable distance, it smoothly settles on the ground. Everybody watching at once realizes: Well this time it flew. But what does „fly“ mean?

Wings reduce the rate of descent of any flying object. To be able to do this they must create lift to counteract gravity. The lift comes about by air flowing along an airfoil. The air starts to flow around the airfoil, when the wing takes up horizontal velocity, i.e. when the aircraft glides forward. As a result, the model covers a certain



distance. Rate of descent and gliding are two very important parameters.

Round Canopies

For many decades, mainly circular canopies were used to get loads safely to the ground. These canopies created enormous drag to keep the rate of descent to a safe limit. These canopies had a vent area at their centre to prevent the load from oscillating. Round canopies did not create any lift and only the most sophisticated of them had a few slots, which allowed the canopies to take up a tiny bit of horizontal speed. So round canopies usually just drifted downwind like a balloon and also landed downwind. The first canopies used for rc-parachuting also were of the circular type. Yet, they are only very rarely seen today.

Ram-Air Canopies

A totally new world opened up when modern ram-air parachutes were used in the world of sport to a large extent during the late 70ies. Ram-air parachutes don't just look like short wings, they also have an airfoil. As soon as the horizontal velocity is high enough, this airfoil starts to

create lift, just like ordinary wings of aircraft. Due to this lift, modern ram-air parachutes are a lot smaller than old round canopies. As you can easily imagine, the ram-air canopies became more and more sophisticated once the basic principle proved successful and reliable. There are canopies that glide extremely fast and wide. Others are extraordinarily agile. Another kind has unusual directional stability and behaves like a lady at the stall - which is why these are perfect for accuracy events.

Ram-Air Airfoils

We can easily sew fabric to the shape of an airfoil, can't we? But how do we maintain the shape of this airfoil up in the sky? We must inflate the airfoil permanently - with ram-air. Therefore the airfoil is closed at the end. Upper and lower surface are sewn together there.

At the front, the part that is called the leading edge of an airfoil section is missing. It is cut off to let ram-air in. There are big round or oval holes in the inner ribs. These holes are called crossports. They make sure that there is the same pressure inside all the cells and especially help to keep the tip cells properly inflated. Stabilizers on either end prevent air from escaping sideways. Little triangles, which are called flares, below the airfoil improve directional stability. They have an effect similar to the rudder of an aircraft and also help to spread the strain of the suspension lines over the ribs.

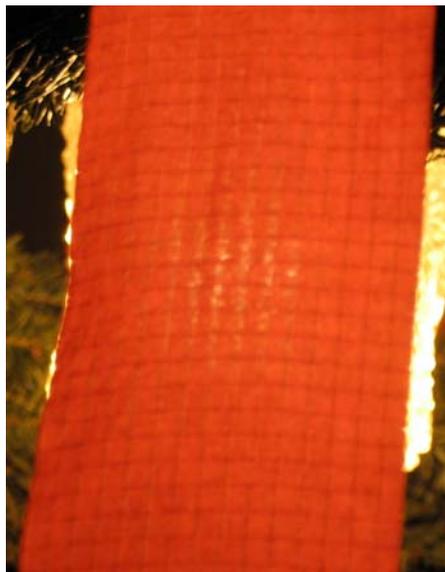
Performance

Wouldn't it be nice to have a canopy that easily outruns even gusty winds, yet at the same time is forgiving at the stall? Wouldn't it be nice to have a canopy suitable for swooping AND relative work?

Unfortunately, what is true for aeroplanes is also true for parachutes. A wing with a thin airfoil and of a high aspect ratio is fast, yet vicious at the stall. A canopy that still remains steerable at virtually nill horizontal speed is no good for swooping. Until industry conceives a „jack of all trades“ kond of canopy we must decide on what is important for us.



In this close-up of a modern ram-air canopy you can clearly see the open leading edge, some crossports and flares. The open „mouth“ lets ram-air get into the cells in order to inflate them. The crossports help to maintain equal pressure in all the cells and keep end cells open. The flares improve directional stability and help to spread the stress imposed by the payload.



This is a little patch of F 111 ripstop nylon fabric. The thicker threads woven into it at set intervals can clearly be seen here. They cause the „ripstop“ effect that gave the fabric its name. The little boxes only appear to be square, in fact they are rectangled. This fabric is very flexible, which makes the canopy easy to pack. On the other hand it is so tightly woven that only an extremely little amount of air can find its way through the fabric under high pressure.

F111

No, this is not the name of yet another interceptor, this is the name of the most frequently used nylon ripstop fabric. F111 means that the fabric weighs 1.11 ounces per square foot. It has been used for making canopies for many decades now. There is also another typ of nylon fabric available, which is called „ZeroP“. This abbreviation stands for „zero perosity“, which obviously means that it is (nearly) 100% airtight.

Both kinds of fabric are used for full-size canopies and are available under all sorts of trade names.

What we also make use of is „parapack“, which is a waterproof kind of fabric. We use it to make containers.

If you want to sew your own stuff, it shouldn't be a problem to purchase the materials from a place where parachutes are manufactured or repaired. If you turn up there with your model skydiver in your arm, they surely will believe you that you are not going to abuse the fabric in one way or another.

To get the feeling for the material, it is a good idea to start by making a container. You have to hotknife the

fabric with a soldering iron of course.

Hint: I personally haven't disposed of my old umbrellas for quite a while now. The fabric I get from them is perfectly alright for making jumpsuits that don't cost a penny.

If you want to sew your own canopy have a look at the special file on this website.

There is further information involved in the instructions that come with the plan for the wooden jumper „CoolBoy“. It can be purchased from:

Verlag für Technik und Handwerk GmbH
76532 Baden-Baden

However if you are a newcomer to the world of modelling it is a good idea to buy your first parachute and, maybe, just make your first jumper yourself.

LR-16 + Parafoil (96)

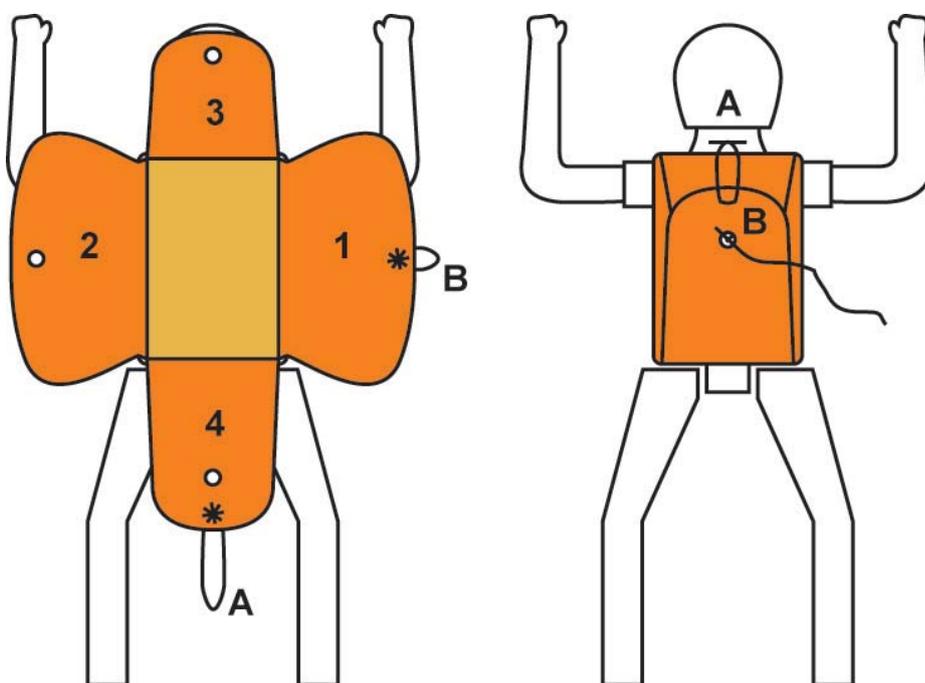
PA Modellbautechnik sell a scaled down version of the full-size LR-16 accuracy parachute. It is a very stable and docile parachute with appr. 1,40 m of span. If the overall weight of the model does not exceed 1,4 kg, you can fly this canopy really well with conventional arms. However if you want to use the LR-16 in competitions, you should resort to fully movable arms. The LR-16 has been used more and more by competitors over the past few years. (In 2008 It's designer achieved a second place with it in both the national Championships and the European Para Trophy, in 2009 and 2010 he came in first!)

PARAMAX offers the biggest variety of parachutes. There is a relatively cheap model called NOHA, for example, which represents the category of the all-round canopies. The CONQUEST is a very fast and maneuverable parachute.

I personally have had quite some experience with the PARAFoil (span: appr. 1,26 m) and the PARAFoil 96 (span: appr. 1,50 m) which I have flown for about ten years now. The two of them are, as you may have guessed, modified (!)



Using a soldering iron for cutting out parts for a container. The fabric is called „Parapack“, the template is made from 4 mm plywood.



In our first report you learnt about an electronic safety device that prevents the canopy from opening during transport. Many a modeller prefers the method shown in the drawing above.



Loop A is the loop that keeps the container closed during freefall. Loop B is there for safety reasons. When you close the container, close it step by step according to numbers 1 to 4. Don't forget to pull loop B through the holes as you work along. Finally lock the container with a locking pin as shown in the little drawing on the left. This locking pin is tied to one end of a „static line“ whose other end is attached to the jump plane. When the jumper is released, the static line pulls the locking pin out of loop B. During free fall, the rc-pilot can deploy the canopy at any moment desired by releasing loop A.



Why not entertain onlookers with additional functions: Flags look really nice in the air. They can be stowed away in a little extra container underneath the packed canopy. Some pieces of lead help to pull the flag out and present it to the audience.



A model parachute as sold by the Czech company MARS. An ideal model for beginners or thermal soaring. Fully movable arms as supplied with the MIKE kit are perfect for flying it.



Having rc-fun at the age of three...



Going for the bull's eye with a MIKE and its Parafoil 96.

The parachute is completely handmade, features flares, gussets, double seams and a slider. It has been THE high end parachute for years.

model replicas of full-size canopies of the parafoil type.

The PARAFOIL is a really good accuracy parachute for skydivers that weigh up to 1,2 kg. Conventional arms are okay. The PARAFOIL used to be the most successful accuracy parachute for many years. Meanwhile its successor, the PARAFOIL 96, has replaced it. The PARAFOIL is considered the pick of the bunch by many a competitor. It's not only a top quality parachute, it also is very expensive, since manufacturing it is very time-consuming.

With the PARAFOIL 96, fully movable arms are a must. The parachute is the perfect match for skydivers weighing up to 1,7 kg. (Our weight limit in competitions.) The parachute is absolutely stable at minimum speed, yet turns out to be really agile whenever the need arises. The canopy behaves like a lady close to the stall, which occurs at an extremely low speed. If you let

go of the brakes during the stall, the parachute re-inflates in the blink of an eye. Just like with all the other accuracy parachutes, there is one big disadvantage to this type: It's maximum speed is fairly low. (How people try to overcome this problem will be dealt with in the fourth report .)

Beginners' Delight

Before I finish off this article, let me draw your attention to a parachute, which our friends from the Czech Republic introduced to the competition scene some years ago. Their parachute, which is made by a Czech company called MARS (they manufacture full-size parachutes for the armed forces) is a little bigger than the PARAFOIL 96 and more docile than you would any flying object expect to be. It is really slow and it's rate of descent is so low, that it is apt for thermal soaring. Even if you hit the ground at „full speed“, it won't do the skydiver any harm. In other words, the canopy by MARS is

the perfect device for beginners and little children. My son started flying it at the age of three and had lots of fun with it for years. Whenever I take unexperienced children to the flying field with me, I let them have a go on the MARS parachute, of course.

Accuracy 3

My son and me have been successfully flying our „Accuracy 3“ parachutes since summer 2009. This parachute is a very good match for the „ANDY“ with fully movable arms, apt for beginners and competitors as well. You can get the milling files for the templates for free. So if you are a handy person, why not have a go? (See further files on this website.)

Packing

If you are interested in how to pack your model parachute, also see the extra file. You can learn how to pack your parachute in two different ways. The procedure described in my essay is more closely related to the technique employed with full-size parachutes.

The next article in this series will focus on carrier planes and their special equipment needed for skydivers.