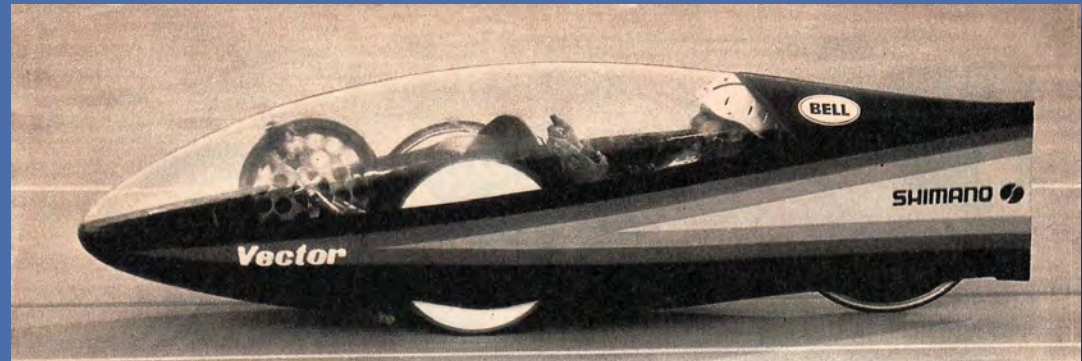


**8<sup>th</sup> European Velomobile Design Seminar**  
**Dornbirn - October 2015**

# **Historical Introduction**

**Presented by C.G. Rasmussen**



# **An Overview of a Hundred Years Velomobiles**

**1925-1950 The Pioneering and War Period**

**1950-1975 The Motorization Period**

**1975-2000 The Oil Crisis and the Velomobile Renaissance**

**2000-2015 The Diversified and Expanding Market**

# 1925-1950 The Pioneering and War Period



Velomobiles as a popular hobby mainly for racing.

< This velomobile designed approx. 1925 by Dr. Manfred Curry has the shape of a torpedo and was quite fast (up to 35 miles per hour).

Charles Mochet produced several hundred of this four-wheeler in France in the 1930s. It was popular for racing and for practical transportation.



A modern replica of Mochet-alike Swedish Fantom.



# Swedish velomobiles

In the period 1930-50 velomobiles became popular in Sweden thanks to the magazine **Teknik för Alle**. It published a number of designs and you could buy blueprints and descriptions how to built your own velomobile. Many thousands of descriptions were sold, but not very many velomobiles were actually built.

**Velo-bilen**  
var mans egendom



NI bygger den själv lätt och billigt efter utförliga ritningar och arbetsbeskrivningar. Den rymmer 2 vuxna personer samt 2 barn i 8-10 års åldern. Försedd med växel, varför den är okänslig för uppförsbackar och dåligt väglag. Det idealliska fortskaffningsmedlet under såväl sommar som vinter.

1 sats rit- och arbetsbeskrivning rek. från E K S O N, Box 6006, Stockholm 6.  
Pris pr sats kr. 7:50 + porto mot post.



En ny utövning

**NU KOMMER ALGA-CYKELBILEN!**

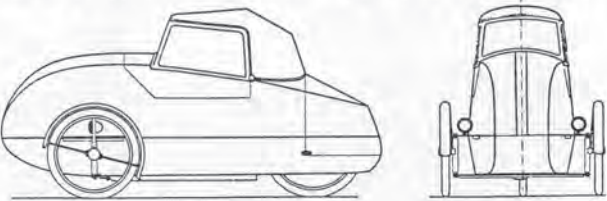
Cykelbilarna blir allt populärare. Här är nu den senaste modellen, konstruerad av en mycket erfaren cykelbilist och konstruktör. Cykelbilen kan NI använda i alla väder. Skaffa ritningen nu, och bygg Er egen bil. Ritningen omfattar 3 blad med detaljritningar och röntgenteckningar samt 2 blad arbetsbeskrivning.

Finnes hos bok- o. papperhandlare, varuhus m. fl.

Pris endast kr. 3:25 inkl. oms.

AB ALGA

**DEN MODERNA CYKELBILEN**



**"PEDOBILEN"**

Cykelbilen blir populärare för varje dag. Tusentals intresserade bygga bilen över hela landet. Cykelbilen är just läte tyngre att trampa än en vanlig cykel. Cykelbilen är strömlinjeformad, försedd med sufflett och dess exteriör skiljer sig icke nämnvärt från en modern vanlig bil. Skaffa er en egen bil, bygg cykelbilen! Ritning och synnerligen detaljerad arbetsbeskrivning Kr 10:50

HOBBYCIRKLARNA — BOX 1057 STOCKHOLM 16

Sänd mot postförskott plus porto  
..... st CYKELBILRITNING å Kr 10:50

Namn: .....

Adress: .....

..... TFA 2 e

**REJ**



*Camping*

**CYKELBILEN**

som även kan användas som tält och är försedd med följande speciella anordningar: Strömlinjeformad med genomgående stänkskärm, Dubbeltrampning (2 pers.), Rattväxel, 4-hjuls bromsar etc.

NI kan med lätthet bygga denna efter mina fullständiga ritningar och arbetsbeskrivningar.

Ingeniör ARNE REJNEFELT  
ya Tanneforsvägen 15 C, Linköping.  
+ porto mot postförskott till

n: .....

d: .....

dr.: .....

**CYKELBILEN**

*Fantom*



**H**

**Den perfekta cykelbilen**

Byggt som en bil i synnerligen lätt konstruktion. Därför lätttrampad som en cykel och en idealisk långtursvagn. Ni sitter i den skyddad för regn och bläst och har godt bagageutrymme. Finnes en- och tvåsitsig.

Ni kan själv bygga den efter våra fullständiga ritningar och vår utförliga arbetsbeskrivning.

Pris kr 4:50

Sändes mot postförskott varvid porto tillkommer.

HOBBY-FÖRLAGET, Borås R

**PEDOBILEN**

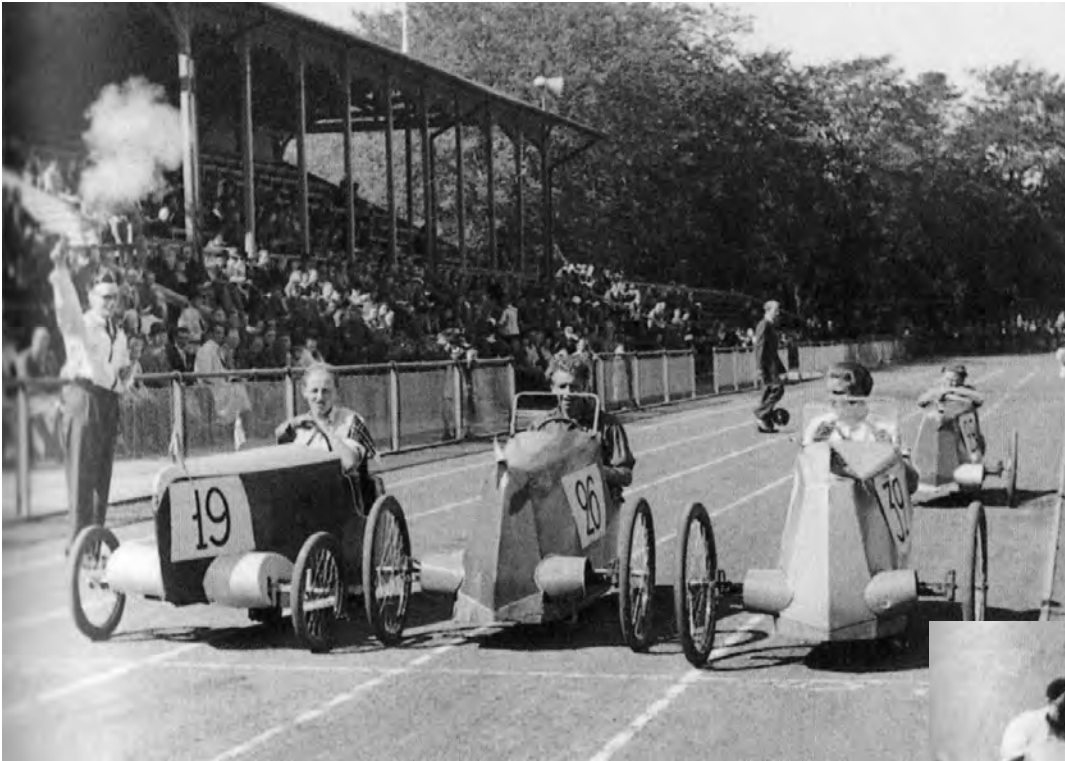
**är alljämnt den ledande cykelbilen!**

Komplett ritning och arbetsbeskrivning i 5 blad med uppgift om utarbetande av varje detalj endast KR 4:25.

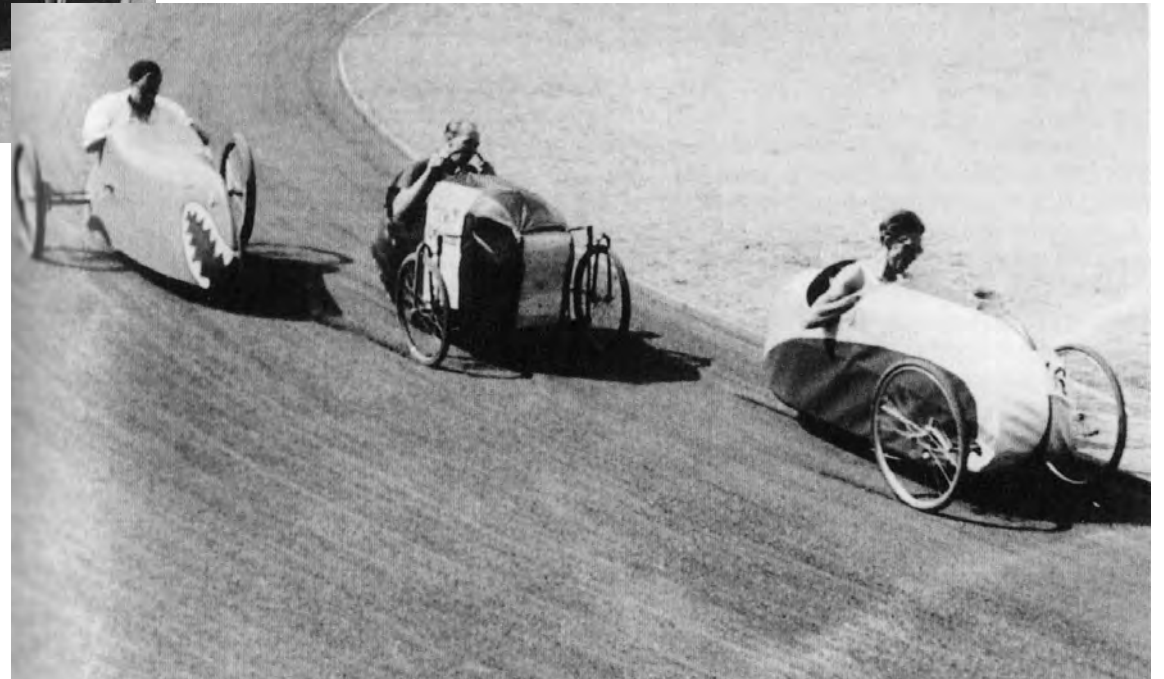
HOBBYCIRKLARNA : BOX 1057 STHLM 16



## *Swedish velomobiles*



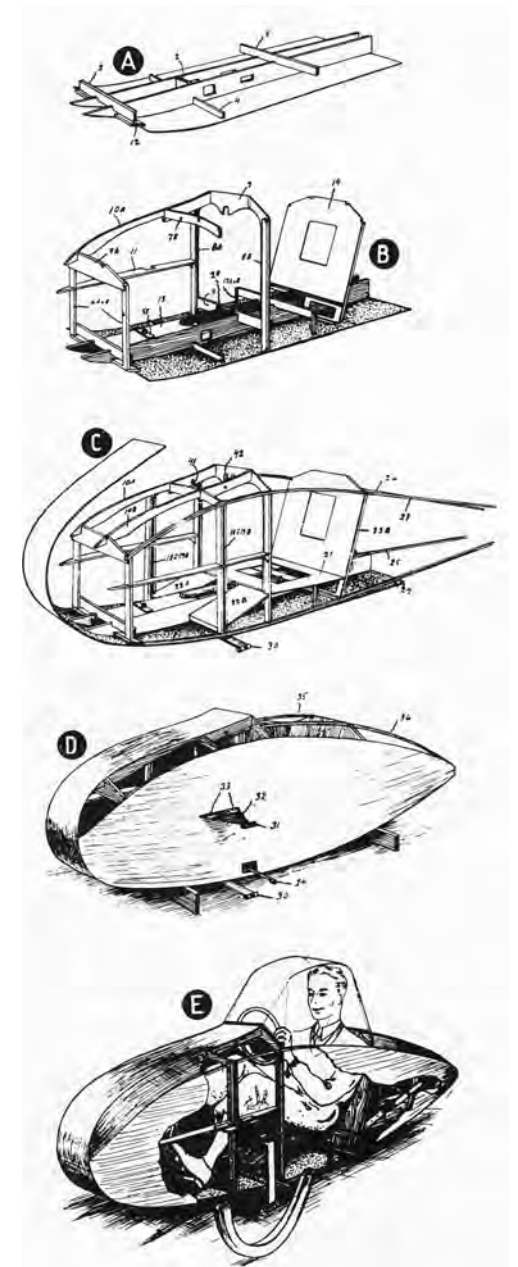
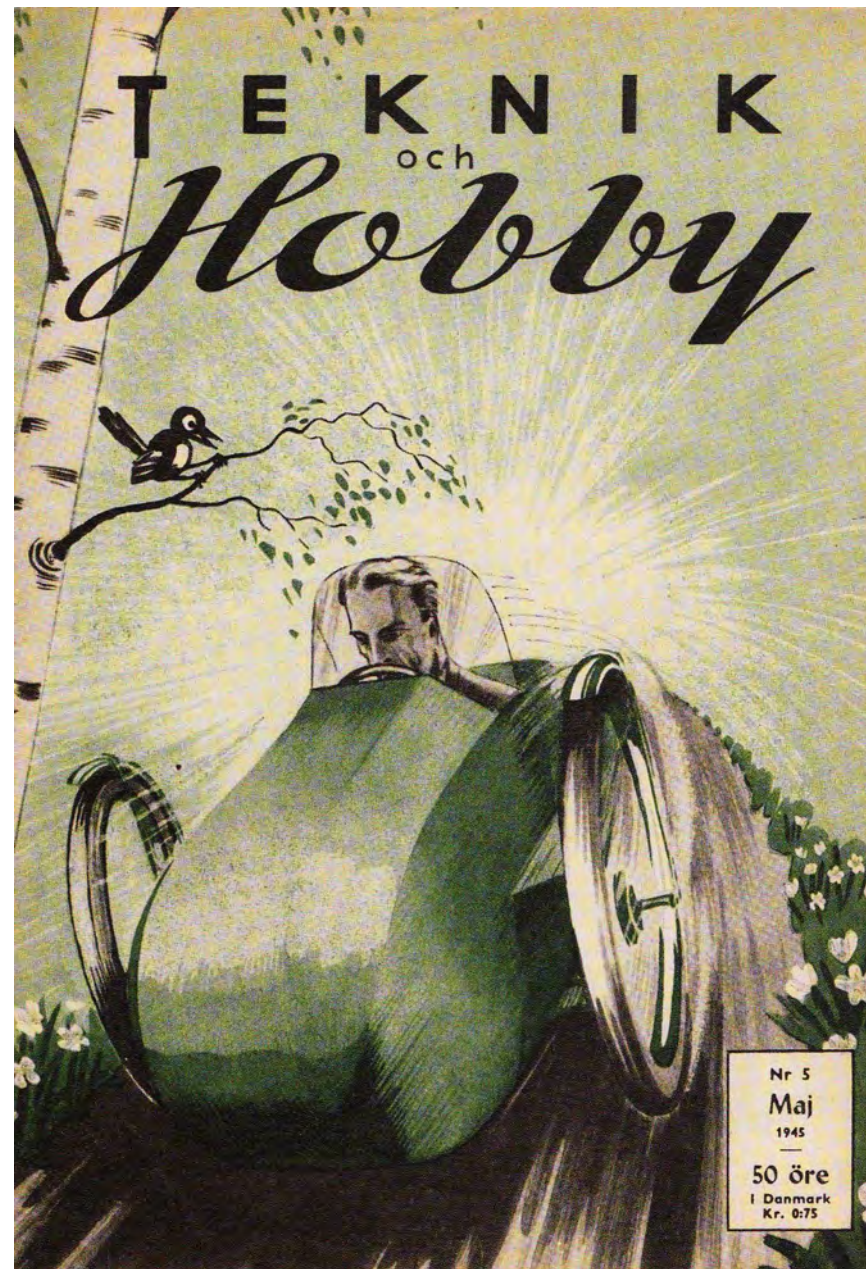
Some Swedish designs were commercialized and sold in small series. But do-it-yourself velomobiles became a popular hobby and they were mostly used for public racing.



## Swedish velomobiles

When I was as a teenager, I was inspired by the Swedish magazine **Teknik och Hobby** and built this Ulf Cronborg design from wood.

This aerodynamical three-wheeler had suspended front wheels and the weight was around 40 kg.



## ***From velomobile to the Messerschmitt Kabinenroller***

After World War II gasoline was still expensive and hard to get for private people.

In München, Germany, the engineer Fritz Fend designed this velomobile for general use.

It was developed through several stages and later equipped with a small combustion motor.

The design was later taken over by the Messerschmitt Company, where it was further developed into the famous Messerschmitt Kabinenroller.



**Bild unten ■**  
Das Velomobil und sein berühmtes  
Vorbild: Veloschmitt und Messerschmitt  
auf der SPEZI 2014



*Photo and text  
from SPEZI  
catalogue 2015  
– but the  
velomobile  
came first.*

# 1950-1975 The motorization period

The interest for velomobile sport faded away soon after the Second World War.

A strong trend towards motorization dominated in this period, supported by low oil prices.

Bicycle infrastructures in the towns were closed down in order to make more space for car traffic.

The conditions for cyclists became more difficult and dangerous.

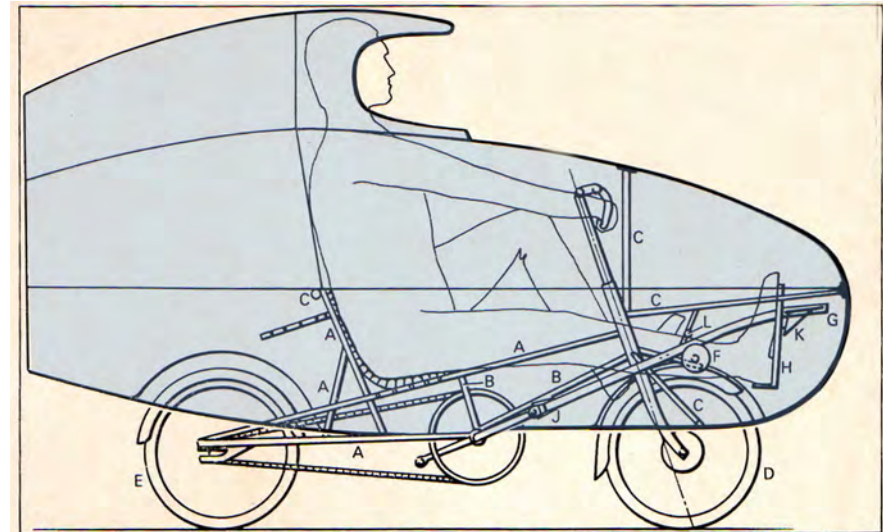
Cars, motorcycles, mopeds, scooters and cabin-scooters forced out the cycle culture. Very few innovations in bicycle design were seen. Here are two examples, both designed by aircraft engineers.

In England this two-wheeled recumbent bicycle with glass fiber fairing, called "Bicar", received First Prize in a competition in 1969. >



^ In the USA a "Pedicar" with wire transmission came on the market in 1971.

Unfortunately it was too heavy (>50 kg) to become a success.





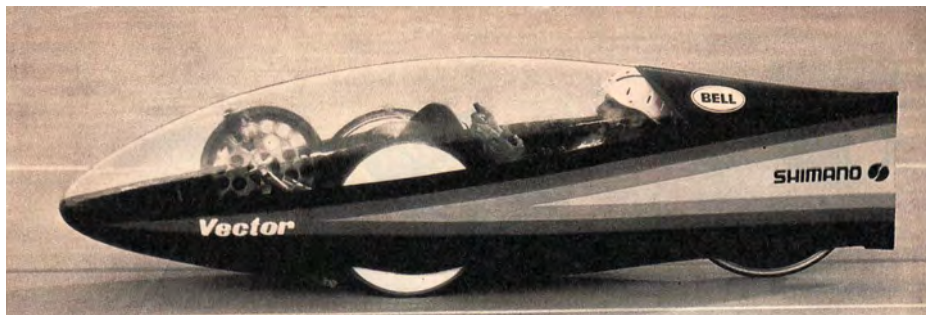
# 1975-2000 The Velomobile Renaissance

Suddenly two oil crises in the 1970's changed the conditions. Ideas of "limits to growth", the need for environment protection, and change towards sustainable societies and life-style gave inspiration to a revival of cycling.

Races organized by the IHPVA (Intern. Human Powered Vehicle Ass., founded 1975) demonstrated, how fast bicycles with aerodynamical fairings could be. Stories of speedy bikes appeared in many newspapers and magazines (e.g. Scientific American). Speed records of the American Vector (1980) were hunted by many speed monsters.

Battle Mountain in Nevada, USA, became the preferred site for annual competitions in 200 m sprint with 8 km run-up. Already in 1999 the World Record reached 133 km/h. These very specialized speed machines can only operate on closed racing tracks.

The original Vector, designed by A. Voigt, and a German successor. >



## ***From speed machines to practical velomobiles***

When maximum speed no longer is the ultimate goal, other specifications get priority in the design process. For a practical velomobile, this could be:

- Comfort
- Maneuverability
- Safety
- Luggage capacity
- Durability and maintenance
- Styling
- Price

It is said, that *form follows function*. It leads to a high diversity of designs, since functions depend on many different needs and wishes. There is nothing like an ideal velomobile, which satisfies everyones needs. So for many people it is fun to design and build a velomobile of their own.



< An early velomobile design from Lithuania, 1982. The V-8 is a 35 kg monocoque with front wheel drive and rear wheel steering.

Also commercial cycle producers like Kalkoff (Germany), Gazelle (Netherlands) and Velerique (Belgium) tested the market in 1982 with concept models. They were stylish, but not really practical. Only the Velerique came into series production for a couple of years around 1985.



A practical velomobile must be able to operate safely in normal traffic, on streets, roads and bicycle lanes, by night and day, all year, in all kinds of weather.

Maneuverability, stability and the ability to see and to be seen are very important qualities.

The vehicle must provide quick and easy access to get in and out, a comfortable seating position and good ventilation.



^ Two early Leitras. First velomobile to complete Oslo-Trondheim-Oslo (1983).

Low weight and good aerodynamics are also essential, in order to minimize the power needed from the rider. These are the criteria, which inspired me to start development of a practical velomobile in 1979/80, after almost 30 years without one.

I called it the *Leitra* (*Let Individuel Transport*). It was not intended as a vehicle for racing.



^ Later production version, first velomobile to complete Paris-Brest-Paris (1987).  
Foto: Jürgen Eick.

There are basically two concepts of velomobiles: The monocoque, with integrated chassis and cabin, and the convertible, which is a recumbent cycle with an exchangeable cabin/fairing.

I chose the convertible principle for the Leitra, mainly for flexibility in various applications. You can easily modify fairings for different purposes: e.g. transport of children, animals, tools, and music instruments. You can ride it as an open recumbent bike/trike in fair weather, and it can be disassembled for long distance transport in trains and airliners.

### **The Festival of Human Power, Thamesmead (UK 1984)**

As an example, I went to the HPV Festival in London by private airplane. Rode to Copenhagen Airport, Roskilde, disassembled the Leitra in 10 minutes and took it on board a Piper Cherokee. I landed in the small GA-airfield "Biggin Hill" south of London and rode to the Festival.



## The legendary Windcheetah

One of the first practical velomobiles, the Windcheetah, a convertible trike designed by Mike Borrows, participated in the First HPV-Festival in Thamesmead, furnished with a sport fairing. It came into series production in UK, and it is still on the market, especially for speed lovers.

It was strong in the street races, where two Vectors crashed because of their low manoeuvrability.



< I took this picture of one of the first Windcheetahs (Thamesmead, July 1984).

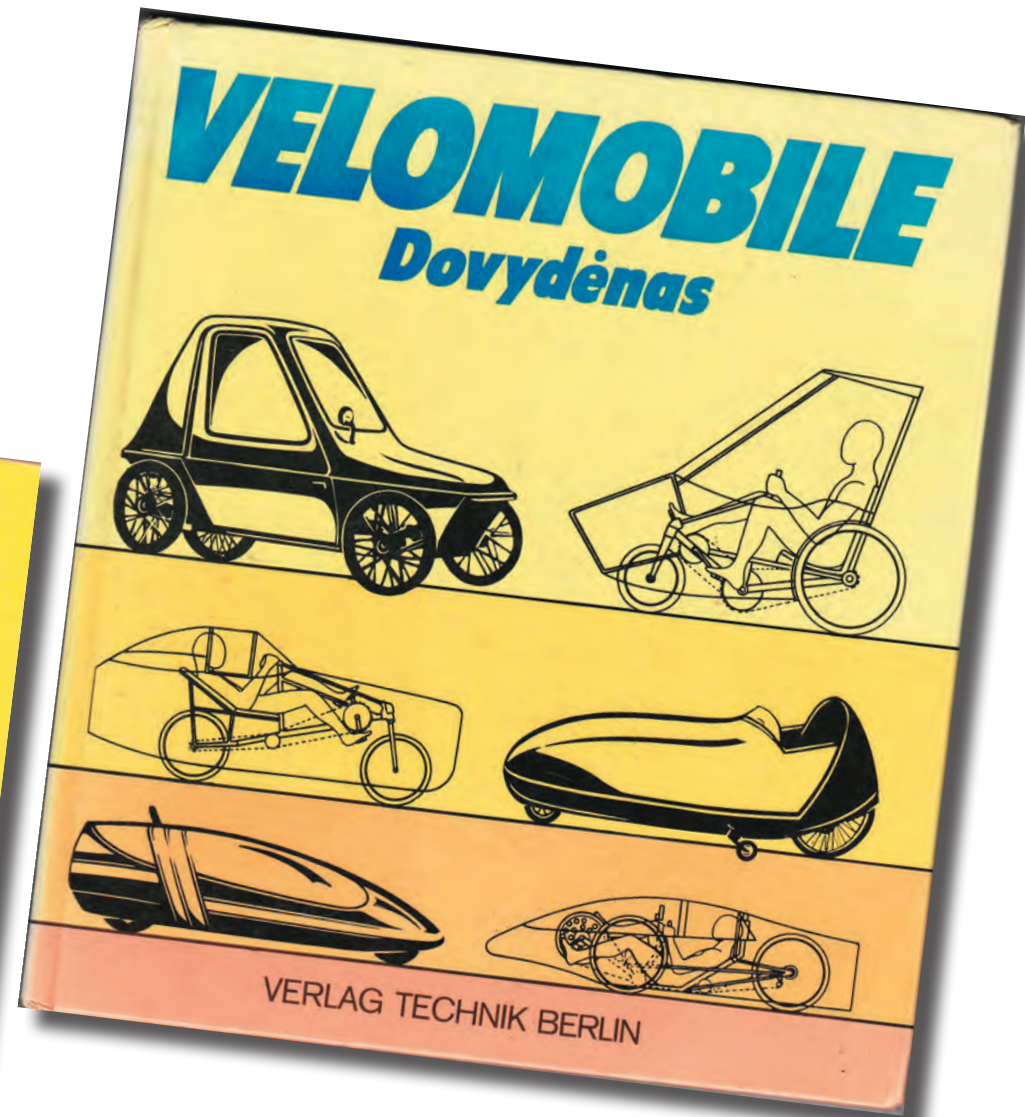


Here an example of later versions. Some fairings were for racing, others for practical use. >

## The first books on velomobiles

The first books on velomobiles were written in Russian by A. C. Popolov, (1981) and Lithuanian prof. Vytas Dovydenas (1986). The latter was translated to German and published in Berlin (1990).

It has very nice graphics of realized velomobiles as well as very futuristic designs.





In the mid-80's the European HPV movement organized a number of national HPV Clubs. In Switzerland they called it Future Bike CH, and they promoted Swiss designs like Twike and Birkenstock through competitions. In 1986, Future Bike CH presented a used Leitra velomobile at an international Bike Show in Geneva. Later (1991) the first velomobile building course was organized in Bern by Andreas Fuchs. Five Leitras were assembled and tested in three days by the new owners.





## Ladies priorities: Luggage capacity and black velvet

The Leitra has room for luggage under the seat and in the rear fairing. This early classic, owned by a Danish lady, has a portable basket for shopping articles. On demand it was extended for even more capacity.

Also the internal finish is important for a lady. Here black velvet all over, with small pockets for phone, letters, extra lamp etc.



After some years riding by pedals only, the lady (then 70 years) invested in a 250 Watt electric assist motor for higher comfort.



A lady in South England wanted a velomobile for her recreation tours with her dog. The Leitra was furnished with a dog cabin behind the rider. I rode it from Copenhagen to her home in Christchurch via Esberg-Harwich-London-Southampton.



Young parents wanted to bring their children to kindergarden or school or to take them along on visits.



< This dentist in Aachen, Germany could transport three children all year around in all kinds of weather.





Older children, like this Swedish boy, was touring with his father in a special trailer. They communicated through a plastic tube with two funnels.

## Individual outfits

A former car owner missed the impression from a car. This Leitra was furnished with blinker, two extra backmirrors and two heavy car front lights. It increased the weight of the fairing by 100% and required extra heavy battery. >

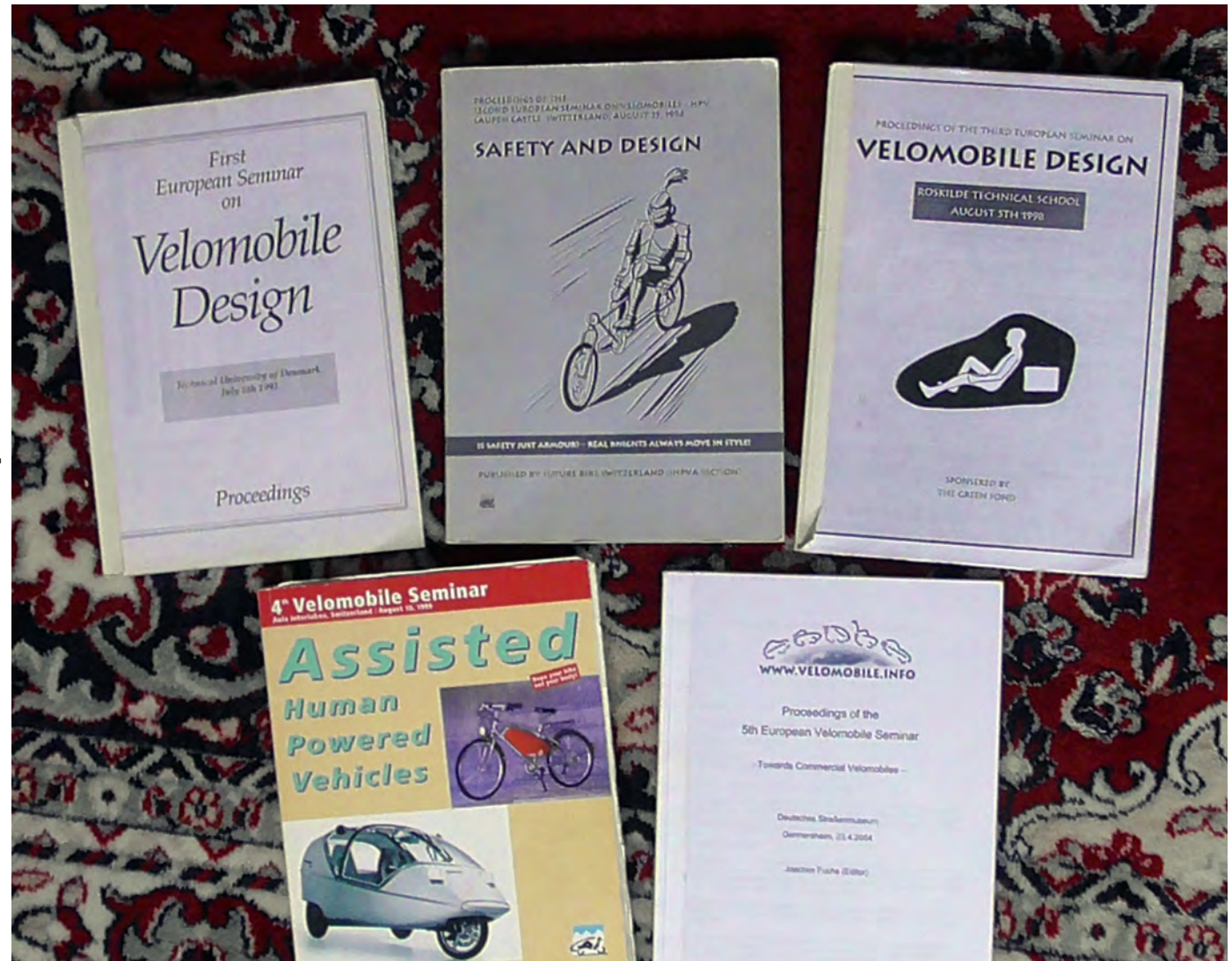
More suitable additional equipment, like a solar panel on top of the fairing, has been installed by several Leitra-owners.

Also styling is used to give a velomobile an individual touch. Photo below from Interlaken 1999.



## Design Seminars

The First European Seminar on Velomobile Design was held on July 8th, 1993 at the Technical University of Denmark. It was followed up by six more seminars in Switzerland, Germany, Denmark and the Netherlands. The 8th seminar is planned for Dornbirn, Austria, on 30 October 2015. Proceedings from the first 5 seminars were published on paper. The rest are in digital form. Thanks to the initiative of Simon Bailey, all earlier proceedings will soon be available in digital form.



## Long distance group touring

Theory and design are important exercises in the development of velomobiles, but practical experience on the road will tell, if the design is successful.

In 1996, a group of Leitras from Germany and Denmark was touring in England, some went up to Edinburgh and Glasgow.

Here the group made a stop in Cambridge. Jurgen Eick (in the middle with his wife Ulla) is responsible for the foto.



## Interesting designs in the UK

Members of the British HPV-Club created interesting velomobiles, both for racing and for practical use. I already mentioned the Windcheetah, but also a company like King Cycle became recognized for its elegant design. In order to make the vehicle as small as possible, it had a special drive system, which could be integrated in the nose cone.





## Flourishing velomobile development in the Netherlands

In the spring of 1993, the Dutch HPV-Club, in cooperation with a Dutch bike magazine FIETS and University of Eindhoven, organized a competition "365 days bicycle".

It was also the market introduction of the "Alleweder", produced by the company Flevo Bike.

It is one of the few velomobiles built from Aluminium.

It became popular as a do-it-yourself product, and it has been further developed in composite material.

It became inspiration for other companies in their design.



## New models from Germany

Two monocoques models, the Cabike and the Go-One came on the market in the late 90th, both inspired by the Dutch Alleweder.

The Cabike, designed by Reinholt Schwemmer and German Eslava, was first produced in Giessen, later in Poland and the USA.

The Go-One, created by the designer Michael Goretzky, was produced by the German company Beyss Kunststoff and came on the market in 1997.



Two Cabikes joined the tour to Switzerland in 1999 for the 4<sup>th</sup> Velomobile Design Seminar in Interlaken. Riding in the Alps and over distances of several thousand km became routine for practical velomobiles. Also Joachim Fuchs joined the group in his own design, the two-wheeler Aeolos.



*Interlaken-Tour '99*

## The velomobiling doctors

In Germany, several medical doctors combine their own physical training with visits to clients.

There is more than enough space for a doctor's bag in the Leitra luggage box, and the distance between clients is often just 5-15 km in urban areas.

Exercise is an important factor for general health and for the fight of obesity.

"When we arrive in a velomobile, it is easier to talk about exercise, and our own example helps to convince people."

The styling of a doctor-velomobile is an individual matter. Dr. Wolfgang Schneider-Rathert of Braunschweig (left) prescribed "pills" in many sizes.



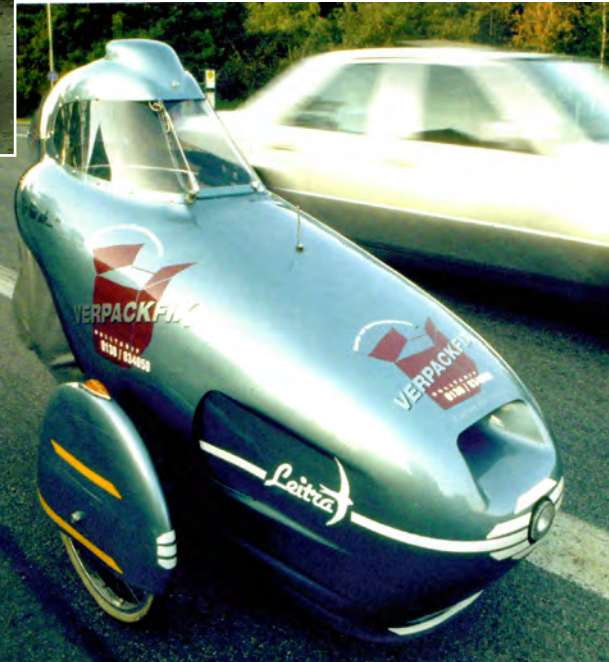
## Artists promoting sustainable mobility

Some artists, concerned about the environment and climate change, have changed their life style radically. Goodiepal, musician and painter, thought he had used up his CO<sub>2</sub> quota on his many flights in Europe and the USA. He bought a Leitra velomobile and toured through Scandinavia from the Faroe Islands, Iceland, Norway, Sweden and Finland to the Baltic countries, playing his music and creating decorative paintings.

Goodiepal's first Leitra can now be seen in the National Museum of Art in Copenhagen.

Tobias Enke, from Germany, lived for a whole year (1996) in his Leitra, traveling from town to town with his sculpture art and silverworks.

A stop in the pedestrian zone attracted immediate attention, and people became impressed by his art and his vehicle. Later, his was able to get income from sponsorships. A velomobile fairing is an excellent carrier of advertisements.



## Practical on 2 wheels

While most high speed record machines are on 2 wheels, the preferred concept for practical velomobiles has for many years been 3 wheels.

Some early designs of practical 2-wheelers, like the Velerique from the 80's, were not stable enough to be used safely in normal traffic.

However, there are a few successful examples of practical velomobiles on 2 wheels in the 90's.



^ Joachim Fuchs also believed in the 2-wheeler concept for a practical velomobile. He designed the Aeolos and has been using it for pendling and touring through many years.



^ Stefan Gloger made careful studies of the stability in gusty wind with his Desira, as well as the safety in crash situations. He was able to ride the Desira in normal city traffic, thereby demonstrating it's potential as a practical vehicle.

# 2000-2015 The diversified and expanding market

About the turn of the millennium the development of commercial velomobiles gained momentum, first of all thanks to groups of very dedicated and determined bicycle designers in the Netherlands and Germany. Speed became the ultimate design goal and competition parameter, resulting in very low, aerodynamic monocoque models with minimum cross section.

Consequently, lower priority was given to manoeuvrability, visibility, luggage capacity and easy access to get in and out. Still a number of compromises are necessary to keep some characteristics of a practical velomobile in the new generation of vehicles for commuting and long distance travelling.



Mango  
Velomobiel.nl

Quest  
Velomobiel.nl



Strada  
Velomobiel.nl

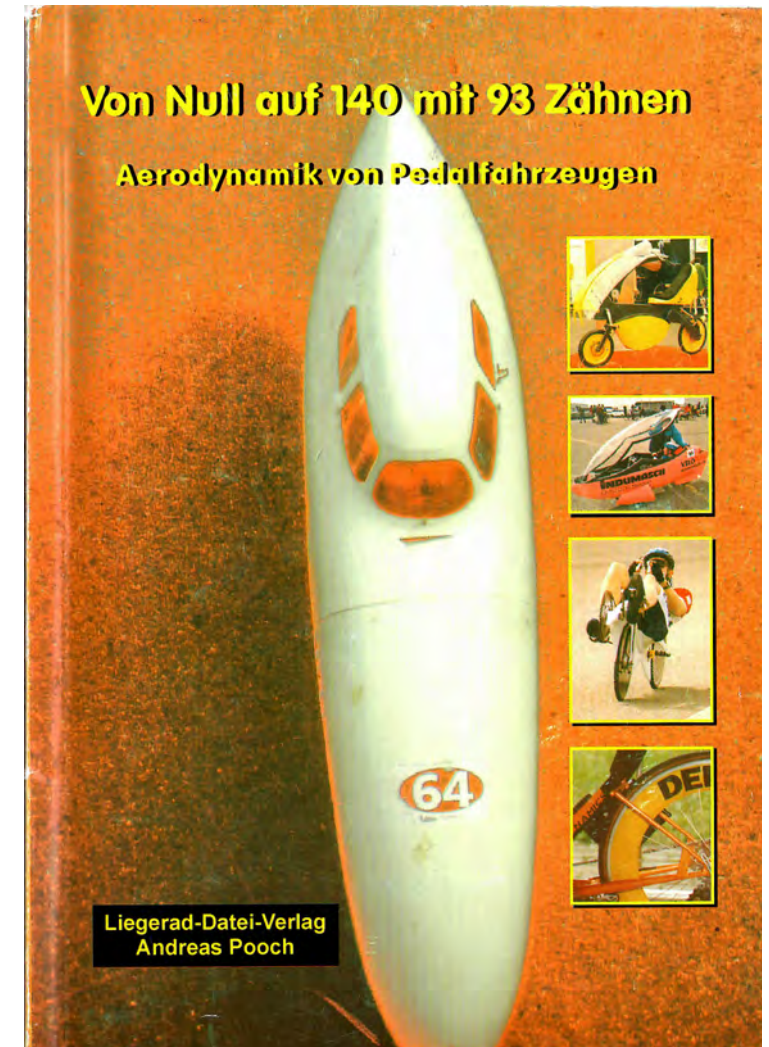
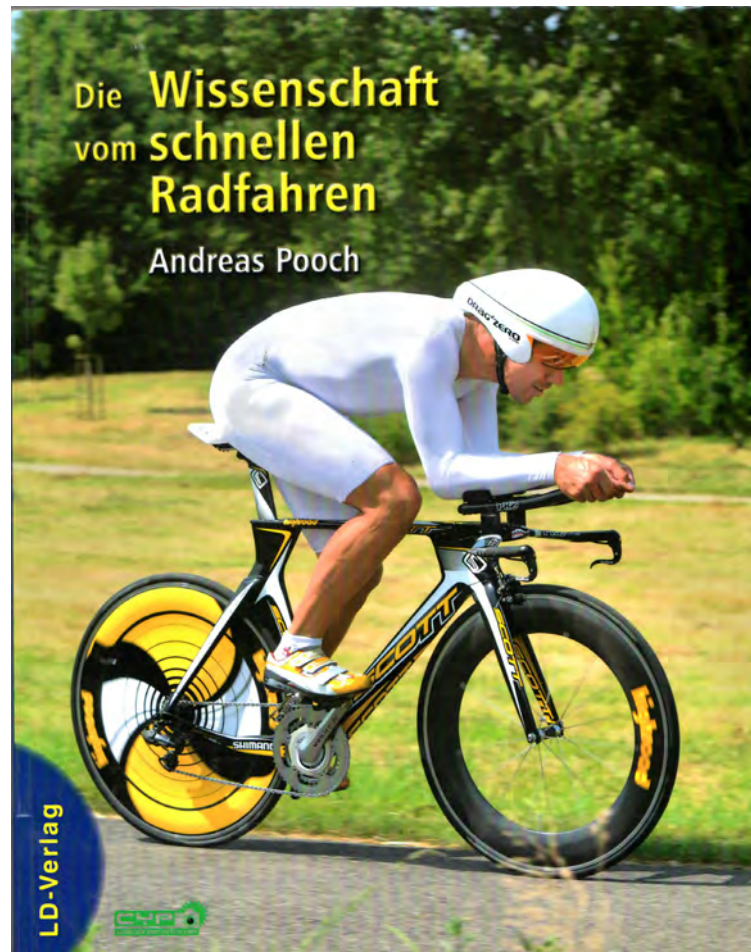
Orca from Flevobike



## Inspiring literature

Andreas Pooch published his first book on velomobile aerodynamics in 2001. It gave inspiration to many designers of high speed as well as practical velomobiles.

His later updates present important contributions to the scientific basis of design. He describes technologies useful for professionals as well as Do-It-Yourself enthusiasts.

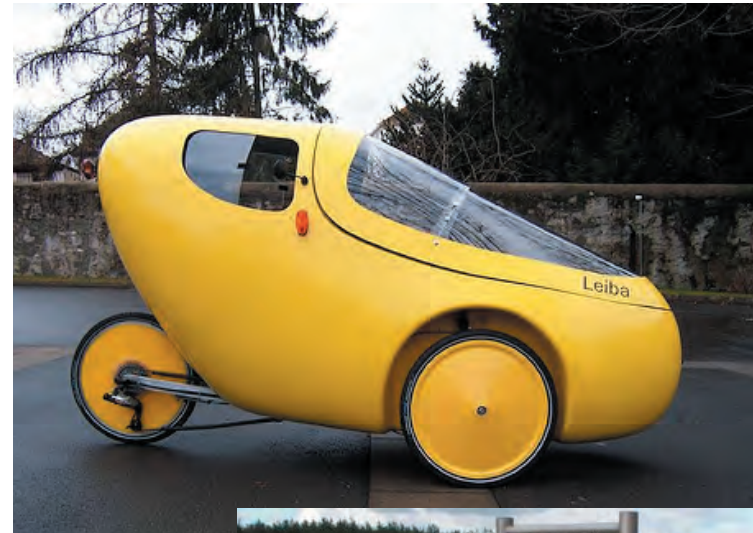




## More German professionals

In the first 10 years of 21st millennium, two new German companies joined the velomobile market, both located in the Hannover area.

The Leiba belongs to the category of practical velomobile, with room for luggage and easy access, while the Milan, from Räderwerk, is an extremely low high speed racer, based on Eggert Bülk's many years of development with low racers.



Leiba

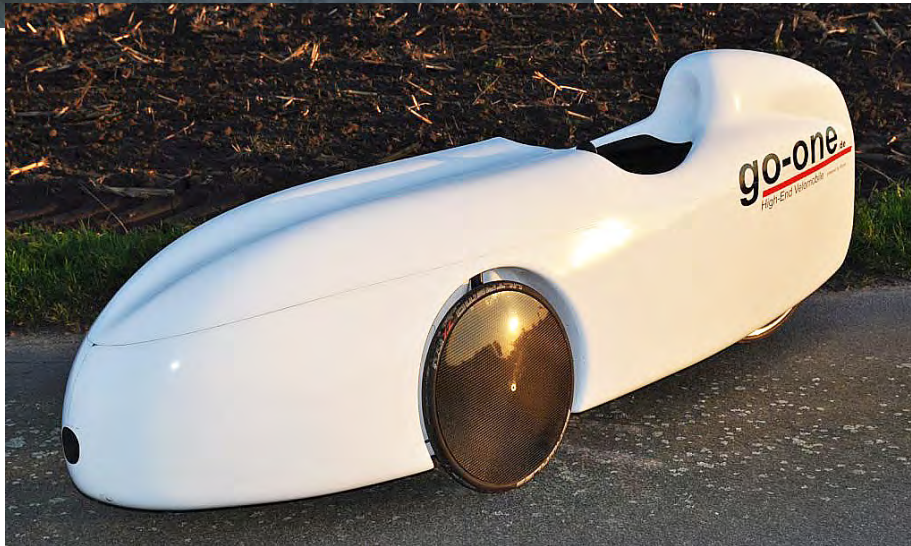


Leiba X-Stream XXL



Milan





### **New generations Go-One and Cab-Bike**

The original "Bubble" Go One has been followed by new models, with higher speed as primary design goal.

The Cab-Bike was adopted by the American company Blue Velo. It was presented to the US market in a cabrio version.

The Cab-Bike became popular in the USA. Below is Mary Arneson and Dale Hammerschmidt in Minneapolis, Minnesota in 2003.



## ***Back to motorization – now electrical***

After almost 25 years of practical velomobiles, powered by 100% human power, the first commercial hybrid vehicles appeared on the market. The Dutch Aerorider, designed by Bart de Vert, has a 500 Watt electric motor to assist pedal power. It has a total weight of 80 kg (including an 18 kg battery).

Since then (about 2005) new European rules for electric bicycles have set a limit of 250 Watts for the category of motor assisted bikes (pedelecs).

The last 10 years has seen many new electric motor systems for bikes and velomobiles. You can now get them as crank, middrive or hub motors, and the battery technology has improved a lot. The organization Extra Energy ([www.extraenergy.org](http://www.extraenergy.org)) has played an important part in the promotion and testing of e-bikes and pedelecs.





^ Leitra pedelec available with hub-motor, crank or middledrive — not as e-bike.

## Pedelects and E-bikes

Newer models of early practical velomobiles are now available as pedelecs or E-velomobiles.

Alleweder as e-bike or pedelec.



## **DIY design**

The last 5 years has been a period with high activity by homebuilders and DIY (Do-It-Yourself) designers. The velomobile is now a very popular design object in schools, clubs, or for individual inventors and designers. Many different materials have been taken into use in order to make a practical velomobile more affordable, lighter, easier to maintain and suitable for a specific purpose. Individual styling creates identity, and that is part of the fun by the design process. The Internet is crowded by DIY-projects and open source design, CAD-designs and even programs for 3-D scanning.

Super light designs:



Danish nylon fabric.



MEUFL, design with PE-foam by Harald Winkler.



The French Mosquito.



Dutch Plywood.

## Emerging market for semi-production and components

For those who want to build their own velomobile, there are plenty of opportunities to get semi-produced components from professional velomobile producers.

Fairings, which is an essential part (but expensive in time and equipment to build), are available in different models. They can be combined with trikes from different producers - or with a homebuilt recumbent.

Arcus fairing, Finland



Wildcat, Denmark



Rotovelo, Australia



Boralis, Canada

## *Young entrepreneurs*

The World needs more sustainable means of individual transportation, and the velomobile is an obvious candidate. Therefore, schools and technical universities show an increasing interest in subjects and projects related to light vehicles. Practical training in velomobile design and manufacturing takes place in cooperation with industry.

As an example, the Leitra company has hosted many international engineering students on internships and trainee projects, some with the support of a 6 month grant from EU.



New company, [www.velovergne.fr](http://www.velovergne.fr), started with license production.

Some students have established their own companies as velomobile producers and dealers. One of them, Sylvain Lemoine, of Velovergne in France, received, together with Leitra DK ApS (host company), a 3rd place prize in a competition organized by the EU program ERASMUS for Young Entrepreneurs. The total number of velomobile producers and dealers is growing year by year – so there is hope for the future.

## ***Modern life style – a paradox***

What do you see here? One of the many fitness centers, which sprout up everywhere like mushrooms in the autumn. Exercise has become big business.

People take their car to the fitness center, pay a tidy fee for sitting an hour spinning on a stationary exercise cycle, then they drive home again by car. I pass several such centres on my way to work. 50 cars are parked in front of the show windows – seldom you see a bicycle.

I am happy with my mobile fitness training machine, a velomobile, free of charge.

