Radio Controlled

Soaring Digest

November 2018

Vol. 35, No. 11

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Front & back covers: Phil Cooke's 1/12th scale McDonnell Douglas A-4 Skyhawk flying near the end of a Power Scale Soaring Association/Lleyn Model Aero Club event held near Abersoch in North Wales. The model was designed by Phil Cooke and Matt Jones for the 2016 Mass Build event held at the Great Orme in September that year. The model spans 36" with a flying weight of 2.2lb. It's a conventionally built-up PSS model for 2-channel R/C. Plans are commercially available through Sarik Hobbies (plan ref MW3775), and a laser-cut woodpack (WP3775) and vac-formed canopy (CA3775CY) are also available. Photo by Andy Meade.
Canon EOS 7D, ISO 100, 1/1250sec., f7.1, 180mm

R/C Soaring Digest

The journal for RC soaring enthusiasts

November 2018

Volume 35 Number 11

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R/C Soaring Digest (*RCSD*) is a reader-written monthly publication for the R/C sailplane enthusiast and has been published since January 1984. It is dedicated to sharing technical and educational information. All material contributed must be original and not infringe upon the copyrights of others. It is the policy of *RCSD* to provide accurate information. Please let us know of any error that significantly affects the meaning of a story. Because we encourage new ideas, the content of each article is the opinion of the author and may not necessarily reflect those of *RCSD*. We encourage anyone who wishes to obtain additional information to contact the author.

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RC Soaring Digest is published using Adobe InDesign CS6

In the Air

Over the last several months we have endeavored to find either an individual or group willing to take over the role of Managing Editor(s) and Publisher(s) for *RC Soaring Digest* without success. While there have been several offers of assisting with some of the individual parts of the publication process, none of these has been accompanied by a long term commitment. As a result, and following more than a year of at times turbulent thought and consideration, we have made the decision to terminate publication of *RC Soaring Digest* with the December 2018 edition.

To allay any fears which may arise, we would like to let readers know the *RCSD* web site <https://rcsoaringdigest.com> will continue and the Archives will remain intact, readily available, and entirely free. Additionally, all of the plans, special publications and other supplemental documents will continue to be in the Supplements folder and remain readily available and free.

As many readers may have noticed, we've not written an "On the 'Wing..." column in several years. Our hope is that we will be able to begin writing this series once again. Should this be the case, we will be adding these materials to the "On the 'Wing..." book collection available through the B^2Streamlines web site <https://b2streamlines.com>. The December 2018 issue of *RCSD* will, in fact, include information on an 18" span tailless model which will (hopefully) be suitable for indoor or at least calm air outdoor flying. Our local club, the Eco-Friendly Little AirPlane Society (EFLAPS), has adopted this design as its first club build. Some will be building from wood while others are going for a foam airframe, but it's sure to be a great experience for all involved.

Time to build another sailplane!

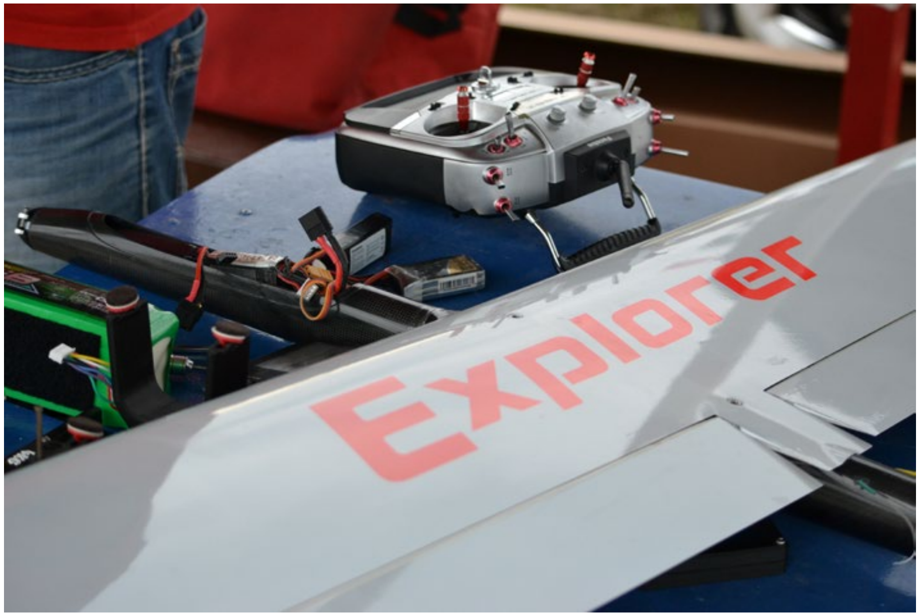
B^2

Photo Album

Photos by George Skargiotis, gskargiotis@embit.gr, and Apostolis Baglatzis


SX-GSW


BA
SX-BAV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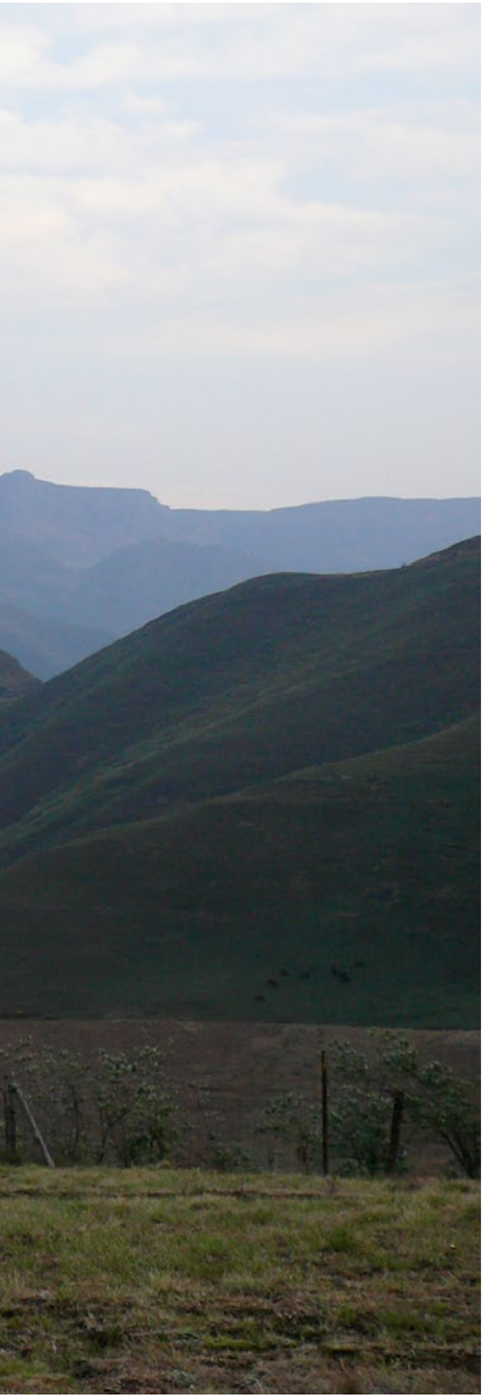
Witsieshoek 2018 Slope Soaring Event
22, 23 and 24 September
Piet Rheeders, piet.rheeders@gmail.com



Witsieshoek mountain resort is situated high (2200m) in the northern Drakensberg/Maloti mountain range +/- 400km south east from Johannesburg, South Africa.

This is also the home of the highly endanger Lammergeyer. Latest statistics show that there are only 100 pairs of the vultures left in South Africa but they are also under threat in other African Countries. They have a wingspan of 2 meters plus and can weigh up to 5 Kg. The resort has set up a hide and a vulture restaurant for photographers to take pictures of them.

If you are keen on slope soaring and even dynamic soaring this is the place to go to.

As a bonus the area has many hiking trails as well as the world famous chain ladder trail up Sentinel Peek (3500m above sea level) +/- 10km from the resort. Not to mention some stunning landscape scenery with photographic opportunities everywhere around.

You can visit the Witsieshoek Facebook page and login to see pictures of the Lammergeyer and the chain ladder at <https://www.facebook.com/witsieshoek/>

This was my 4th visit to the resort. High petrol cost and late bookings to the already fully booked resort were some of the reasons why this year's group consists of only +/- 10 RC pilots.

However, those that attend the fun-fly meeting had good winds to fly in and although the wind on both Saturday and Sunday which started out from the west suddenly died down at midday and swapped around 180 degrees to the east as if it was an electric fan that was switched off in one direction and on in the opposite direction.

This caught Evan Shaw as he was flying his 4 meter Fox and caused him to do an out landing in front of the west slope. I have taken pictures of Evan as he retrieves his undamaged Fox from the valley below.

As for me, I dusted the wings of my now aging Chinese 2.5 meter Discus, still piloted by my veteran pilot "Teddy Brown" and flew very well.

My brother Gert took some nice launching pictures on Saturday afternoon on the east slope with the resort below and on the bottom right of us.

Evan also made use of this good lift and maidened his beautifully finished "Shongololo," a local build F3B composite glider, and completed the flight with a good landing.

Nigel and his son Bradley got to do some DS soaring on Sunday on a saw-toothed hill that he named "My-hill" about 1km walk from the resort(the walking there is okay, but the climb up to the top is quite steep).

On Sunday morning Gert and myself went by road up Sentinel Peek as he has never been there. Chances were that the early morning mist would not clear before 10 am and we indeed drove most of the way up in it. This part of the road was really not in a good condition and I had to use

Panoramic view of the Drakensberg from behind the Witsieshoek resort.

the differential lock utility on my pickup "bakkie" to get through the bad patches.

When we got to the Sentinel car park we had to wait another hour for the mist to partially to clear. This is the highest point (3000 meters) that you get to with your vehicle; the rest from here on will have to be on foot with the Sentinel's peek still another 500 meter above the car park.

On the way down we managed to take some pictures as the mist finally started clearing.

On Sunday evening Evan arranged a barbeque as to coincide with our national "Braai day." The socialising and flying stories equate to that of great fishing stories like "the big fish that got away."

We were just finished with our barbeque when a sudden wind came up and put an end to our "big flying stories." Evan had to put the "braai" fire out with water in a hurry to prevent the open fire from spreading to the nearby chalets.

Gert and I left early on Monday morning, September 24 (Heritage day a public holiday in South Africa), but not before booking my place for next year's outing.

Evan, Shaun and the rest of the group left the resort later that afternoon.

Philp launches the 2.5 meter Discus into a strong easterly wind at Witsieshoek. The resort can be seen in the bottom right of the picture.

View of the resort below and to the right of The east slope.

Evan Shaw retrieving the 4 meter Fox after the wind turned around 180 degrees and he had to land down valley on the west slope.

Fun flying at the resort with Evan monitoring the video camera feedback of Sean's quad copter which is in the background directly in front of Sean.

Bradly assembling his F3B ship.

Philp posing for the camera with the CMPro Discus while Piet with the transmitter is ready for launching. The three photos to the right show Piet's CMPro Discus against the clouds and flying high over the east slope.

Evan's Fast & Furious comes in for a very fast landing.




Skalk launching a Zagi – Drakensberg, the eastern portion of the Great Escarpment, in the background.

Skalk flying his Zagi 'wing on the East slope Saturday afternoon.

Sean launches Evan Shaw's "Shongololo" on its maiden flight.

Left: Evan with his “Shongololo.”

Below: A fast “Shongololo” fly past just below and in front of the ridge.

Evan's "Shongololo" comes in for landing following its maiden flight.

Above left: Skalk and Philp walking back from the slope with their Zagis.

Above: Evan and Philp flying on the east slope Saturday afternoon.

Left: View of the resort below and to the right of the east slope.

Views from the resort.

View of the resort and the DS slope “My–hill“ 1km away.

Big flying stories at the Sunday night barbeque.

Pumpkin carving?

F9enstein. Happy Halloween!

F9ENSTEIN

Philip Randolph, amphioxus.philip@gmail.com

Happy Halloween. It's even orange. Partly. It looked worse before I put it back together. You've seen those horror flicks where you can see through the rotting holes in the ghoul's cheeks to his teeth? (They always still have teeth.) In this case if you tip it right you can see through the new top intakes to its 64mm EDF. And that EDF does have teeth. Makes this thing zonk.

This is a Freewing Grumman F9 Panther EDF Jet I've been rebuilding. Chris Erikson bought it from Motion RC and crashed it last spring on Saddle Mountain, Washington State. Destroyed. Nose broken off. Note the EPP patch on its right side. That was a missing chunk. Missing chunk in front of canopy. One wing broken off. All servos broken.

It flew well, but he had the rates too high. And Chris can handle high rates – I've seen him fly the Freewing Lippisch P.15 64mm EDF Jet. It's incredibly fast with phenomenal climb and roll rates. The P.15 was Alexander Lippisch's proposed jet-powered version of the Me-163 Komet.

I'll give a posthumous flight exhumation next month.

The holes in the top of the fuselage about where it joins with the wing are shaped and lined with plastic cut from a Mitchum antiperspirant cap. They won't help it glide on the slopes but they do have two purposes. First, I want to fly it on the beach, so I have to get rid of the vents underneath. They would suck sand into the motor. For the same reason I'll try plugging wing root vents with a leading edge shape. And I figure a suck up on the top instead of the bottom should add a bit of lift. Maybe even keep flows attached on the front half of the wing roots, for added effective wing area. Who knows?

But I did carve it like a pumpkin.

Two Hour LSF Level III Qualification Flight

Chuck Norris

From the October 2018 edition of the *Gull Wings Newsletter*. Published by the Torrey Pines Gulls Radio Control Soaring Society <https://www.torreypinesgulls.org/>, located in the San Diego California area, the *Gull Wings Newsletter* is edited by Dale Gottdank <dgottdank@gmail.com>. This material is reprinted with permission.

On Thursday, September 13, John McNeil and I attempted a two hour slope flight for our LSF Level 3 requirements. Ian Cummings and Bill Eckles generously volunteered to come out and act as witnesses for the event.

For anyone not familiar with the League of Silent Flight, it is a Soaring Accomplishment Program with 5 levels of increasing difficulty. At Level 3, which both John and I were working on, you have to complete a 30 minute thermal flight, a 1 kilometer goal-and-return, a 2 hour slope flight, and participate in 6 contests earning enough points to make the limit .Check it out at https://www.silentflight.org/ - I think it's a great program and recommend it heartily.

We both launched at about 3:15 pm into solid lift, with very active paraglider activity. I was flying my trusty Oly IIS (the Skybench version - 2.5 meter), and John was flying a semi-scale 2.5 meter Discus.

With my Oly, I was able to climb up above most of the paraglider traffic and cruise well above and west of the traffic

Photo by Ian Cummings / https://www.iancummingsphoto.com/

for the entire two hours. But John was cruising right at the paraglider altitude, and there were several times when he was very concerned and maneuvering to avoid the "jellyfish."

Fortunately, he managed to avoid disaster, and after about an hour into the flight, things cleared out and for the most part we had the sky to ourselves!

The lift was moderate, but solid throughout the 2 hour flight. There were one or two times when the breeze dropped off a

Photo by Ian Cummings/ https://www.iancummingsphoto.com/

Photo by Ian Cummings / https://www.iancummingsphoto.com/

bit (perhaps because of thermal activity) but those were short-lived, and we were never really scratching for altitude.

A long-duration flight is mostly about managing battery power, bladders, and the urge to hot-dog to kill the boredom. Fortunately, our club LSF-captain, Gary Fogel, had cautioned us sternly about fooling around and risking shedding a part or otherwise doing anything that might compromise the flight. We managed to contain our urge to do a bit of hot-dogging, but two hours is sure a long time for flying "S" patterns at the slope!

As for batteries, I installed a second NiMh battery pack at the CG, plugged into a spare port on my receiver. Judging from the battery voltage when I finished, I think I could do a four hour flight on my battery setup. John's plane was set up with extra battery power instead of lead in the nose, so I believe he had juice to spare as well. The main power management strategy for long-duration flights is to minimize control inputs to keep the servos sipping power, but that does make things pretty tame.

Photo by Ian Cummings / https://www.iancummingsphoto.com/

Photo by Ian Cummings / https://www.iancummingsphoto.com/

Above photos by Ian Cummings / https://www.iancummingsphoto.com/

For John, the main excitement came from dodging paragliders, but for me, I had an encounter with an aggressive seagull that was flying in formation with me for maybe 10 minutes. At first, I thought he was just feeling a bit lonely, and he flew in perfect formation for several minutes - matching my every turn perfectly. It was awesome! But then he started pecking at my left wingtip as we flew! At first, I didn't quite believe what I had seen, but then he repeated the attack several times before he finally gave up. The plane rocked a bit, but was mostly undisturbed by the treachery. Truth be told, it was kinda' fun, and I was never concerned about my plane. But when I landed, I had some peck-marks and scratches in the wingtip as souvenirs!

The rest of the flight was uneventful, and we both landed past the two hour mark for a successful mission.

For me, that flight completed my Level III requirements, so once I get everything buttoned up and in the mail, I'll be a Level IV aspirant!

The tasks get progressively harder (up to an eight hour slope flight for Level V!) but now that I've completed several levels, that doesn't sound quite so daunting.

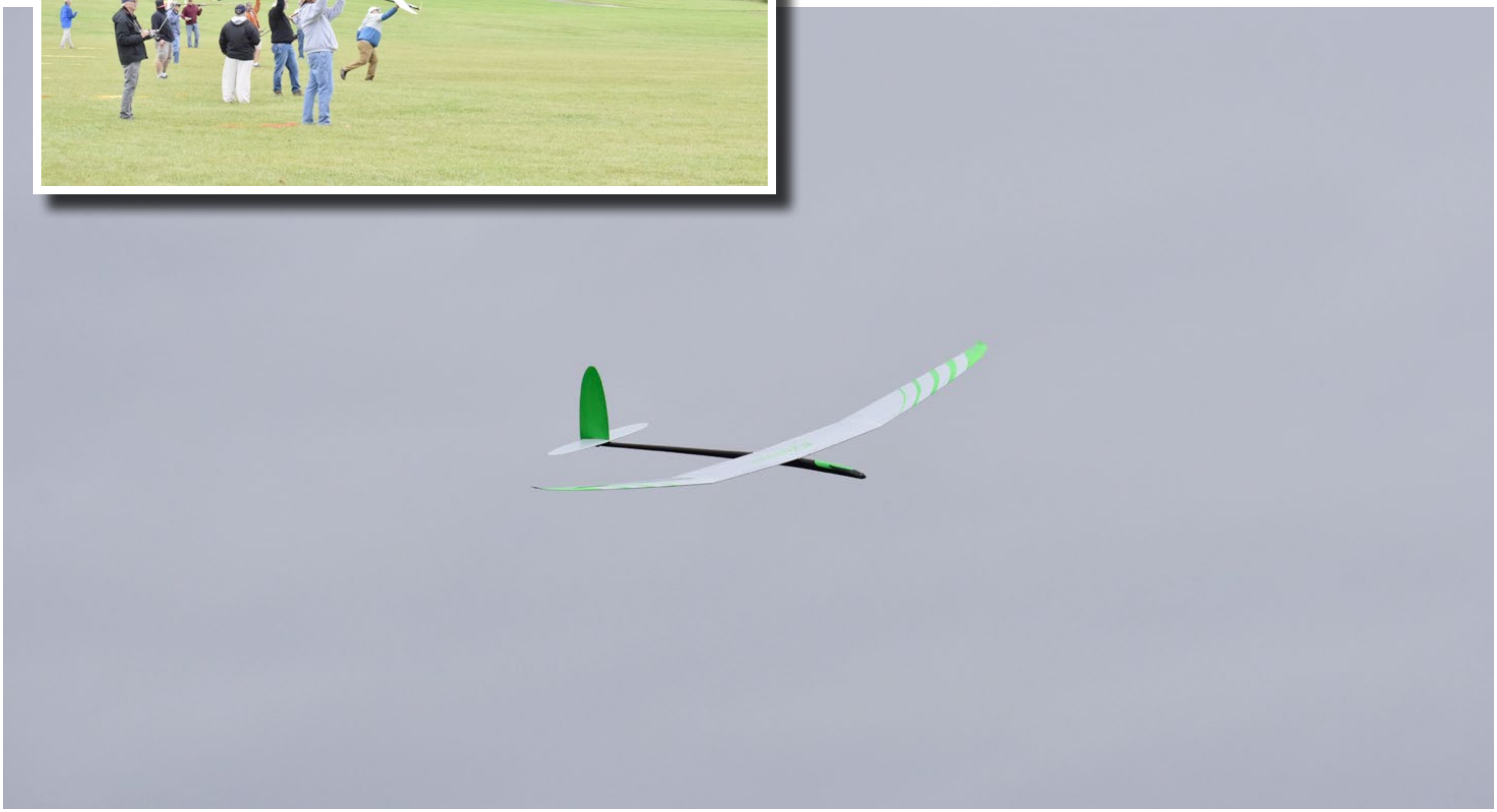
Many thanks to Bill Eckles and Ian Cummings for timing for us, and Ian Cummings and Dan Cummins for flying with us for a bit. LSF is definitely a team sport, and John and I really appreciate the support.

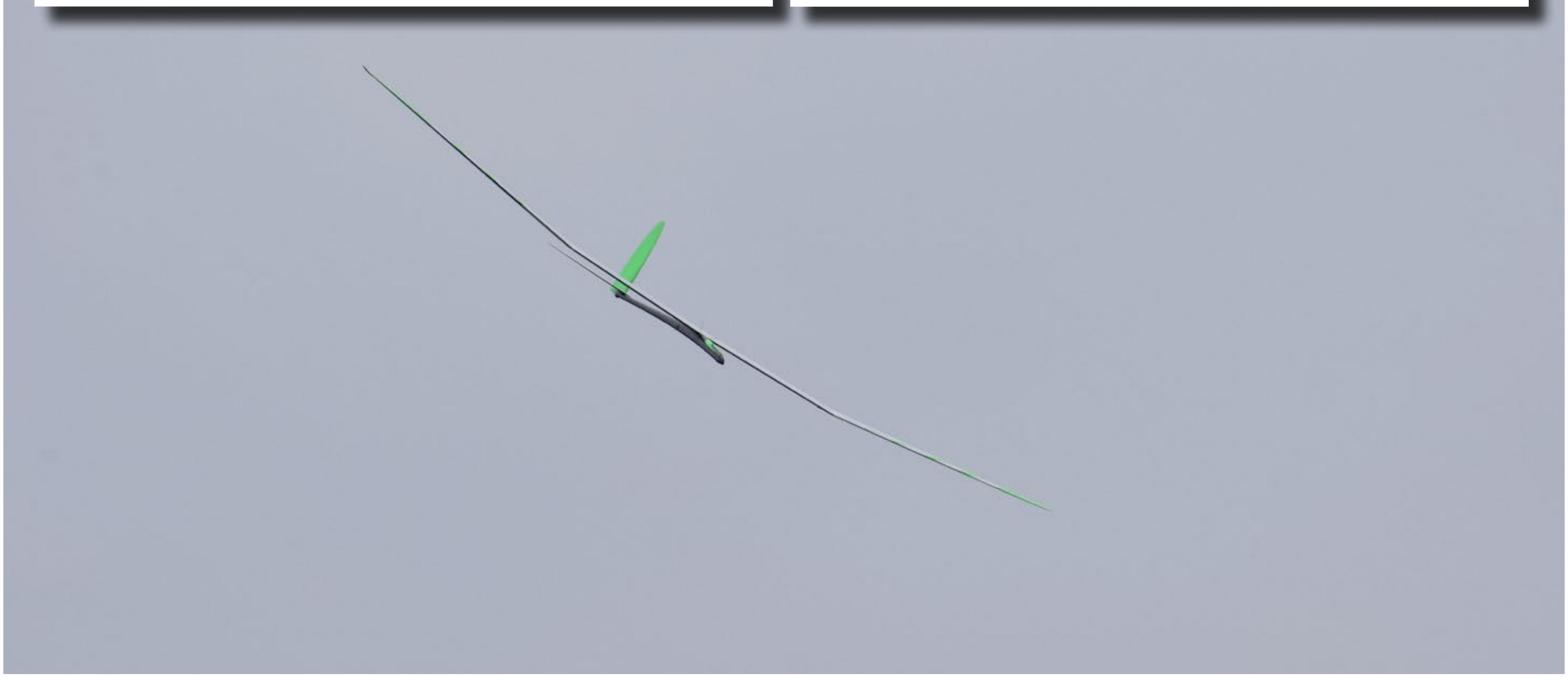
Mid Ohio Soaring Society

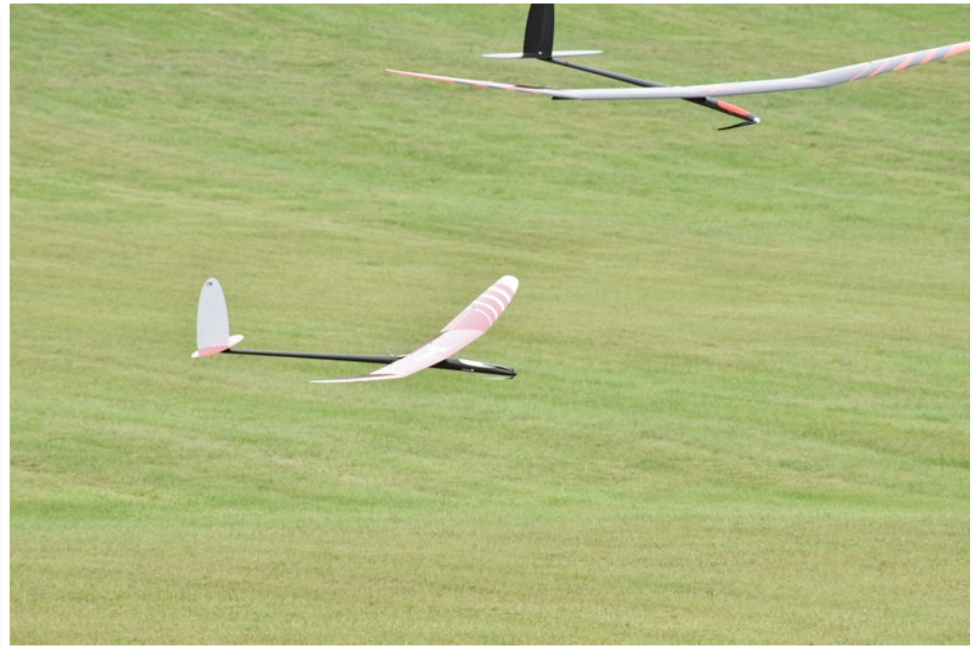
M.O.S.S. WEEKEND ALES 09.30

A PHOTO ALBUM

by Joe Sampietro, js.rcplanetech@gmail.com





Speed Recording Issues in High-Speed Dynamic Soaring

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Abstract

Dynamic soaring uses changes in the speed of horizontally blowing wind (wind shear) to gain energy so that engineless flight is possible. By exploiting the wind shear behind mountain ridges with fast winds, radio controlled gliders can achieve extremely high speeds. The dynamic soaring mode for this type of high-speed flight consists of an inclined closed loop where the shear layer is traversed upwards in the climb phase and downwards in the descent phase. The speed recording which is accomplished with a radar gun is usually taken in a section of the loop after the glider has reached the lowest altitude and is climbing upwind again. Mathematical models describing the glider flight mechanics and the shear wind are developed to determine the speeds along the maximum-speed dynamic soaring loop. It is shown that the maximum speed is achieved in the descent phase at the upper part of the loop when the glider has just reached the shear layer. Thereafter, the speed continually decreases to show the lowest values in the upwind climb phase where the speed recording is usually taken. It turns out that the difference in the speed recorded in the upwind climb phase and the maximum speed can be significant, with the result that the maximum speed is underestimated by a correspondingly significant amount. Furthermore, it is shown that the lift-to-drag ratio is key factor for this difference, to the effect that the difference is the larger the smaller the lift-to-drag ratio. Since compressibility has an influence on the lift-to-drag ratio, the Mach number exerts an effect in the high subsonic flight regime in such a manner as to strongly increase the difference between the maximum and the recorded speed.

1. Introduction

Dynamic soaring is a powerless flight mode by which energy is gained from horizontally blowing wind so that it is possible to fly without a propulsive force produced by an engine (Idrac, 1932). The type of horizontal wind that enables dynamic soaring shows a change of the wind speed with altitude, yielding what is termed shear wind. For sustained powerless flight by means of dynamic soaring, it is necessary that the strength of the shear wind is above a minimum level required for that soaring mode (Sachs, 2005).

There is a variety of shear wind types which involve different shear characteristics. The shear wind type of interest for the subject under consideration features a thin shear layer where the wind speed shows large changes within a small altitude interval. Such a wind scenario can occur in the leeward side of sharp-crested ridges where a thin layer separates the wind blowing over the ridge from a zone of still air below the layer (Richardson, 2012, Bird, J:J., Langelaan, J.W., Montella, C., Spletzer, J., and Grenestedt, J., 2014), as graphically addressed in Fig. 1.

The described shear wind scenario at ridges provides a unique opportunity for dynamic soaring as it offers the possibility of high speeds (Wurts, 1998). The mode of dynamic soaring appropriate for achieving high speeds is shown in Fig. 1. The trajectory consists of an inclined closed loop where the wind shear layer is traversed upwards in the climb phase and downwards in the descent phase. The dynamic soaring loop shows as an important aspect of the energy management (Sachs, 2005) that the upper curve is in the wind region with a high wind speed and the lower curve is in the zero wind region. By exploiting the speed difference in the air masses above and below the shear layer, radio controlled (RC) gliders can achieve extremely high speeds (Richardson, 2012, Lisenby, 2017). That manifests in ever-growing speed records to reach a value as high as 545 mph in 2018 (B2, 2018).

The speed recording which is accomplished with a radar gun is usually taken in a section of the trajectory after the glider has reached the lowest altitude of the dynamic soaring loop and is climbing upwind

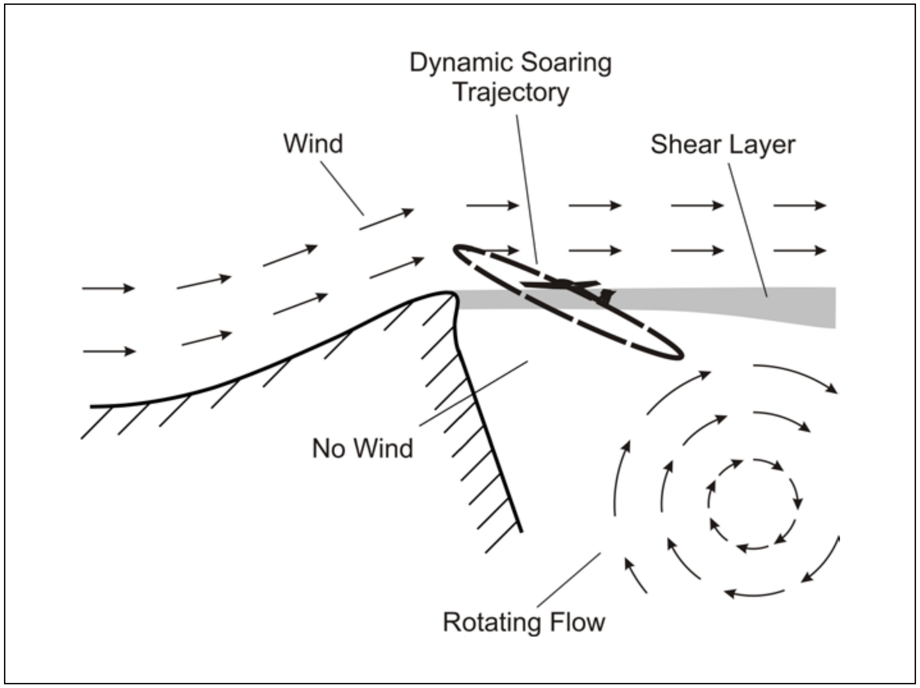

Figure 1. High-speed mode of dynamic soaring in region behind ridge.

again (Richardson, 2012). The speeds recorded in that trajectory section are considered representative of typical speeds in the loop, and they are regarded as somewhat smaller than the highest values achieved in the dynamic soaring flight maneuver.

Basically for speed recording, there are several issues in regard to the speed characteristics along the dynamic soaring loop. One issue is how large the maximum speed actually is. Another issue is how the maximum speed compares with the recorded speed in the trajectory section outlined above. This includes as a most important question whether or not there is a difference of significant magnitude between the two speeds, implying that the recorded speed can be at a value too low and not representative for the maximum speed. A further issue is the point of the trajectory where the maximum speed is reached.

The goal of this paper is to develop solutions concerning these issues. For this purpose, results on maximum-speed dynamic soaring will be presented, developing a treatment based on energy considerations as well as one using realistic mathematical models for describing glider flight mechanics and ridge shear wind properties. A trajectory optimization method is applied for computing precise solutions of the dynamic soaring problem under consideration.

2. Modelling of Maximum-Speed Dynamic Soaring at Ridges

For accurately describing high-speed dynamic soaring at ridges yielding the maximally possible speed, mathematical models of the flight mechanical and aerodynamic characteristics of the glider are required so that its motion in a wind field can be determined. Also, a mathematical model of the wind scenario behind ridges is necessary to describe the wind characteristics relevant for high-speed dynamic soaring.

There is a variety of dynamic soaring loops that are physically possible for a given wind scenario at a ridge. These loops which can be determined using the above mathematical models show different values with regard to the maximum speed attained in a loop. Among all loops, there is one loop that features the highest maximum speed when compared with the others. This loop which is subject of the present paper can only be found using an optimization method which is a systematic mathematical search strategy. The optimization method used in this paper is the direct optimal control tool FALCON.m which is a free optimal control tool developed at the Institute of Flight System Dynamics of Technische Universität München (Rieck, M., Bittner, M., Grüter, B., and Diepolder, J., 2016).

3. Dynamic Soaring Yielding Maximum Speed

Results achieved with the described procedure of optimizing dynamic soaring for the maximum speed are presented in Fig. 2. This Figure provides a perspective view on the closed loop trajectory and shows the spatial extension and the relation to the wind.

Three trajectory points are highlighted because they are of primary interest for the speed recording problem under consideration. At point A, the maximum speed is achieved. This point is in the upper part of the shear layer when the glider descends from the wind region to the

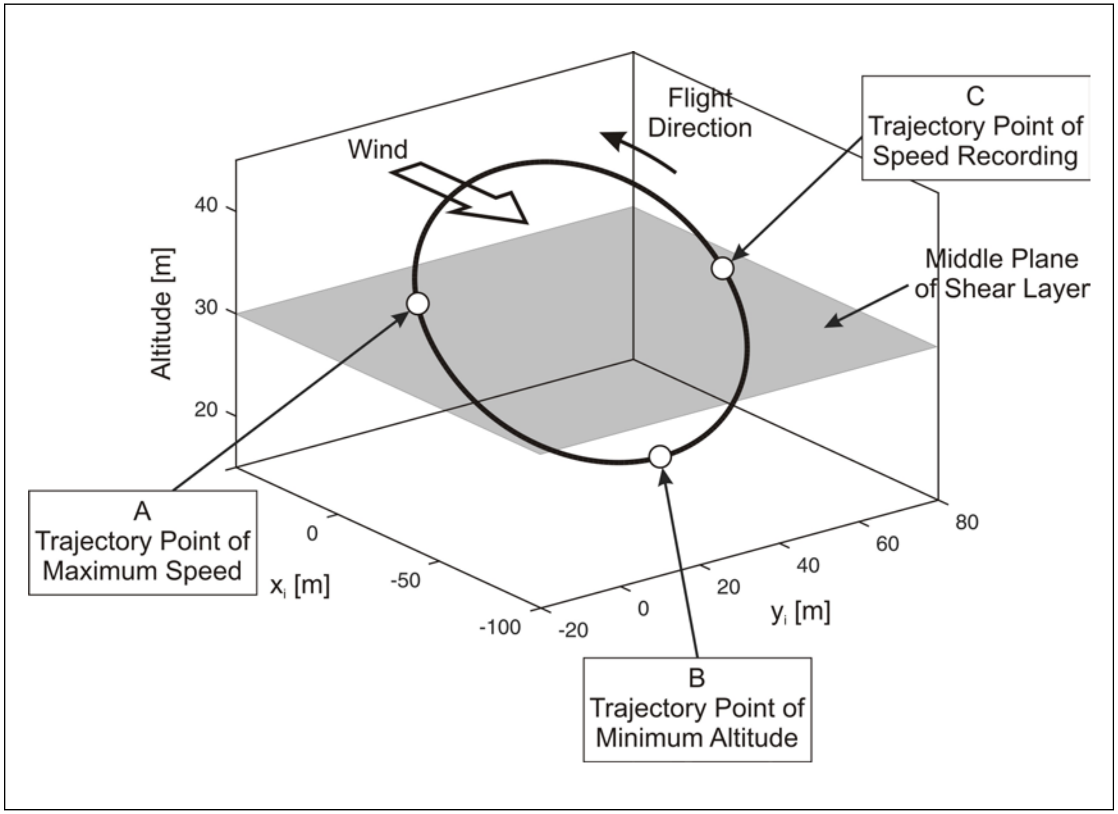

Figure 2. Dynamic soaring loop optimized for maximum speed.

windless region. Point B is at the lowest altitude of the loop. This is in the windless region. Point C which is in the ascending part of the loop, after the glider has reached the lowest altitude of the dynamic soaring loop and is climbing upwind again. This point is considered to be in in the trajectory section where speed recording is usually taken, regarded as representative for the achievable speed level.

The time histories of the speed V_{inert} and the altitude h are presented in Fig. 3 which shows how these quantities vary in the course of the dynamic soaring loop. The speed denoted by V_{inert} is the inertial speed or absolute speed, i.e. the speed relative to the Earth which is the speed recorded by a radar gun. The inertial speed differs from the airspeed − as speed relative to the air − in the regions where the wind is not zero.

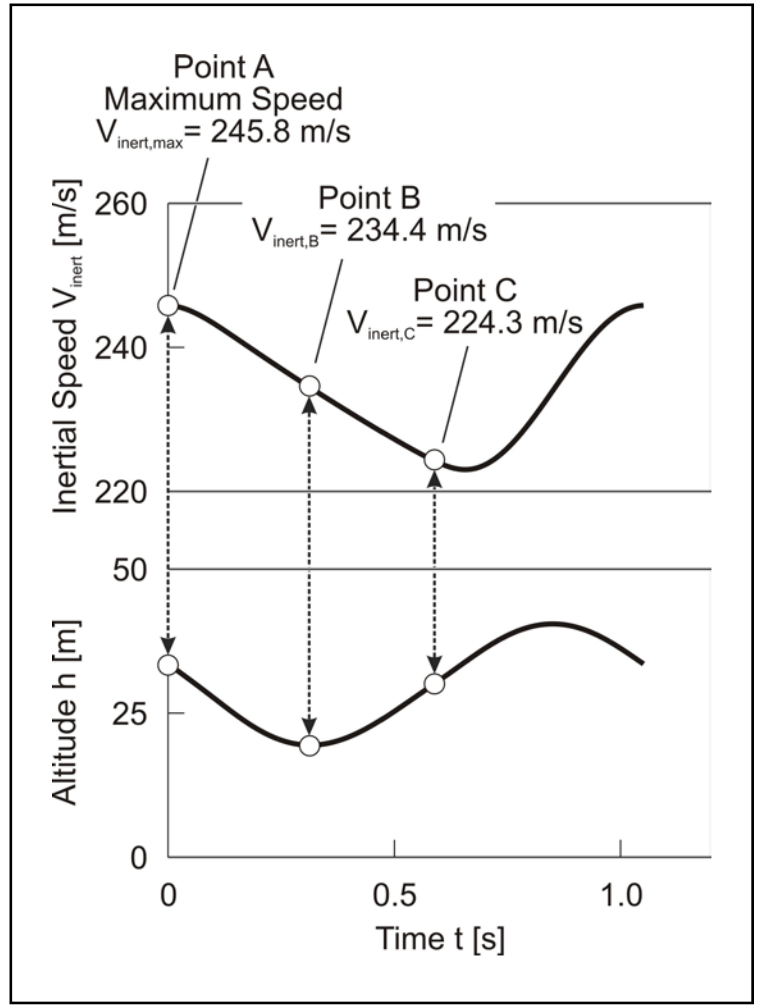

Figure 3. Speed and altitude time histories of dynamic soaring loop optimized for maximum speed.

The inertial speed values of primary interest are those at points A, B and C. The maximum speed, reached at point A, amounts to $V_{inert,\max}$ = 245.8 m/s, the speed at point B to $V_{inert,B}$ = 234.4 m/s, and the speed at point C to $V_{inert,C}$ = 224.3 m/s. Accordingly, the speed decreases continually from point A to point C where the V_{inert} curve suggests that the rate of the speed decrease between points A and C is practically constant. This holds in spite of the fact that there is an effect increasing the speed due to the decrease of the potential energy between points A and B.

The main outcome refers to the speeds at points A and C. It turns out that there is a difference of significant magnitude, such that $V_{inert,\max}$ is larger by an amount of $\Delta V_{inert} = 21.5$ m/s compared to $V_{inert,C}$. As a result, it is necessary to examine and assess whether or not the speed measured at point C can be regarded as representative for the maximum speed at point A.

4. Maximum Speed and Recorded Speed in High-Speed Dynamic Soaring

In the following, the speed recording issues in high-speed dynamic soaring are treated with several goals, yielding:

− Identifying key factors of the decrease of $V_{inert,C}$ against $V_{inert,\max}$, with emphasis on those effectuating a difference of significant magnitude

− Deriving results holding not only for a specific vehicle, but being generally valid

− Understanding the physical mechanisms causing the decrease of $V_{inert,C}$ against $V_{inert,\max}$.

4.1 Relation between Maximum Speed and Recorded Speed

The treatment of the relation between $V_{inert,C}$, and $V_{inert,\max}$ is based on the work and energy balance of the dynamic soaring loop between points A and C. It is assumed that the dynamic soaring loop is circular and the shear layer thickness is infinitesimally small, according to the graphical representation shown in Fig. 4.

The work and energy balance is given by

$$E_A - E_C = W_D \tag{1}$$

where E_A and E_C denote the energy states at points A and C and W_D is the work done by the aerodynamic drag D along the path between points A and C. The drag work along that path which is of length πR can be expressed as

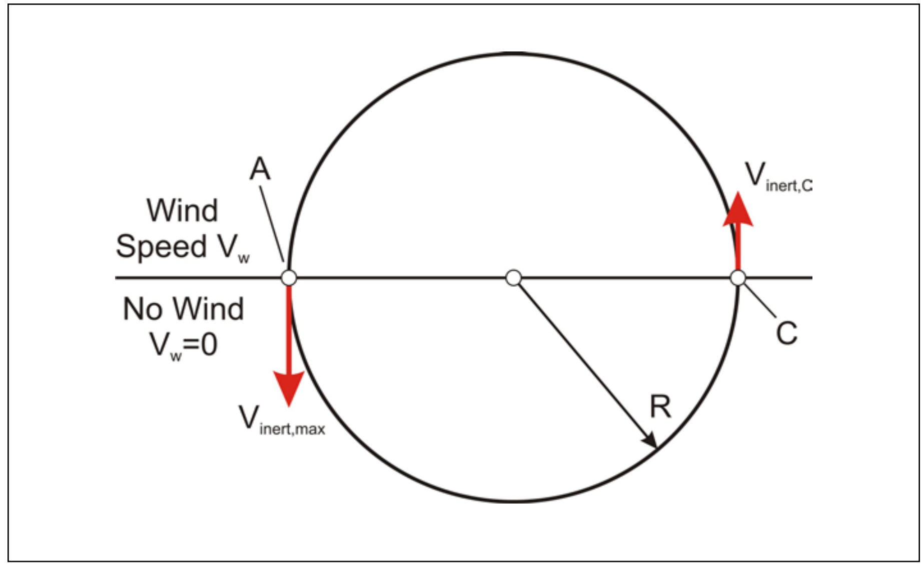

Figure 4. Modelling of dynamic soaring loop for dealing with maximum speed.

$$W_D = \pi D_{av} R \tag{2}$$

where subscript "av" denotes the average (here and in the following). The energy difference between points A and C is given by the difference in kinetic energy because the potential energy is the same at both points. Thus

$$E_A - E_C = \frac{m}{2}(V_{inert,\max}^2 - V_{inert,C}^2) \tag{3}$$

For expanding the drag work expression described by Eq. (2), the lift relation in curved flight is introduced, yielding

$$C_L(\rho/2)\overline{V}_{inert,av}^2 S = n_{av} mg \tag{4}$$

where n_{av} is the load factor. With this relation, the drag, $D = C_D(\rho/2)\overline{V}_{inert,av}^2 S$, can be written in the following form

$$D = \frac{C_D}{C_L} n_{av} mg \tag{5}$$

Using Eq. (5), the drag work, Eq. (2), can be expressed as

$$W_D = \pi \frac{C_D}{C_L} n_{av} mgR \tag{6}$$

For further expanding the drag work relation, the following expression holding in curved flight is applied

$$n_{av} = \sqrt{1 + \left(\frac{V_{inert,av}^2}{Rg} \right)^2} \tag{7}$$

Because there are large load factors in high-speed dynamic soaring (n >> 1, Richardson, 2012), this relation can be replaced by

$$n_{av} \approx \frac{V_{inert,av}^2}{Rg} \tag{8}$$

Applying that relation and accounting for

$$V_{inert,av} = (1/2)(V_{inert,\max} + V_{inert,C}) \tag{9}$$

the drag work, Eq. (6), can be expressed as

$$W_D = \pi m \frac{C_D}{C_L} \left(\frac{V_{inert,\max} + V_{inert,C}}{2} \right)^2 \tag{10}$$

Using this expression and Eqs. (1) and (3), the following result on the relation between inert $V_{inert,C}$ and $V_{inert,\max}$ is obtained

$$V_{inert,\max} = \frac{C_L / C_D + \pi / 2}{C_L / C_D - \pi / 2} V_{inert,C} \tag{11}$$

This result shows, firstly, that $V_{inert,\max}$ is basically larger than inert $V_{inert,C}$, and, secondly, that the lift-to-drag ratio C_L / C_D is key factor for the relation between $V_{inert,C}$ and $V_{inert,\max}$. Furthermore, Eq. (11) suggests that there is no other factor of comparable significance exerting an effect on $V_{inert,C}$ and $V_{inert,\max}$.

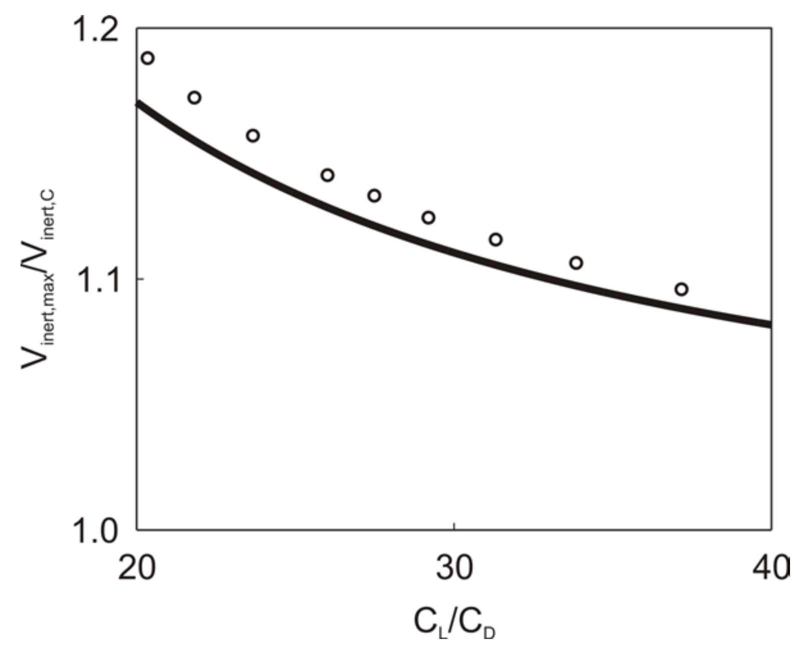

Figure 5. Dependence of speed ratio $V_{inert,max}$ / $V_{inert,C}$ *on lift-to-drag ratio* C_L / C_D.

Symbol —— Eq. (11)

Symbol ○ full optimization results (with C_L / C_D *denoting mean lift-to-drag ratio of cycle)*

An evaluation of Eq. (11) is presented in Fig. 5 which shows the dependence of $V_{inert,\max}$ / $V_{inert,C}$ on C_L / C_D . The range of C_L / C_D is selected such as to cover the values usually holding for model gliders applied in achieving high speeds. Therefore, the results presented in Fig. 5 can be considered to be generally valid for high-speed dynamic soaring.

The results show that $V_{inert,\max}$ is larger than $V_{inert,C}$, by about 7 % to 17 % in the range of C_L / C_D from 20 to about 40. These results imply for a given model glider that flying at the maximum lift-to-drag ratio $C_L / C_D = (C_L / C_D)_{\max}$ would show the smallest difference between

$V_{inert,\max}$ and $V_{inert,C}$. As a consequence, any other lift-to-drag ratio yields a higher difference.

From both a computational and practical point of view, it can be assumed that the C_L / C_D values effective in high-speed dynamic soaring deviate from $(C_L / C_D)_{\max}$. This is because results on C_L / C_D obtained by optimizing maximum-speed dynamic soaring show non-constant C_L / C_D values (Sachs and Grüter, 2018), i.e. $C_L / C_D \neq (C_L / C_D)_{\max}$. Furthermore, it can be assumed that the relation $C_L / C_D \neq (C_L / C_D)_{\max}$ also applies in actual flights, because of the high demands in controlling the vehicle. As a consequence, the effective C_L / C_D value holding in a concrete case yields $C_L / C_D > (C_L / C_D)_{\max}$. This contributes to increase the difference between $V_{inert,\max}$ and $V_{inert,C}$.

Also in Fig. 5, results are presented which were obtained by optimizing dynamic soaring for maximum speed using the complete mathematical models of the glider flight mechanics and the shear wind, as described in the preceding chapter (with outcomes presented in Figs. 2 and 3). The complete modelling results which are denoted by the ○ symbol are close to the curve determined by Eq. (11), to the effect that that both kinds of results compare well. This close agreement can be understood as a confirmation of the above treatment based on the work and energy balance that has led to the relation between $V_{inert,\max}$ and $V_{inert,C}$ given in Eq. (11).

For understanding the physical mechanisms causing the decrease of $V_{inert,C}$ against $V_{inert,\max}$, reference is made to the forces effectuating the energy state of the vehicle along the path from point A to point C (Fig. 4). The only forces in this respect are the drag, D, and the component of the weight acting parallel to the flight path, $mg \sin \gamma$ (where γ is the flight path angle).

The main influence is due to the drag because of two reasons. First, the drag, D, is acting always against the flight direction so that it continually causes an energy decrease. Other than that, the weight component, $mg \sin \gamma$, is acting in the flight direction during the downward section and against the flight direction in the upward section so that the related effects cancel each other, with the result that the net effect on the energy state is zero for the complete path from A to C. Second, the drag, D, is much greater than the weight component, $mg \sin \gamma$. This means that D has a much higher effect on the motion than $mg \sin \gamma$.

The fact that D is much greater than $mg \sin \gamma$ can be considered a characteristic feature of high-speed dynamic soaring. For showing this fact, reference is made to the drag relation described by Eq. (5). Using this relation and assuming $C_D / C_L = 1/35$ and $n_{av} = 100$ as representative values, the following result is obtained

$$D = 2.9\, mg$$

For the weight component $mg \sin \gamma$, it is assumed that $|\gamma| \approx 20°$ or smaller in the path from A to C. Thus

$$\sin \gamma < 0.34$$

Consequently, the drag is much greater than the weight component, yielding

$$D >> mg \sin \gamma$$

As a result, the drag exerts the main effect on the speed in terms of a large deceleration throughout the path from A to C. This is the physical mechanism causing the decrease of $V_{inert,C}$, against $V_{inert,\max}$.

4.2 Compressibility Issues

Compressibility is a unique aspect of high-speed dynamic soaring when compared with soaring in general. The speed level showing compressibility effects is associated with higher subsonic Mach numbers beginning at about $Ma = 0.6 \div 0.7$. This speed level has been reached now with high-speed dynamic soaring activities including the recent dynamic soaring speed record. Compressibility effects become of more significance for high-speed dynamic soaring in the future when the speed level is further increased.

There are several compressibility issues important for high-speed dynamic soaring (Lisenby, 2017). The issue under consideration is the drag rise caused by compressibility at high subsonic Mach numbers. The drag rise has a substantial impact on the lift-to-drag ratio C_L / C_D, with the result that there is a large decrease of the achievable

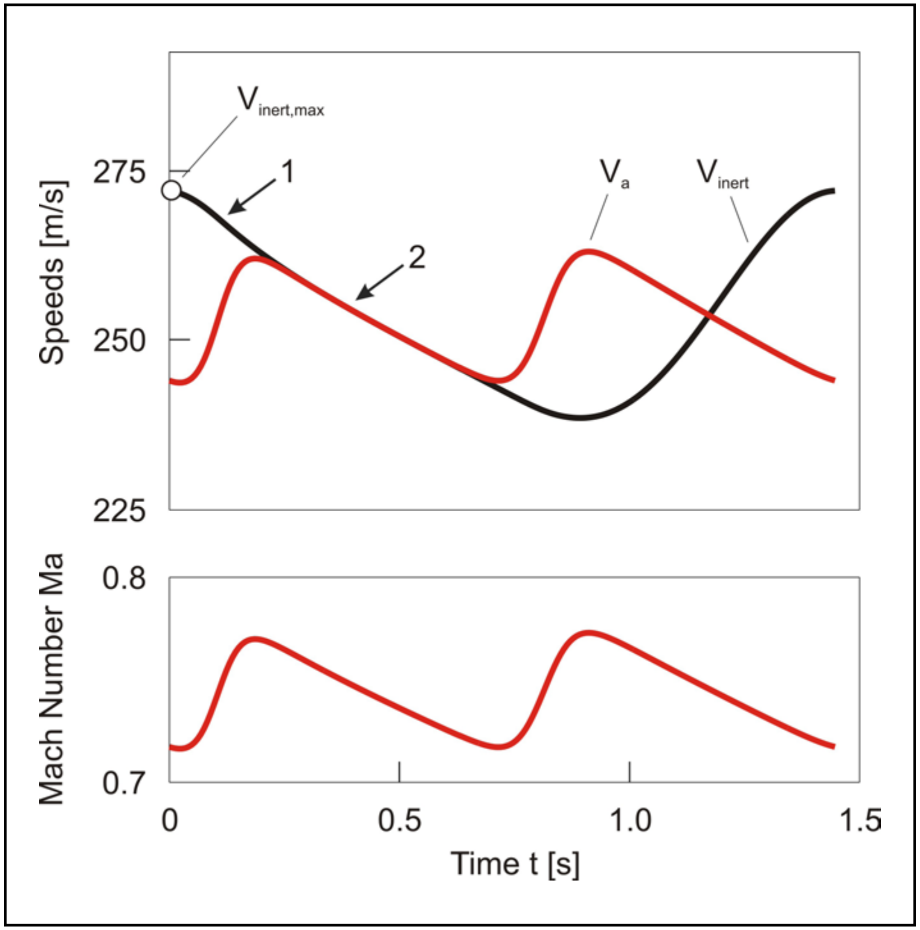

Figure 6. Time histories of $V_{inert,\max}$, V_a and M_a and during high-speed dynamic loop optimized for maximum speed.

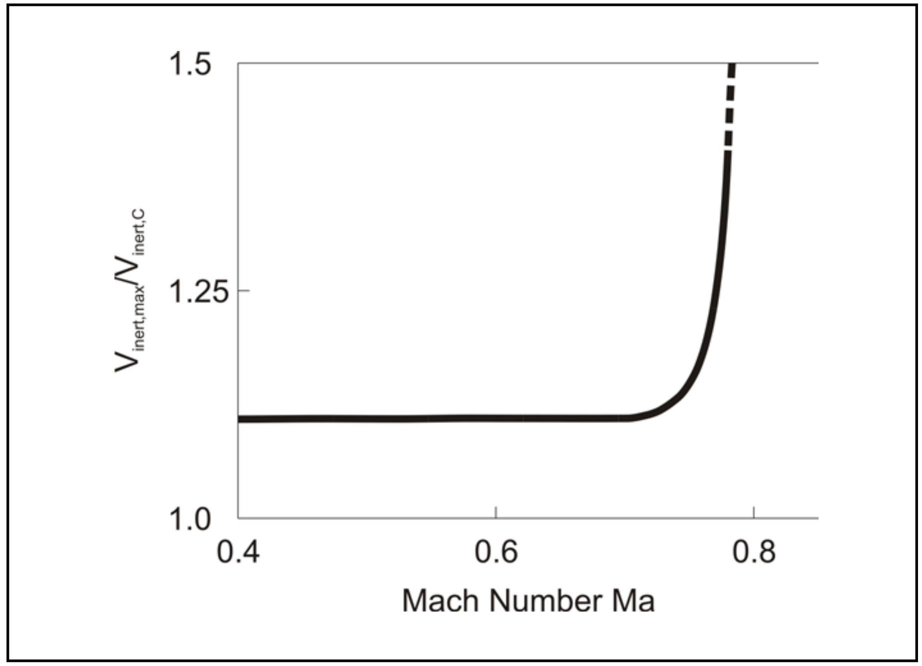

Figure 7. Effect of compressibility on the relation between $V_{inert,\max}$ and $V_{inert,C}$.

$(C_L / C_D)_{\max}$. As a consequence, the relationship between V_{inert} , V_a and M_a is correspondingly affected, according to Eq. (11).

For the compressibility issue under consideration, the relationship between the inertial speed V_{inert} which is the speed recorded by the radar gun, the airspeed V_a which is the speed relative to the moving air and the Mach number Ma which is indicative for compressibility effects is important. A representative case for that relationship is graphically addressed in Fig. 6 which shows the time histories of V_{inert} , V_a and Ma. The Mach number is determined by V_a , given by the relation $Ma = V_a / a$ where a is the speed of sound.

There are distinct differences between V_{inert} and V_a in regard to the compressibility issue under consideration. First, V_{inert} shows a higher level than V_a , particularly in the section denoted by 1, with $V_{inert,max}$ as the greatest speed at all in the dynamic soaring loop. This occurs in the wind shear layer region. There is a section denoted by 2 where V_{inert} and V_a coincide. This is in the zero wind region, corresponding with the lower part of the dynamic soaring loop. While V_{inert} shows one oscillation, there are two oscillations in V_{inert} which are nearly equal. The time behavior of the Mach number Ma follows that of V_a . Accordingly, there are also two nearly equal oscillations.

For the compressibility issue under consideration, the relation between $V_{inert,\max}$ and $V_{inert,C}$ is of primary interest. Results on this relation are presented in Fig. 7 which shows the ratio $V_{inert,\max} / V_{inert,C}$ dependent on the Mach number. These results were obtained by optimizing dynamic soaring for maximum speed, using the complete mathematical models of the glider flight mechanics and the shear wind as described in a preceding chapter. The Mach number *Ma* used for the horizontal axis relates to the mean value of a dynamic soaring loop.

The $V_{inert,\max} / V_{inert,C}$ curve can be subdivided into 2 parts, one below about $Ma = 0.7$ and the other above. The part below $Ma = 0.7$ shows $V_{inert,\max} / V_{inert,C}$ values that are virtually constant. This is the *Ma* region where no compressibility effects exist, with the results that C_L / C_D is independent of *Ma* so that it is constant. Thus, that $V_{inert,\max} / V_{inert,C}$ is also constant, in accordance with Eq. (11).

The other part of the $V_{inert,\max} / V_{inert,C}$ curve, above about $Ma = 0.7$, shows that $V_{inert,\max} / V_{inert,C}$ is not constant but increases with *Ma*. This is the *Ma* region where compressibility exerts an effect on the aerodynamic characteristics. The compressibility effect strongly increases with *Ma*. For C_L / C_D, compressibility means that C_L / C_D progressively decreases with *Ma*.

Thus, the $V_{inert,\max} / V_{inert,C}$ ratio increases in a correspondingly progressive manner, according to the relation between $V_{inert,\max} / V_{inert,C}$ and C_L / C_D given in Eq. (11). As a result, the difference between $V_{inert,\max}$ and $V_{inert,C}$ becomes increasingly larger in the compressible speed region.

This holds in terms of the relative increase, as described by the ratio $V_{inert,\max} / V_{inert,C}$. In terms of absolute values, the increase of the difference between $V_{inert,\max}$ and $V_{inert,C}$ is if even greater when accounting for the fact that each of $V_{inert,\max}$ and $V_{inert,C}$ increases with the Mach number, *Ma*. This means for using $V_{inert,C}$ as speed representative of typical speeds in the loop that $V_{inert,C}$ differs more and more from $V_{inert,C}$ when flying at a higher Mach number *Ma*.

A concrete, exemplary case can show the significance of compressibility for the relation between $V_{inert,\max}$ and $V_{inert,C}$ in an illustrative manner. For this purpose, the recent speed record of 545 mph is considered as a reference speed level. It is assumed that the speed at point C amounts to $V_{inert,C}$ = 540 mph. Furthermore, it is assumed that the $V_{inert,\max} / V_{inert,C}$ ratio is 1.15, according to Figs. 5 and 7. Then, the maximum speed would be obtained as $V_{inert,\max} = 621$ mph.

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Adaptable ballast spreadsheets using array formulae

Mike Shellim, mike@rc-soar.com

F3X pilots love ballast - it makes their models fly faster! The problem is knowing how much to add, and where to put it. One method is to use a weighing scale and CG balancer, however it's very time consuming (and not much fun). It's far more productive to use a spreadsheet!

In this post, I'll describe the principles behind the ballast spreadsheet. I'll also explain how to make it easily adaptable using a "power user" Excel technique. Finally, I'll provide links to some examples.

Development history

Before going further, I should acknowledge the work of Pierre Rondel who kindly sent me his ballast sheet for the Needle 115 a couple of years ago. I found it extremely useful, and it soon had a permanent place in my transmitter box. However, when I tried to adapt it for my new Stribog, I found that the Excel formulae would break if the spreadsheet was altered.

To get round this problem, I redesigned his sheet with a simpler structure, and using *array formulae* <https://support.office.com/en-us/article/guidelines-and-examples-of-array-formulas-7d94a64e-3ff3-4686-9372-ecfd5caa57c7>.

The result is a spreadsheet which is easy to maintain and adapt.

Needle 115 ballast and spacers

Benefits of a ballast sheet

My Stribog is a good example of a model which benefits from a ballast spreadsheet. It comes with a ballast tube in the fuselage (10 slug capacity), and a lightweight carbon wing joiner. I also have the optional steel joiner - a massive lump weighing 1.3 kg. Crucially, the joiner is located ahead of the target CG, so switching between the steel and carbon joiner necessitates some juggling of slugs and spacers.

	Model (dry)	Steel joiner	REAR <<-- fuselage ballast --->> FRONT										Outputs				
			1	2	3	4	5	6	7	8	9	10	Total wt (g)	CG (mm)	Delta (mm)	Loading (g/dm^2)	Loading (oz/ft^2)
Component Wt (g)	*2424*	*1220*	*77.8*	*77.8*	*77.8*	*77.8*	*77.8*	*77.8*	*77.8*	*77.8*	*77.8*	*77.8*					
Component CG (mm)	*106*	*87.5*	*268*	*232*	*196*	*160*	*124*	*88*	*52*	*16*	*-20*	*-56*					
	1												2424	106.0	0.00	39.8	13.0
	1						1	1					2580	106.0	0.00	42.4	13.9
	1					1	1	1	1				2735	106.0	0.00	44.9	14.7
	1				1	1	1	1	1	1			2891	106.0	0.00	47.5	15.6
	1			1	1	1	1	1	1	1	1		3046	106.0	0.00	50.0	16.4
	1		1	1	1	1	1	1	1	1	1	1	3202	106.0	0.00	52.6	17.2
	1	1	1	1									3800	106.0	-0.04	62.4	20.4
	1	1	1	1	1					1			3955	106.0	-0.04	64.9	21.3
	1	1	1	1	1	1			1	1			4111	106.0	-0.04	67.5	22.1
	1	1	1	1	1	1	1	1	1	1			4266	106.0	-0.04	70.1	23.0

Screenshot of ballast spreadsheet for Stribog

Stribog F3F

The spreadsheet has:

- Identified the ballast configurations which maintain the CG within +/- 0.5mm of the target cg. This is necessary in order to maintain the same pitch trim regardless of ballast - a key requirement for F3F racing (the last thing you want is to have to fiddle with the elevator trim!).
- Discovered a “gap” in loading from 53 to 62 g/dm^2 when transitioning from fuselage ballast to steel joiner.
- Verified that the loading is always within the FAI limit.

I was lucky that the target cg could be maintained without variable nose weight, but if necessary the spreadsheet could have been modified with an extra column for this.

Hopefully I’ve persuaded you of the usefulness these sheets, so let’s now see how to design one.

Planning the spreadsheet: identifying components

For the purposes of creating a ballast spreadsheet, we consider the model as a collection of *components*. Each component has a weight (Wt), a quantity (QTY) and a centre of gravity (CG). Each component will end up as a column in the spreadsheet. The first task is to identify all the components

The first component is the *empty model*, that is: the plane ready to fly but without ballast. There's only one empty model, and it's mandatory (obviously!) so we always have QTY = 1 in this column.

- CG = CG position
- Wt = weight
- QTY = 1

By convention, the reference position for the cg is the wing root leading edge

Next, consider *fuselage ballast*. This will consist of a combination of slugs and spacers arranged in a tube along the fuselage axis. Each ballast location has a unique cg and therefore counts as an individual component, with its own column in the spreadsheet. For each individual slug:

- CG = CG of slug, from root leading edge.
- Wt = weight of slug
- QTY = 1 (slug) or 0 (spacer)

Note: it's easy to calculate the CG given the slug's position in the tube, the location of the tube, and the length of a slug. The slug position can be specified in an extra row in the spreadsheet. For an example, please see Stribog sheet (link at end).

Finally, consider *wing ballast*. This is normally carried in pockets aligned perpendicular to the fuselage axis. Each pair of left/right pockets is treated as a single component (since they share the same CG).

- CG = distance of pocket centre-line to root leading edge
- Wt = weight of a "standard" slug
- QTY = number of slugs in the pocket. Fractions can be used to represent non-standard slugs.

The same idea can be used to represent other types of component such as special ballast pockets for fine tuning of CG, steel joiners etc.

Equations for weight and CG

Two key outputs are Total weight and overall CG. These will depend on the QTY of each component.

If there are N components, the total weight is:

Total weight = SUM(Wt1*QTY1 + ... + WtN*QTYN)

The overall CG is the sum of the moments about the wing root leading edge, divided by the total weight:

CG = SUM(Wt1*CG1*QTY1 + ... + WtN*CGN*QTYN)/Total weight

These equations map easily to Excel formulae.

Spreadsheet structure

We start with an "Inputs" block, for basic dimensions and weights.

Lower down is the main "Components" block:

- Each column represents a component
- The first two rows contains the component Wt and CG
- Subsequent rows contain various combinations of QTY for all the components. In other words, each row defines a particular ballast configuration.
- Extra columns hold the outputs e.g. overall CG, total weight, wing loading etc.

CG calculation using standard and array formulae

There are two types of Excel formula: *standard* formulae are what most users will be familiar with. *Array* or *“CSE”* formulae are less used, but very powerful.

First, here’s the CG expressed using a standard formula. Each individual component contributes a term to the formula:

```
=((C23*$L$16)/(J23+$L$4)*$F$14)+((D23*$L$16)/(J23+$L$4)*$F$15)+((E23*$L$17)/(J23+$L$4)*$F$16)+((F23*$L$17)/(J23+$L$4)*$F$17)+((G23*$L$18)/(J23+$L$4)*$F$18)+((H23*$L$18)/(J23+$L$4)*$F$19)+((I23*$L$18)/(J23+$L$4)*$F$20)
```

Typical CG calculation using standard Excel syntax

There are some obvious issues with this approach. First the formula is tricky to construct (lots of terms, and lots of clicking). Secondly if a component is added or deleted the CG formula will break.

Here is a CG calculation expressed as an array formula:

```
{=SUM(B$26:M$26*B28:M28*B$27:M$27/N28)}
```

CG calculation using array formula

The formula is short and expressive - the cell ranges refer to complete blocks of QTY, Wt and CG values. Also, the cell ranges adapt as columns are inserted or deleted - this makes it easy to amend a sheet for a different type of model, or to add, say, a corrective pocket in the nose or tail.

To make an array formula, terminate it with Ctrl+Shift+Enter (note curly brackets { } are added automatically).

For more info on array formulae, see array formula examples and guidelines. <https://support.office.com/en-us/article/guidelines-and-examples-of-array-formulas-7d94a64e-3ff3-4686-9372-ecfd5caa57c7>

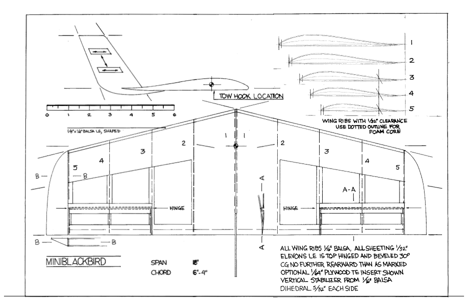
From my brief experiments, array formulae are supported by most Excel-compatible apps, including Google Sheets (available free with your Google account), and OpenOffice.

Sample spreadsheets using array formulae

- Stribog Mk 1 (fuselage ballast) <http://rc-soar.com/files/spreadsheets/stribog_mk1_ballast.xlsx>
- Needle 115 (wing ballast) <http://rc-soar.com/files/spreadsheets/N115_ballast.xlsx>

Remember to alter the input data for your particular model.

Always check on a CG scale before flying!



In the December issue!

A complete description of the 18" span version of Jochen Boy’s MiniBlackbird.

Full size PDF plans will be available through the Supplements section of the RCSD web site.

A non-programmer wades into Taranis

It's powerful but not easy, in contrast to the Spektrum ease of programming that other transmitters will emulate within a few years. I make it work and give it the boot.

By Philip Randolph, amphioxus.philip@gmail.com

There is a sub-species which claims to be human but which is actually the evolutionary bridge from ugly-sacks-of-mostly-water to silicon-based life forms. You can tell these beings because they get along well with programming. Like, they understand their iPhones without asking their little sister.

(Yep, I have.)

Supplied with something like the Taranis 9D Plus or QX 7 and the free download OpenTX Companion these semi-digital beings wade into each, poking buttons and switching screens with near instant navigational intuition.

It's like ducks swim and we cats mostly don't, although my family's favorite Siamese tom, Mao, 'cuz that's what he said, followed my siblings back from a small island in north Puget Sound, swimming. So if Mao can swim to adopt a family, you and I should be able to swim through OpenCompanionTX to adopt a Taranisaurus without wrecks.

As the dominant slightly antiquated species, here's how to do it. Find a neo-species nerd buddy and ask. Seriously. I was getting nowhere. After a couple hours with transitional species person Rick Jay I get it. Amazing. Which shows a difference in learning styles. Some folks are explorers, and some are emulators. A lot of us just need to watch how it's done. This ends my brief lecture on evolutionary psychology. Gawrd.

Quick pros, cons, and a decision to leave Taranis to them what likes this sort of thing:

Pro: “Open TX is like a fine wine. It’s gotten better and better with age.” – https://www.youtube.com/watch?v=f0bFTYrH8l4

Con: “Damn. I can’t get both ailerons on a motor glider. I downloaded a program from the 9D+ and it won’t work on the QX 7 because the extra switch isn’t there.” – This by a Taranis expert on a ridge in Eastern Washington.

Spoiler: I made it work. Then I said, “Too much trouble.”

Why I’m qualified to write about Taranis: It’s because I’m not good at this sort of stuff.

Guys who know too much often fail to answer the most basic questions. How I swore at my JR 9303, and its manual which assumed you knew what to do next when you entered flight mode programming. It didn’t say that within each mode-switch position you just change trims and it sticks. Durn basic information.

Well, I also swore at its pre-assigned switches and significantly different programming and channel order for its Acro and Glider modes.

The state of the art and the trend toward ease of programming. Transmitters are getting better, but. Why to get good at updating your firmware on your Taranis’ XD card. Spektrum vs. OpenTX.

Transmitters and receivers are getting more capable and easier to use. Spektrum is leading ease of programming. You just click through a bunch of icons to indicate whether you have flaperons, elevons, V-tails. And then you apply the usual endpoint adjustments, differentials, dual rates, and so on.

All transmitter manufacturers are slowly following suit. Some more slowly than others. But I expect that within a few years even OpenTX will emulate how Spektrum does it.

Currently it’s much like the fight between early MS DOS/Windows and Mac. Early PC advocates would talk about the great flexibility and capability of having MS DOS command lines. As Microsoft adopted the look and feel of Macs it became evident that ease of use could be compatible with capability. So it is with Taranis versus Spektrum. Spektrum has been showing that ease of programming doesn’t mean less flexibility or capability.

Like with Apple, Spektrum’s OS only operates on its own hardware, while like with DOS and Windows working on a host of brands, OpenTX can be installed on a few brands of transmitter. Also similar to Apple versus PC, Spektrum’s prices are roughly double those of similar Taranis. For those who wish to spend more time flying than fussing, Spektrum is probably well worth the extra bucks.

Chinese and Taiwanese manufacturers are nipping at the heels of the old established firms. That's probably why Spektrum prices have dropped to halfway between prices for Futaba and Graupner or pre-bankruptcy prices for JR, and the relatively low prices of Taranis, Jumper, Orange, Turnigy/FlSky and so on.

But it can't be too long before the inexpensive imports copy ease of use features and add functionality. It's just programming.

Even quality may improve. The Jumper TSG8 Plus has Hall Effect gimbals and multiprotocol chips that allow it to control a variety of 2.4 and 5.8 MHz models, including Spektrum's DSMX, all for about $130. So Spektrum only currently leads the race to straightforward programming.

Part of Spektrum's market approach has focused on a simple PnP (Plug and Play) interface with parent company Horizon Hobby's DSMX and DSM2 2.4 MHz flying things. It's not a unique strategy so it's not a horizontal monopoly, but it's a good market move.

Taranis does have the standard JR module bay, so with a Spektrum module you can indeed fly your DSMX or DSM2 stuff.

If you're pairing a Spetrum Tx with one of the planes in your hoard, initial setup is superbly easy: You click through a bunch of pictures of virtually every airplane planform imaginable. Flaperons? Click. V-tail? Click.

Taranis does part of that. Setting up a plane you get similar screens, but not so many. If you want flaperons you have to do a mix. The way to figure out that mix is to copy a template of a model that has such a mix from your tech buddy onto your computer and add it to the models in OpenCompanionTX. Then you can duplicate it, rename it, tweak it and put it into your radio, where you can adjust trims and such. Having the template you may even figure out how to do such mixes yourself. But if you just want to fly stuff like, now already, that's comparatively a bit of a pain.

The promise of updatable firmware: in a couple years your Taranis (or other Tx that uses OpenTx) will be better.

There is blight at the end of the tunnel. Or light, depending on your perspective. Taranis (and the others) will catch up. That's why you want to get comfortable with downloading the latest firmware to its SD card. At some point you'll be able to simply click to get flaperons. When that happens, will the old-guard companies survive? They'll probably be forced to lower prices and more foreign manufacturing.

In the meantime, Taranis is still an incredibly capable radio line, great for the transitional species nerd, with durn reasonable prices.

Connecting Taranis to your computer

The Taranis stores its internal programming interface as firmware on its SD card, as well as up to 250 models.

When you follow the 'three-finger-salute' procedure (different for the Horus) to connect it to your Mac or PC it shows up as two drives. One will be labeled Taranis. The SD card shows up as an unnamed USB drive. You can open each as a window on your computer. You are looking right inside your transmitter via regular computer windows.

Important: When you want to disconnect your Taranis from your computer, eject both drives first. Then unplug the USB cable.

How to update the firmware on your Taranis SD card

Before updating firmware, do back up copies of your old firmware and models onto your computer. In companion the file handling buttons are on the left. Explore them.

In my PC laptop, in a personalized folder in 'Documents' I have a folder 'Taranis X9D+,' with a shortcut on the desktop. I made folders for radio backups, firmware backups (Open TX), and model templates from semi-digital life forms. The Companion 2.2 and Firmware Simulator 2.2 software will have installed in Programs (PC) or Applications (Mac).

I'm not going to tell you how to install the latest firmware on your Taranis. Instead, do what this guy says:

https://www.youtube.com/watch?v=YZVtGIX4zTc

Or, in OpenTX Companion if you check the 'Edit Settings' gearwheel icon, at the bottom of the page you'll see a checkbox, 'Offer to write FW to Tx after download.' Make sure you've correctly listed your transmitter so you get the right firmware. Then under the 'File' pull-down menu you can click 'Download.' Pretty streamlined.

Hardware, firmware, software, batteries

FrSky builds the transmitter and receiver hardware. The firmware on the SD card and the Open-TX Companion software for Mac, PC, or Linnux are open source, developed by a separate team of programmers that accepts feedback from users.

Taranis may also be run with FrOS, FrSky's operating system. But most use OpenTX.

Open TX also works on the Turnigy/FlySky 9X series and the DIY – Mega2560.

All the FrSky Taranis use the same OpenTX firmware and OpenTX Companion software, from the QX 7 to the Horus X10. The QX 7 doesn't have sliders and doesn't have as many switches as the fancier versions.

Even the 9D Plus only comes with a NiMH battery. To upgrade to a LiFePO4 or a LiPO, search the web. There are numerous YouTubes on this subject. It generally takes soldering the right connector to the radio onto the new battery.

I have a Taranis 9D Plus, also known as the FrSky Taranis Plus. Some years back JR sold the molds for its JR 9303 to FrSky. FrSky changed the buttons, but otherwise its physically identical, and the same battery will fit.

Buttons

The buttons on the Horus are more intuitive than on the X9D+. Holding the MENU button on the X9D+ gets you back to radio setup from model setup. Exit gets you to model setup. In the Horus the 4-way button on the left is explicit.

Crucial weird basic disambiguation: In 'Radio Setup,' 'Channels' refers to the sticks, so RTAE is standard Mode 2, with Rudder and Throttle on the left stick, Ailerons and Elevator on the right stick. (What they call 'Channels' should be 'Sticks.' Duh. But in 'model' setup, 'Channels' refers to the channel order on your receiver.)

Hall Gimbals?

The fancier version of the QX7 comes with Hall Gimbals. These offer finer control and don't wear out like potentiometers do. But I asked veteran DLG (discus launch glider) competitor Adam Weston whether they are worth it. He said, "You'll have to put a whole lot of hours on a radio before you start to notice." Certainly my somewhat aged fingers don't have the sensitivity to tell the difference.

I opine to readers: You might as well save your bucks. Though you won't, because you want them.

Okay, my JR 388S, very well used when I got it in 2000, did get a minor pot glitch in the right stick.

Goofy Rx pins No Battery connector

Ostensibly to save space, the X series of FrSky receivers doesn't have a separate set of pins designated as 'Batt.' I bought a little pile of Y connectors. Rick Jay removes the case and solders on a two-wire JR style lead. If you're running an ESC it plugs onto the Throttle pins, so no Y connector needed. And if you use the S-Bus connector it's not a problem. But: what what? Silly.

Telemetry

Wild! For around $20 or $25 you can get a telemetry receiver that will notify you of battery voltage and signal strength. And you can hook up a variometer or GPS and more.

Assignable switches and cross elevator trim!

The problem with actively using the elevator trim while flying is that one has to take ones thumb off the right stick. The Taranis has assignable switches. Rick Jay assigns the elevator trim over to the throttle trim. Who uses throttle trim anyway? Then you can adjust it with your left hand while flying with your right.

Back on my old JRs one couldn't assign switches. On a slope flyer when skimming over sage brush it helps to be able to do fine adjustments to subtrim, because thumb control is often anything but fine. Sometimes I'd mix a bit of fine elevator trim onto the throttle stick. That worked great, in spite of the lack of centering. On the X9 you could do the same with the left slider.

Amber Sound Pack for v2.2

The Taranis will talk to you. It will tell you when your battery gets low or when you switch between flight modes. You can tell it when to say what. You can even load you own voice swearing at yourself, so you don't have to when you are in the field and things go south.

An Aussie gent had his wife, Amber, record alerts for the Taranis. I equipped my D9+ with Amber.

But me, I'd really like a sound pack with a voice like a fishwife. Maybe something like the many robot wives of Harold Mudd off that old Star Trek episode. It would make me laugh every time.

Amber doesn't sound like a wife. Her voice is very popular among males. Download at:
http://open-txu.org/home/version-2/v2-2-resources-2/

Epilog:

Now, I fly mostly slope stuff, and LiFePO4 and LiPo batteries have gotten so dependable with such amp hours that I don't need battery telemetry. Nor any of that other telemetry, which is a big attraction of the Taranis for them what wants that sort of stuff.

Thermal flat-field flyers and competitors really do need the subtlety and features of a truly complex transmitter, and the various telemetry options. About half the guys at the local field use Taranis. The others use the fancier Spektrums.

As said, I made my Taranis 9D+ work. I downloaded a program and applied it to a glider. Then I said, "This is too much trouble. I'll stick with my old JR 9303."

I found a subspecies nerd guy currently in the evolutionary process of bridging the gap from meat-based to silicon-based life forms. He appreciates it, perhaps quasi romantically.

Skip that.

TMI.

Redact.

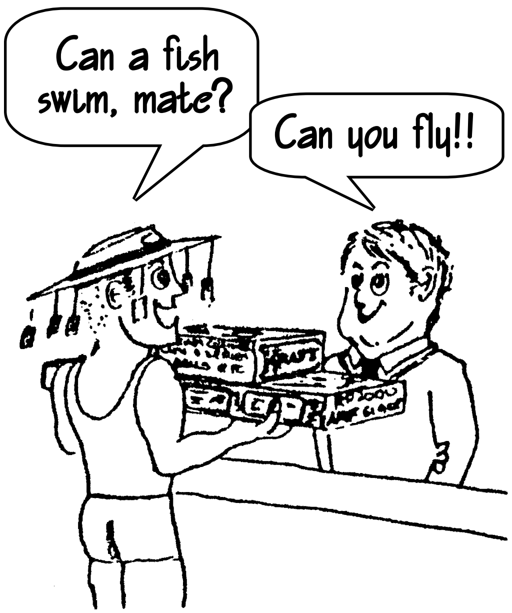
Action:

Sold down the river.

From *Aspectivity*,
the newsletter of the Victorian Association of Radio Model Soaring (VARMS)
via *DELTA*, the newsletter of the Versmold Germany, Reinhard Werner, Editor

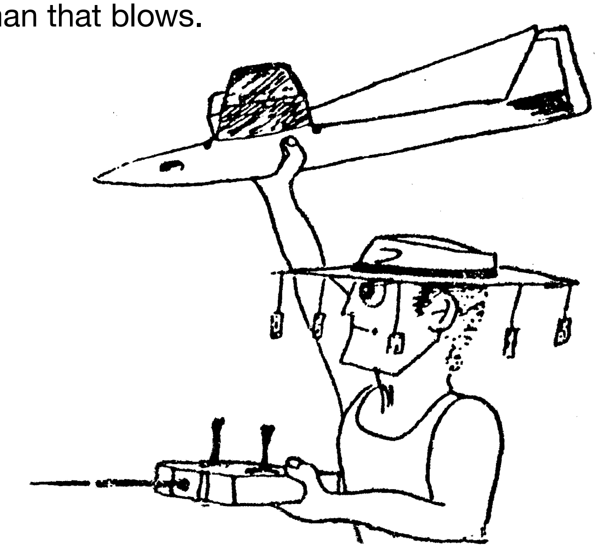
Mulga Bull's soarer

With abject apologies to Banjo Patterson



’Twas Mulga Bill, from Eaglehawk, that caught the soaring craze;
He put away the old golf clubs that served him many days;
He dressed himself in soaring clothes, resplendent to be seen;
He hurried off to town and bought a shining new machine;
And as he eased it through the door, with glory in his eye,
The grinning shop assistant said, “Excuse me, can you fly?”

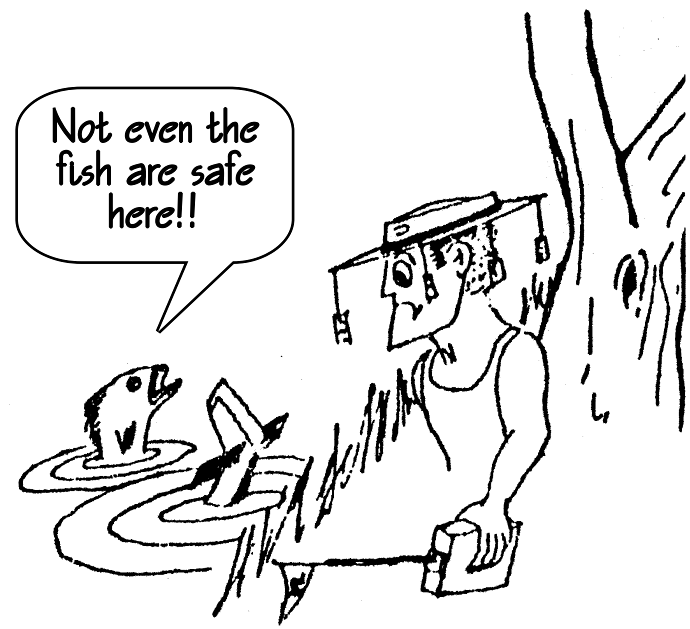
“See here, young man,” said Mulga Bill, “from Walgett to the sea,
From Conroy’s Cap to Castlereigh, there’s none can fly like me.
I’m good all round at everything, as everybody knows,
Although I’m not the one to talk - I hate a man that blows.



“But flying is my special gift, my chiefest, sole delight;
Just ask a wild duck can it swim, a wild cat can it fight.
There’s nothing clothed in silk or film, or built of wood or foam,
There’s nothing glides or flits or soars, or calls the air its home,
But what I’ll fly while wings will hold and rubber bands are tight;
I’ll fly this here two-winged concern right straight away at sight.”

’Twas Mulga Bill, from Eaglehawk, that sought his own abode,
That perched above the Dead Man’s Creek, beside the mountain road.
He aimed the soarer down the hill, assembled for the fray,
But ‘ere he’d flown a dozen yards it bolted clean away.
It dropped its nose, and through the trees, just like a silver streak,
It whistled down the awful slope towards the Dead Man’s Creek.

It shaved a stump by half an inch, it dodged a big white-box;
The very wallaroos in fright went scrambling up the rocks,
The wombats hiding in their caves dug deeper underground,
And Mulga Bill, as white as chalk, he followed every bound.
It struck a stone and gave a spring that cleared a fallen tree,
It raced beside a precipice as close as close could be;
And then, as Mulga Bill let out a last despairing shriek,
It made a leap of twenty feet into the Dead Man’s Creek.



’Twas Mulga Bill, from Eaglehawk, that stood upon the shore;
He said, “I’ve had some nearer shaves and lively rides before;
I’ve rode a wild bull round a yard to win a five pound bet,
But this was sure the darnedest thing that I’ve encountered yet.
I’ll give that two-winged outlaw best; it’s shaken all my nerve
To see it whistle through the air and plunge and buck, and swerve,
It’s safe at rest in Dead Man’s Creek - we’ll leave it lying still;
A horse’s back is good enough henceforth for Mulga Bill.”

Dedicated to all of you who remember just how Mulga Bill felt.

Test Flights of 4-Meter Size Contemporary Scale Gliders Fitted with Homemade Winglets

Joe En-Huei

Introduction

Properly designed/installed winglets are known to minimize the wingtip vortex strength effectively and thus the efficiency of glider wings can be improved. In addition, a glider is perhaps more appealing when the long wings are fitted with winglets.

Since the air pressure on the bottom of the wing is higher, the air (at the wing tip area) tends to flow outward then upward to the top of the wing where the air pressure is lower. From there, the airflow is drawn inward by the wake trailing behind the glider in flight. Airflow at the wing tip is given a momentum of rotation and thus vortex is formed. Vortex tends to rotate counterclockwise at the right wing tip and clockwise at the left wing tip (when observing from TE toward LE). For full-size gliders, wing tip vortex accounts for large energy loss especially at low speed range.

The concept of adding winglets to scale glider wings comes from the full- size gliders. Winglets often work only at the low to middle speed range on full-size gliders. At high speed, the winglets often create a lot of drag and become inefficient. It appeared that winglets minimize the airflow on the outer side of the wing tip from being drawn into the wake trailing behind the glider (thus tendencies of airflow to rotate is minimized) resulting in less energy loss.

I added homemade balsa winglets to several 4-meter electric scale gliders (a Roebers Discus, a Roebers ASW-24 and a

The e-power Roebers ASW-24, one of the large scale sailplanes evaluated with homebuilt winglets.

Rodel ASK-21). Test flights indicated improved wing efficiency mainly for non-aerobatic flight.

Based on a limited study on winglets (full-size and model, see references), I found the winglets design to be quite complicated and perhaps only experts can comprehend the theory of what is really going on. However, the rule of thumb on basic winglets elements for gliders are discussed below:

Winglets Alignment

Some 4-meter size scale gliders such as EMS DG-800, EMS Albatross and Graupner ASW-22 Vario come with molded winglets (nearly vertical type). Measurements of winglets alignment (between chord line at winglets base and centerline of fuselage) on these planes indicate there is a slight toe-out ranging from about 3 to 5 degrees. The toe-out angle is often set to be parallel to the airflow at the wing tip. Pilots of these planes around the world report great performance in thermals. I think that my homemade winglets (nearly vertical type) could be toed-out slightly perhaps 3 degrees as a starting point. It appeared that the purpose of adding winglets to scale glider wings is mainly to improve the stability/handling at low speed.

Some experimental winglets are canted-out (varies from about 10 to 30 degrees from vertical) on full-size sailplanes. These winglets are also toed-out slightly at the base. Wings on full-size gliders are quite flexible and slightly canted-out winglets often become vertical in flight. In addition to minimizing wing tip vortex strength, some winglets on full-size sailplanes also create a forward thrust and can further increase L/D ratio. Some winglets are curved such as LS-8's, LS-9's, LS-IO's and Buzzard's (multiple-element design i.e. wing tip feathers). The toe-out on the winglets is very subtle.

The nearly vertical type winglets are much easier to install and align and is the type that I experimented with. The curved, canted-out and other type winglets are much more complicated to fabricate and align.

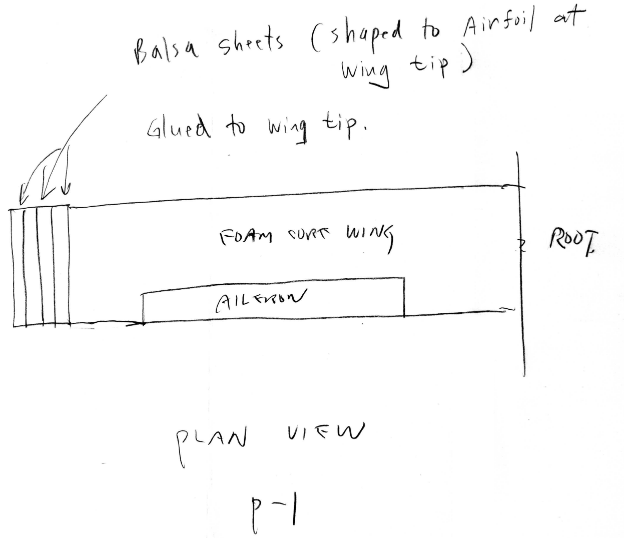
Winglets Geometry

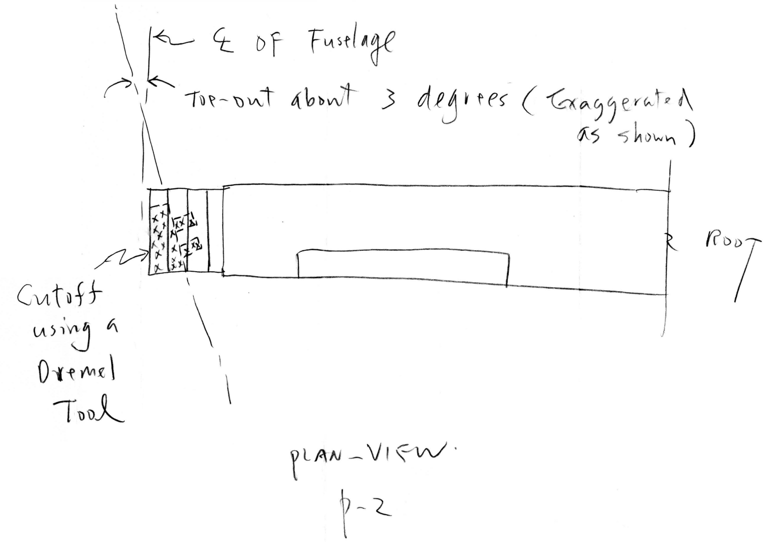
The geometry of the winglets on the models is more or less copied from the full-size gliders. Typical winglets have a swept backward and upward configuration. In general, the trailing edge of the winglets at the base and the trailing edge of wings at the tip could be flush. Normally, the leading edge on the winglets is step-tapered and the trailing edge is straight. The leading edge of winglets at the base is often slightly behind the leading edge of wing tip but they could be flush. There are few other winglets with fancy geometry such as some unique scimitar shape winglets are used for full size sailplanes (see in-flight photos of full-size sailplanes - Ventus and ASW-27 @ 1997 15-meter Nationals, courtesy of George Penokie, Paul Remde & SSA).

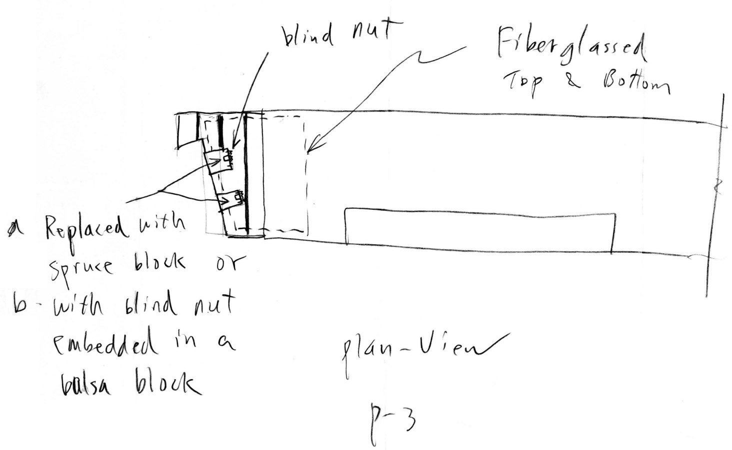
Winglets Profile

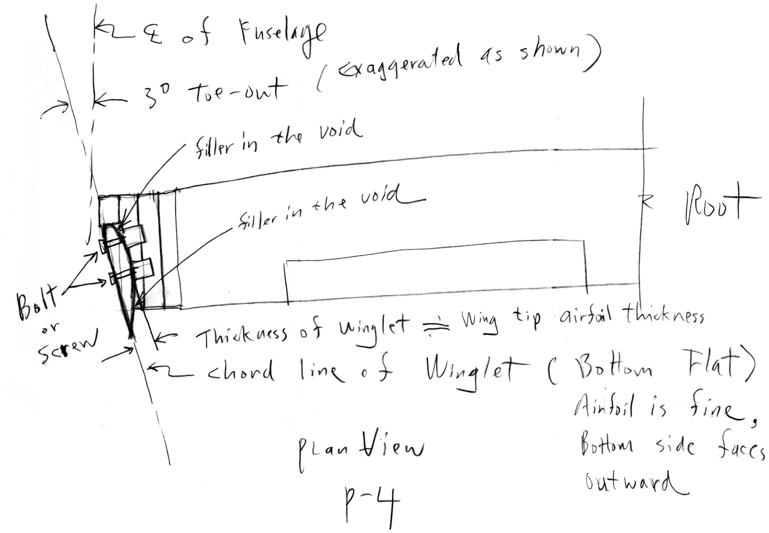
The profile of winglets at the base and the profile at wing tip are somewhat similar (slightly undercambered, virtually bend the regular wings 90-degree upward at the wing tip and you get the primitive winglets). In addition, twist and turbulator tape are also incorporated in the design to get the optimum performance. For these nearly vertical molded winglets, the maximum toe-out angle is at the base. The toe-out angle gradually tapers off to almost nil at the tip of winglets (thus the so- called "twist-in"). The thickness of airfoil at the wing tip and the thickness of winglets at the base are about the same.

For simplicity, my homemade winglets are made of balsa plates laminated and shaped to a "low speed" bottom flat airfoil with a toe-out at about 3- degree (no twist). Because the winglets are relatively small plus the typical built-in twist is subtle; perhaps it is OK if my homemade winglets are free of twist. My homemade winglets have a slightly "negative" incidence angle (toe-out 3 degrees) and therefore would not stall sooner than the wings do, especially at a low speed range. It is noted that the flat side (bottom side) of the homemade winglets faces outward such that







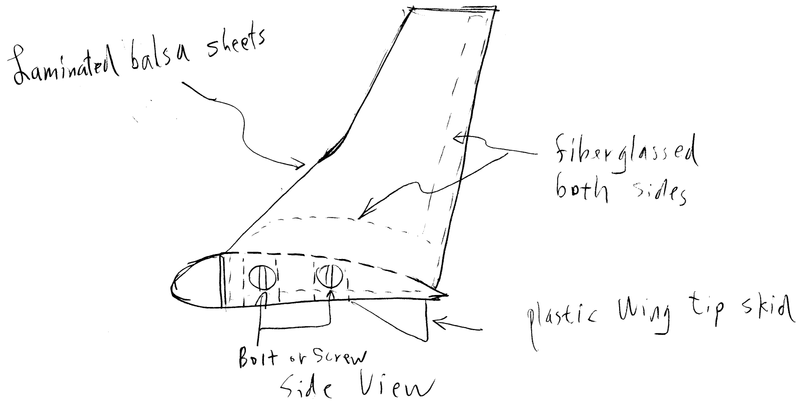


an inward lifting force is created in flight. The winglets are fiblerglassed (only at the base) and covered with heat-shrink film.

A few latest ARF scale gliders have an airfoil on the winglets compatible with the twist-in. These molded winglets can be plugged in and out at the wing tip.

Winglets Installation

I simply bolted the homemade winglets to the wing tip balsa block also reinforced with fiberglass. The winglets base and wingtip balsa block are nearly perpendicular to each other without a curved transition as typically seen on the molded winglets. I have included some installation diagrams and they



P-5

should be self-explanatory. The dimensions of the winglets: about -inch thick, about 2.5-inch at the base from LE to TE and about 3.5-inch from base to tip. The additional weight of winglets is nil for 4- meter size gliders.

Test Flight

I have been flying my 4-meter electric Discus, ASW-24 and ASK-21 (without winglets) regularly on weekends for about 3 years and I know their flying characteristics very well. These sailplanes have a wing loading at about 20 to 22 oz/sf and the wings are of foam core construction. I think these planes are among the greatest in 4-meter size. I have been flying these planes for a long time and I can tell any subtle changes in flight after fitted with winglets. Winglets can further improve the efficiency of glider wings as evidenced by the following:

- Stall characteristics become more docile.
- Tight thermal turns can be done easier and tendencies of associated skid/slip are minimized.
- Aileron controls become more responsive especially at low speed.
- Model can track better when flying upwind in gusty conditions.

Test flights show winglets are more effective on the Roebers ASW-24 and Discus and are less effective on the Rodel ASK-21. Wing planform, wing loading, incidence angle, wing airfoil, dihedral angle, wing flex in flight, aspect ratio of wings, washout angle, tail boom length and many other factors perhaps also have an effect on the performance of winglets. I performed mild aerobatics on my test planes and found the winglets to be sturdy.

At one occasion, a flying club member recommended test flew the Roebers ASW-24 with only one winglet on the right wing and so we did. The results were quite interesting that the left wing became draggy in flight and I had to reset the trims on rudder and opposite ailerons in order to maintain a level flight. It was evident that the right wing was more efficient than the left wing because the left wing stalled sooner than the right wing did.

In fact, I also test flew the Roebers ASW-24 with slightly toed-in (2 degrees) winglets and similar improvements on low speed handling were noticed but the toed-out winglets were more effective. However, test flight of a 2.3 meters electric Salto indicated instability (very difficult to fly) when fitted with slightly toed-in winglets. The Salto became docile to fly after removal of winglets. Subsequently, slightly toed-out winglets were added to the Salto and improvements on low speed handling were found.

It is noted that the wings on the 1/4 EMS Nimbus-4 have an upward break (about 65-degree from vertical) near the wing tip fitted with an aileron. Herr Scheifele (owner of EMS) said this aileron should only deflect upward (for the lower wing) and stay neutral (for the upper wing) during turns. This special wing tip break is intended to optimize the performance in tight thermal turns and during high-speed runs.

Conclusion

Limited test flights show that simple homemade winglets can improve 4-meter scale gliders' handling at low speed range. The improvements are noticeable but the effect is not quantified. Winglets (nearly vertical type with bottom flat airfoil and no twist) work fine when the alignment is toed-out slightly. I am surprised that the relatively small winglets can achieve so much.

For optimum design of winglets on scale gliders, complicated computer analyses i.e. flow analyses/pressure distribution and test flights with performance measurements are desirable but I will leave it to the experts to tackle.

The 4m Roebers ASW-24 and the 2.3 meter Salto mentioned in the text.

References:

I. Winglet Design for Sailplanes, 1991, Peter Masak.

2. Feedback from Robin Lehman and Ian Lynall.

3. Interview with Martin Simons, August 1996, *RCSD*, Steve Savoie.

4. On the Winglets, Martin Hepperle's web site.

5. On the Winglets, DG Flugzeugbau's web site.

6. Fascination Nurflugel, 1995, Hans-Jürgen Unverferth.

7. My own interview with several full-size and scale glider pilots.

FaceBook PSS.Power.Scale.Soaring

Some pictures of our PSS meeting at Cap Blanc Nez (France)

29/30 September 2018

Francois Gierszal, facebook.com/francois.gierszal


SMOKEY
Stover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E9


AERONCA


C3


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G-AAPN

DTOC

2018 AWA State Thermal Championships

Nigel Molyneux, molyneux.n@gmail.com

The Time:	Sunday 2nd September 2018
The Place:	KAMS Club, Oldbury, Perth WA
The Field:	Lush, green and soft
The Reason:	The 2018 AWA Thermal State Championships for F3J and F5J Classes
The Weather:	24°C, sunny, blue skies, occasional clouds, light Easterly breezes
The Boss:	CD Ian Salau
The Lackey:	Assistant CD Nigel Molyneux
The Ring-in:	Mr. Steve “IMAC” Maitland
The Jnr Ring-in:	Blair “can beat Dad” Maitland
The Surprise Entry:	Old School Scale boy from KAMS, Mr. Greg McClure
The Master Chief:	KAMS President Dave “The BBQ King” Trewarn

An early wake-up call and a beautiful spring day greeted the 18 entries in this year 2018 AWA Thermal State Championships at the pristine KAMS Club in Perth southern suburb of Oldbury. This year’s event although originally intended as just the F3J winch launch Thermal class state event was opened up to include the growing numbers of F5J electric launch Thermal class flyers around town. With 10 F3J entries and 8 entries in the F5J it was decided that we would host a combined Thermal Championships with winners for each class as well as an overall Open winner.

CD Ian Salau, ready for anything.

The eager crew set up early and soon in the air testing conditions before the 8.45am pilots briefing by CD Ian Salau. As this was a combined event with both classes flying directly with/against each other and that nobody had height limiters for their electric launch models, the winch boys would launch first and then the electrics would motor up to match their height and then start the 10 minute Duration task. Some late entries caused need for the pre-setup draws to be redone so the start was delayed slightly and the first 6 pilots in group 1 in round 1 hit the skies at 9.15am.

Those willing to travel to find lift all did well during the first round and achieving good times and landing. Those new to this event of not willing to travel all struggled to make times above 5 minutes. Tim “Mr. F3B” Kullack proved once again he was going to be a force for everyone to chase with a near perfect 9min 58sec flight and perfect 100 landing points. However it was evident that Tim wasn’t going to run away with the results with Don Tester, Nigel Molyneux, Simon Watts and surprise package, first timer Steve Maitland all posting similar times and only being separated by landing scores. The rest of the field was a jumble of results as some struggled to dust of the winter cobwebs and others just overflew the light conditions.

Round 2 was more of a mixed bag for everyone as it seemed the promising lift in round 1 had left and we were left with very light conditions and cold air. Steve Maitland and Nigel Molyneux went head to head in the 1st group of the round. Both gents sporting 4m Euphoria F5J machines which seemed perfectly suited for the conditions. Both flyers managed to get away in lift closely followed by Danny hales with his 4m Pike Perfection. Danny made a wrong decision at some point and landed just over the 9 minute mark. Steve and Nigel continued to fight it out to be to the top Euphoria pilot and after the dust settled Steve went over time but with a worse landing allowing Nigel to take the heat win by a solitary point (and a bucket of sweat). Steve along with his 13yr old son Blair and with Bob Chitty also joining in are all better known as top level IMAC pilots. This was the first gliding event for each of them and their flying skills seemed to be translating well to gliding. This is especially true when you hear that Steve only took delivery of the Euphoria the week before the event and Blair maidened his Radian only the day before the comp’.

In group 2 it looked like conditions were getting harder as the morning progressed. Tim Kullack shone through again with another near perfect score while the rest struggled to fly 5

Euphoria E launching into another Round

minutes. Group 3 in round 2 was a carbon copy of the struggles group 2 faced. This time Don Tester won the heat by just making 8min 25sec of the 10 task.

Round 3 was shortly underway with Nigel claiming the honours in group 1 by using the “floatability” of his Euphoria to good effect to post a near perfect score. Group 2 seemed to hit the jackpot as the lift picked up again with 5/6 of the pilots posting

Team S.A.W.A. L/R: Steve Maitland, Blair Maitland, Bob Chitty.

The 2018 Crew group photo.

near max score for their flight times but being let down by their landings. Tim Kullack again up the pointy end but hot on his heels was Simon Watts, Gavin Tilson and the IMAC Boys Steve Maitland and Bob Chitty. Group 3 was the exact opposite to group 2 with Jnr Blair Maitland and his radian taking the heat win with a 5min 45sec flight time while seasoned flyers behind him failed to fire.

With 3 completed rounds in the books and the smell of onions and burgers on the BBQ thanks to KAMS club President “The Kitchen Master” Dave Trewarn, we decided the smell was to irresistible to continue and it was time for a lunch break to recharge both models and pilots. It was also great to see the

Mr. Greg “old School” McClure.

pit area busy with spectators and families on “Father’s Day” all enjoying the beautiful weather and a good feed.

After the masses had been fed and watered the whip was cracked and pilots were soon in action again for round 4. Thankfully the lift had returned with the majority of pilots all posting high scores and landing points. Flight of the day had to go to KAMS Military Scale enthusiast Greg McClure. This was Greg’s 1st time joining us for a gliding event as he didn’t have a proper glider he had brought along one of his old timer vintage free flight models minus motor and undercarriage. Up to this point and even with all the help and coaching the group could muster Greg’s model was destined not to break the 3 minute barrier. That was until Group 2, everyone launched and went straight into the best lift of the day. Greg launched last with the help of Paul Marshall did his best launch of the day and straight into the column of lift. With lots of cheering from the spectators and competitors, Greg flew 10min 12sec and nearly maxed out his landing score. It doesn’t matter if you’re 9 or 90 the massive smile and sheer joy of accomplishment on Greg’s and everyone faces after his flight is the reason we all love our hobby.

Steve Maitland, Don Tester and once again Tim Kullack all one their respective heats while Greg decided to pack up and ride off into the sunset happy with his accomplishment and saying “it couldn’t get any better than that so it was time to go”. Hope we see you again next time Greg.

Round 5 was underway with group 1 still enjoying the tail end of the good lift from Round 4. This time Simon Watts took the heat just in front of Steve Maitland with Nigel Molyneux hot on his heels. Group 2 and this time the lift had and started to go again but Don Tester managed to narrowly hang on for the win in front of Ian Salau. Group 3 was a mixed bag with only Tim Kullack heading of cross country to find lift and post a near perfect score again.

And then the end was near.

Round 6 commenced with the first group packed full of the heavy hitters. It was in large a very tight round with 4 near perfect scores. Nigel was in the hunt for 80% of the round but a late judgement call to go left when everyone else went right ended up costing him valuable flight time when they hit lift and he didn’t. In the end it was Don Tester for the group win in front of Danny Hales, Tim Kullack and Simon Watts.

Group 2 became the “Battle of the Maitland’s” as Dad Steve Maitland took on Son Blair Maitland it wat turned out to be a close and humours battle especially when the crowd got behind young Blair and his $200 Radian. Gavin Tilson and Paul Marshall had their own battle for worst flight of the group. By this point the air was starting to get cool and had swung direction. Steve Maitland posted a good time of 9min 52sec but totally misjudged his landing to land out with now score. The following look on his face when realised son Blair was still flying was priceless (no rivalry in the Maitland family household!). The cheering grew louder as Blair brought hi Radian in for one of his best landings of the day. Blair had landed a little short of time compared to his dad in order to make sure he got landing points and after some quick calculation it was Jnr Maitland not only beating his dad but also taking the heat win. Once again the smile on Blair’s face was priceless and bet it was a long drive home for Steve afterwards.

Last, but not least the money round with Group 3 of Round 6. This time around it was Stuart Hamilton who seemed to again be struggling to find his normally good form. He struggled as Brett Moffat, steady improver Bob Chitty and Ian Salau fought for the final group honours. After the dust had settled it was Ian for the heat win in front of Bob and Brett.

Oh I suppose you want the results... Well ok, just for you.

In the F3J Class there could only be the one and only class of the field Mr. Tim Kullack at the top with Don Tester only 10 points behind in 2nd followed by Simon Watts in 3rd.

AWA State Thermal F3J Class Results			Models
Position	**Name**	**Points**	
1	Tim Kullack	5000	Freestyler 5 F3B
2	Don Tester	4990	Jedi F3B
3	Simon Watts	4638	Pitbull F3B
4	Ian Salua	4154	Explorer F3J
5	Paul Marshall	3771	Pitbull F3B
6	Brett Moffatt	3558	Shinto F3B
7	Gavin Tilson	3516	Fosa Lift F3B
8	Stuart Hamilton	3488	Euphoria F3B
9	Greg McClure	1743	Old Timer ?
10	Daren Peake	892	Explorer F3J

In the F5J Class the battle went down to the last round with Nigel Molyneux just pipping gliding newbie and IMAC boy Steve Maitland by just 10 points followed by Danny Hales in 3rd and Blair Maitland in 4th.

AWA State Thermal F5J Class Results			Models
Position	**Name**	**Points**	
1	Nigel Molyneux	4938	Euphoria E
2	Steve Maitland	4928	Euphoria E
3	Danny Hales	4642	Pike Perfection E
4	Blair Maitland	4114	Radian E
5	Bob Chitty	3631	Mystique E
6	Geoff Doughty	1953	Shadow Pro E
7	Margaret Pettigrew	0	Radian E
8	Bill Pettigrew	0	Radian E
9			
10			

For the Overall the win once again went to Tim Kullack who won 5 out of 6 of his heats closely followed by Don Tester in 2nd then it was the F5J boys led by Nigel Molyneux in 3rd.

Overall Placings AWA State Thermal F3J/F5J			Models
Position	**Name**	**Points**	
1	Tim Kullack	5000	Freestyler 5 F3B
2	Don Tester	4990	Jedi F3B
3	Nigel Molyneux	4938	Euphoria E
4	Steve Maitland	4928	Euphoria E
5	Danny Hales	4642	Pike Perfection E
6	Simon Watts	4638	Pitbull F3B
7	Ian Salua	4154	Explorer F3J
8	Blair Maitland	4114	Radian E
9	Paul Marshall	3771	Pitbull F3B
10	Bob Chitty	3631	Mystique E
11	Brett Moffatt	3558	Shinto F3B
12	Gavin Tilson	3516	Fosa Lift F3B
13	Stuart Hamilton	3488	Euphoria F3B
14	Geoff Doughty	1953	Shadow Pro E
15	Greg McClure	1743	Old Timer ?
16	Daren Peake	892	Explorer F3J
17	Margaret Pettigrew	0	Radian E
18	Bill Pettigrew	0	Radian E

2 Classes, 18 heats to make 6 rounds in total flown and 18 pilots with no broken models, lots of sunshine and in general a really great day.

A big thank you once again to the KAMS Club Membership and Committee for their continuing support of the Gliding events, the AWA, the great bunch of pilots both new and old, helpers and the spectators who helped make it a great day.

Upcoming Gliding events for 2018

Sunday October 28th - 9.00am - “2018 AWA F3B Glider” - KAMS Field Oldbury, Perth WA - CD Tim Kullack

Saturday November 10th – “Sportsman Cup” F3F Glider (2m) - Albany WA - CD Steve Revell

Trippp Report: Jumpoff Mountain Part Deux

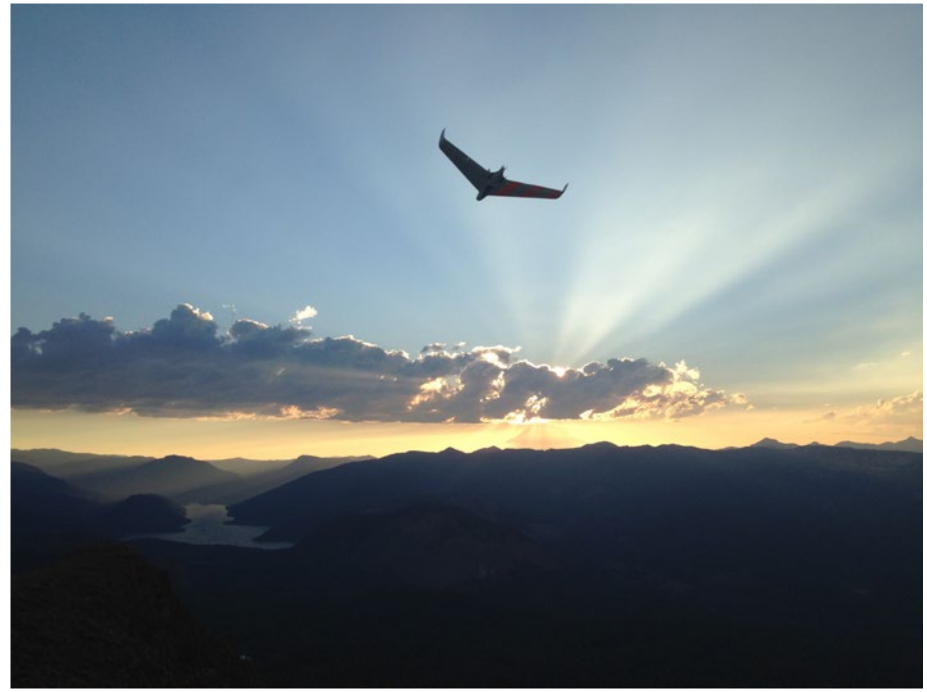
Pictorial supplement

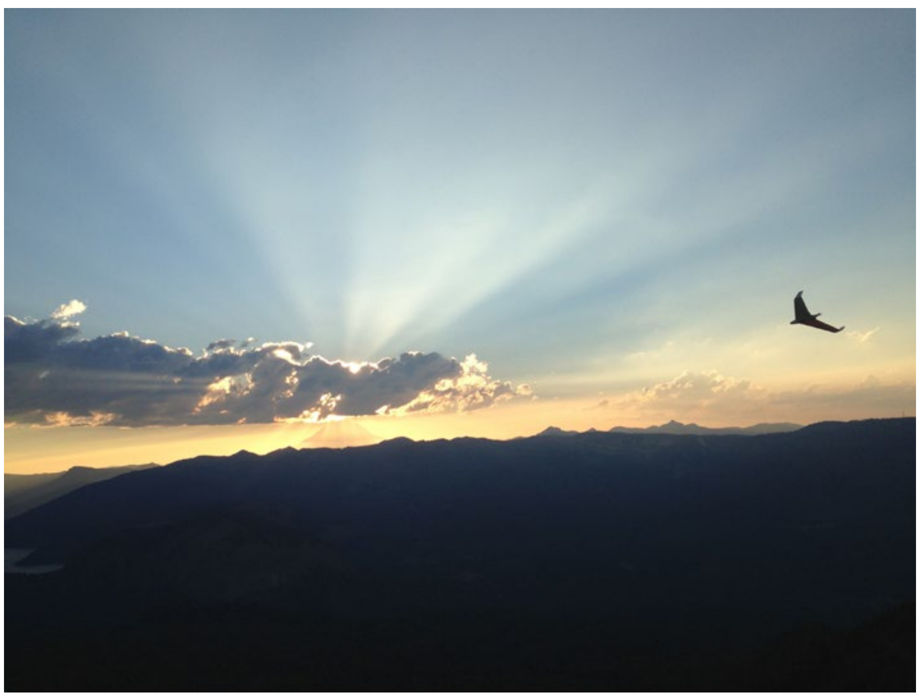
(a too silly addition by Philip Randolph, amphioxus.philip@gmail.com)

Somehow I didn't get all the photos associated with last month's travelogue about the CEWAMS trip to Jumpoff Mountain back in July.

So here they are!

Late Friday eve I followed Chris Erikson and Michelle Lyons up 12 miles of excruciatingly bumpy road to 5700' Jumpoff Mountain. This is in Washington State's Cascade range. Chris promptly put up his 6' Opterra. Mount Rainier is in the sunset. Photo by Michelle Lyon.

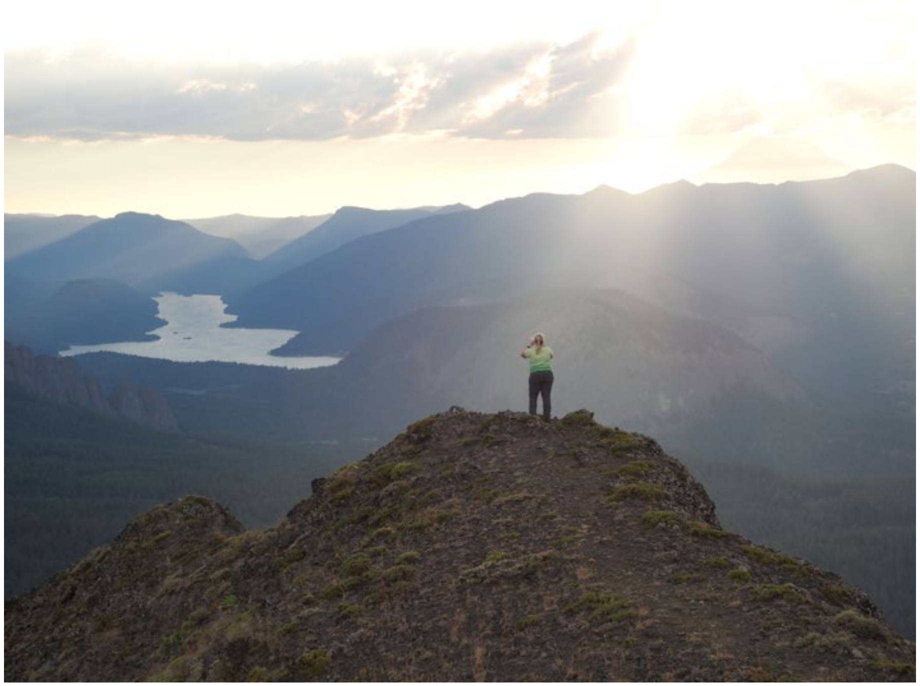




Upper left: Chris flies his Opterra. Philip observes. Photo by Michelle Lyons.

Above: Ditto. Rampart Lake to west. Photo by Michelle Lyons.

Left: Sunsets this pretty are worth repeating. Photo by Michelle Lyons.



Above: *Jumpoff Point, perspective 2. This was just a bit earlier than the flight photos, right when we arrived. Michelle, Rampart Lake, Mt. Rainier. Photo by Chris Erikson.*

Upper right: *Jumpoff perspective 3. Looking north from Jumpoff's point to Jumpoff Lookout Saturday morning. Yep, the night before, Chris was flying above this stuff.*

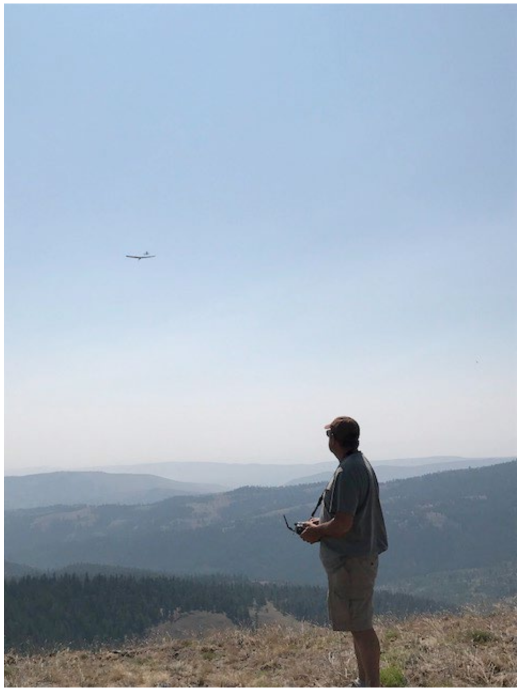
Right: Jumpoff Lookout, perspective 3. Looking west to jagged Kloochman Rock and Rampart Lake. Photo by Michelle Lyons.

Above left: Philip, Chris, and Steve with his Evo 2.6m. Photo by Michelle Lyons.

Above right: Steve All-maras arrives Saturday. He flies his Bowman Hobbies Super Scooter in an east wind.

Left: Philip, Steve, Chris. Opterra (high) and Steve's Evo. Photo by Michelle Lyons.

Right: Philip flies his Monarch II fuselage with a red DLG wing. Photo by Michelle Lyons.

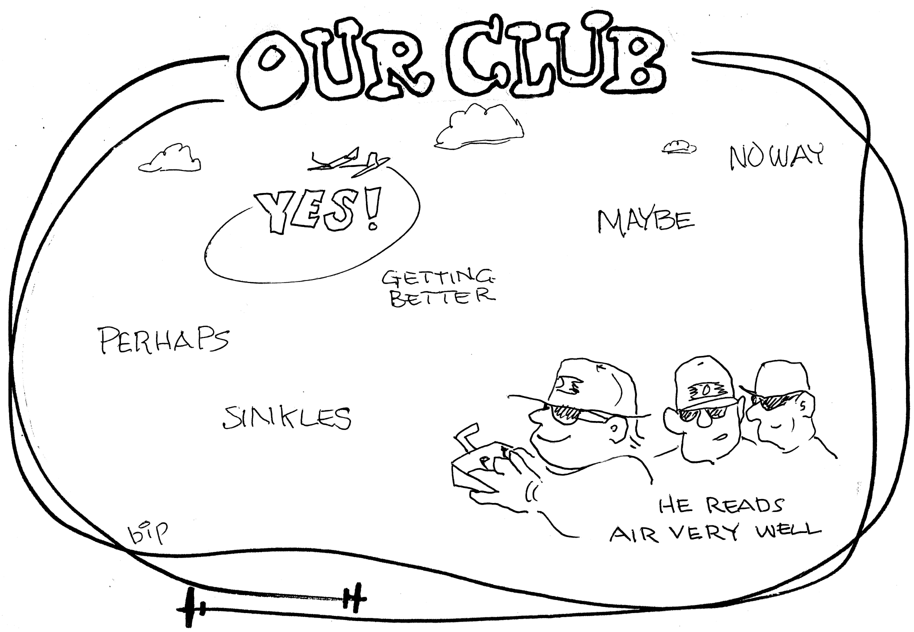


Upper left: Damian Monda arrives Saturday. He's flying his 2.6m Phoenix Evo. Photo by Michelle Lyons.

Above: Damian's Evo blown back up a tree after a vertical stab failure. See last month's photo of Chris throwing a tire iron hooked to a cord over it. Steve's Evo exceeded VNE and ripped off an aileron, but ended in a shorter tree.

Left: Chris doing touch and goes with his Cub. The east face of Jumpoff is one of a few places we get to that has a decent landing zone.

Above: The sunset from Jumpoff Point. A perfect end to a perfect adventure.
Opposite page: Philip's 26" span ME 109. Photo by Michelle Lyons.



Bill Pettigrew, Coogee WA Australia

F3F World Championship results from FAI

Christine Rousson <christine@fai.org>

Sport: Aeromodelling - F3F - Slope Soaring Gliders

Title: 2018 FAI F3 World Championship for Model Gliders

Type : World

Date: 07.10 - 13.10.2018

Location: Kap Arkona, Rügen Germany

Final Results:

F3F - Overall

1st:	Philipp Stary	AUT
2nd:	Lukas Gaubatz	AUT
3rd:	Thorsten Folkers	GER

F3F - Team

1st:	Austria
2nd:	Germany
3rd:	France

The full results can be found at the following address: http://wm2018.f3f.de/

FAI congratulates the Winners and thanks the Organisers of the Championship.

Baltic Bees Aero L-39C Albatros

The aircraft used by the Baltic Bees Jet Team is the L-39C Albatros, a tandem 2-seat jet training aircraft. It is developed by Aero Vodochody in former Czechoslovakia.

Now the plane has found wide popularity all over the world, both among private owners and aerobatic jet teams. The airplane possesses good technical and aerodynamic characteristics. Also it has a simplicity of control. The L-39C Albatros has zero-height ejection seats for both the pilot and the trainee.

Baltic Bees Jet Team was formed in 2008. First flights were flown in a two-ship formation. In the following years two more jets were added to the team and a full aerobatic display program was created.

From the very beginning, flight instructor and creator of the display program is the well known skilled aerobatic pilot Valery Sobolev. The program was developed in a very short period of time and Baltic Bees Jet Team gained reputation as a professional civilian aerobatic display team.

Homebase of the team is Jūrmala Airport (EVJA), 60 km west of Riga, Latvia.

Display consists of complex and tricky vertical maneuvers in a six L-39C aircraft formation and with exceptional individual performances with unique and top difficulty concepts.

https://www.balticbees.com/


6
Baltic Bees
YL-KSP
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3
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Baltic Bees
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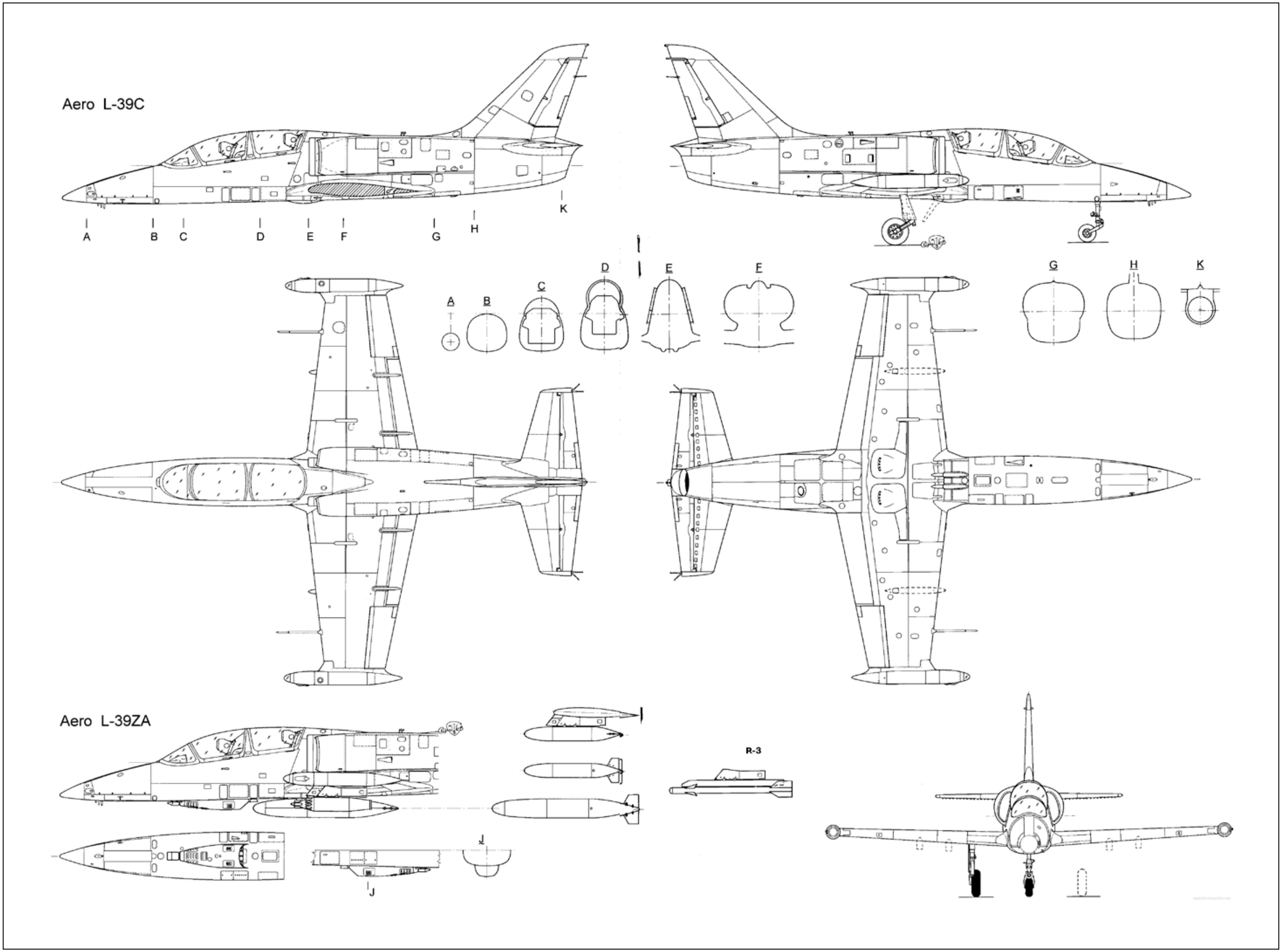
Baltic Bees
5
YL-KSL

Characteristics:

Wingspan	31 ft
Length	41 ft
Height	16 ft
Wing area	202 ft^2
Empty weight	7200 lbs
Maximum speed	560 mph


Aero L-39C
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AEROBATICTEAMS.NET

Reminiscences of Dust Bowls

a Sam's Dirty Ridge (SDR) experience

Philip Randolph, amphioxus.philip@gmail.com

(1) Bill Babin launches his Half Pipe. All summer we were used to wildfire smoke. This looks the same, but it's dust, blowing 30 mph.

The wind was so filled with dust that when at the motel rooms we washed our faces and the towels turned brown.

Then we went off for bathtub-sized margaritas.

Well, Tom and me. Steve had a bathtub sized glass of ice water.

Bo abstained completely. Bo is Tom's dog. In his superhero role he is SlopeDawg!!!

They let Bo into the restaurant.

Me they thought twice about.

Even though I had washed my face.

Anemometer photo by Steve Allmaras.

(2) Bill blows Sam's Dirty Road dust off Steven's car. It's perfectly logical that Bill would bring a LiPo brushless weedblower. The batteries also power a hot glue gun.

Most of us made it to Sam's Dirty Ridge before noon Saturday. 9/29/2018. Sun. Wind, straight in. 'Most of us' means: Tom Provo, by about 8:00 AM. "I couldn't sleep, so at 4:00 AM I got up and left." Bill Babin. Me. Then Steve Allmaras. Intrepid slope explorer Chris Erikson with 12-year-old Jacob showed about 1:00, day tripping.

Winds? Oh, yeah. See photos. Winds started at thirty, with higher gusts.

(3 & 4) Tom is fighting to hold his Energic 2.4m against the wild vortex. Tom's Energic streaked once in the air.

(5) Chris shows off his Motion RC EDF P-14. In the last year of WWII Alexander Lippisch proposed this as a jet version of the rocket-powered ME 163 Komet. It was to be powered by the Heinkel HeS 011A turbojet, with landing gear from the Bf 109. It was never built. This little model sloped fine, and with full throttle was incredibly fast. Its roll rate could blend banana daiquiris.

My flying highpoint of the weekend was with my trusty carbon 60” Zipper. Plank. Straight wing. Very light, but so slippery it handled the thirty mph winds with no trouble. Fast. I probably flew for an hour-and-a-half. Felt like two. Even a good landing, a little farther back than I planned, but SDR’s backside is deep grass and then a plowed field. Several of the guys planes landed back in the field.

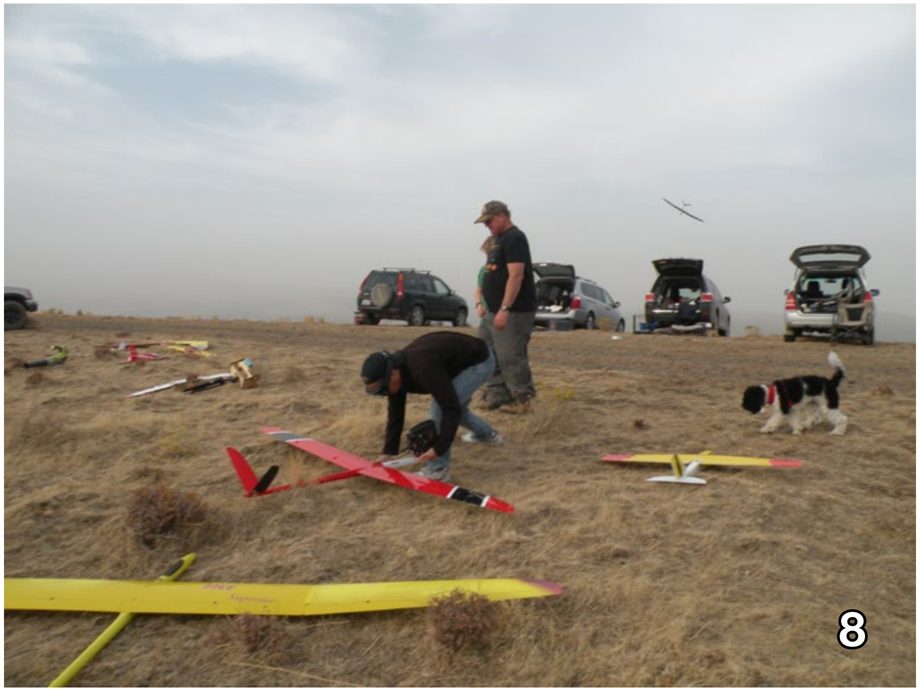
(6) Tom and Bo launch Steve’s Acacia 3m.

(7) Steve’s Acacia aloft.

5

7

6



(8) Tom's Pike Superior, Tom and Energic 2.4, Chris, Bo, Acacia flying.

Carnage:

Then the weekend's carnage began. Mostly mine. One of Steve's. I was going to put up my 60" Mini-Blade V-tail. Bill observed that the mushroom-shaped head of the servo horn had busted loose from the left aileron. Previous distress. That evening I'd fix it with JB Weld.

So I put up this little 31" Rifle, a T-tail pylon racer someone had converted to a sloper. Dave Yardis found it in the trees down at Bald Butte, northern Oregon, several years ago, with its nose busted off. I fixed it up this spring. Well, It could have used a bit more exponential to damp down the ailerons.

Here's my failing for the weekend. Well, second failing. First is that all the guys I fly with are better pilots than me. Second is that I start trying to do fancy stuff near the ground. Dumb. I flew the Rifle for a while. Way fast little thing. Twitchy in the

roll rate. Then I tried a downwind turn partly behind the lip. It will only take me an hour or so to repair it. (That was pre-repair optimism.) A crack around the nose. The wing popped partly off. The T-tail floppy. Hoot.

(9) The Rifle during first rebuild. I inflated a bike inner tube section to put pressure on the wet Kevlar patch inside the broken-off nose. Here I've patched and filled the outside with CA and Gorilla glue. Without the Kevlar inside it would be weak.

(10) The Rifle on my porch, looking over Puget Sound after the second rebuild. All it needs now is paint. Looks better in the dark. Heh.

(11) Steve has his Boomerang ballasted. It's hard to hold it steady for launch.

(12) Steve's Boomerang launched. Tom's WindRider Bee. They attempt 48" combat. No contact.

We hear a thud. Steve explains that he shot himself down all by himself. His Boomerang ripped nearly in two.

As the winds were edging up past 35 mph Tom and Steve agreed to chevron flying wing combat. Tom has a 48" Bee.

They near-miss for a while.

I'm downwind of the cars when I see Steve's 48" Boomerang. Gawrd, he laid up its ailerons with diagonal carbon cloth. It tumbles back through the air and Wham!, it hits like one of those Kapowies out of a Batman and Robin comic book.

I ask, "Which one of you knocked that out of the air?" Steve says, "I'm afraid I did that all by myself."

(13) Ripped it pretty well in two.

(14) The winds picked up, from 35 to 44 mph.

(15 & 16) Bill's Half Pipe, looking east into the dust.

Getting the hell off the ridge:

Bill Babin and I had planned on camping on SDR. That can be great, but with the wind meters showing gusts of up to 44 mph… Bill camped down below in a Benton City campground. He'd come prepared with a tent, a stove, and prawns. He wanted to make sure it all went to waist. Me, I didn't want to leave all my stuff out in a public campground just so I could sleep in my CRV. So off to motel land.

Sunday

Steve has objected to the dirt road up to SDR from the east. "I wasn't sure my Subaru was going to make it." I was surprised my AWD CRV did. Deep dust and deep wheel ruts. How did Bill's 2WD van get through? So we'd left by the bumpy road along the ridge. Sunday morning we said, "Skip all that," and just met at Kiona. It's a gentle slope up an easy gravel road up from the towns of Kiona and Benton City (sic). The lift is light.

Sunday at Kiona the lift is light.

(16) Bill tip-launches his AB Models BAE Hawk 900mm.

(17) Bill’s BAE Hawk in flight. Steve and his Ahi down in the corner.

(18) Steve launches his Ahi.

(19) Steve's Ahi aloft.

(20) Philip and the 60" Jaro Muller Mini Ellipse. Note Philip's AOPA cap. That's Aircraft Owners and Pilots Association. I was waiting for some gorgeous woman to say, "You're a pilot? You own an airplane?" "Yes, I actually own several." "Ooh! Will you take me for a ride?" Once I did give a female an airplane ride. She was a preying mantis, who clung on for a couple circuits at someplace called Yaksum Ridge. That's about as big a critter as my airplanes might carry. I have not had to fail to disabuse any human females about the size of my airplanes. Photo by Steve Allmaras.

(21) Mini Ellipse and Ahi. The Mini Ellipse flew great! until I scrambled an Immelmann turn. I'd come downwind straight at me, loop up, and roll, headed upwind. Minor damage. I glued and flew more.

(22) Bill launches Steve's Acacia 3m.

(23) The Acacia in flight. Even in the light air with few thermals it stayed aloft. Well, for a while.

(24) Tom and his Alula after a long walk. Tom walked all over, a quarter-mile down the hill. Steve went down and stumbled on it a bit closer.

Off to world-famous Eagle Butte, chasing auspicious wind directions

And then the lift reverses. Steve drives home. Tom, Bill, and I say, "Now the wind is coming from the south. That will work at world-famous Eagle Butte." And, "It's only twenty minutes away."

(25) Looking east from Eagle Butte. Sam's Dirty Ridge is a third from the left. Kiona is a quarter from the right.

(26) Eagle Butte from west, part way from Kiona via scenic two-lane blacktop.

We get there. It is pleasant to sit in the sun. But the wind at Eagle is also slowly downhill. Tom chucks his Alula anyway. Short flights. We start figuring ways to amuse ourselves.

(27) Philip plays retriever, trying to show Bo what a good SlopeDawg!!! should do. Philip demonstrates good bird-dog airplane retrieval to Bo. Tom tries to direct the attention of his student.

(28) Bill provides lift for Tom's Allula with his cordless leaf blower. Bill: "It has a brushless motor ducted fan." Philip: "You should put wings and a tail on that thing, and a servo on its variable-speed trigger." It would make a thrilling Ryobi slope jet. So many good ideas, so little time.

After a while we all fade into the west.

Boeing B-47 *Stratojet*

https://www.reddit.com/r/aviation/comments/49ul2l/b47_on_approach_castle_afb/

The Boeing B-47 was the country's first swept-wing multiengine bomber. It represented a milestone in aviation history and a revolution in aircraft design. Every large jet aircraft today is a descendant of the B-47.

Boeing engineers had envisioned a jet-powered plane as early as 1943. However, wind tunnel tests of straight-wing jet aircraft indicated that the straight wing did not use the full potential of jet-engine power.

Historical Snapshot

<http://www.boeing.com/history/products/b-47-stratojet.page>

The best way to tell about the performance of the Stratojet is to say that any good crew could have flown it. It took no unusual ability or education. Neither Scott Osler nor I deserve any credit for the flight. Rather, the credit should go to the men who carried out these visions on the drafting boards and the factory workers who made the visions a reality.

— Robert Robbins, test pilot for the B-47, 1949

Near the end of World War II, Boeing aerodynamicist George Schairer was in Germany as part of a fact-finding mission. At a hidden German aeronautics laboratory, Schairer saw wind tunnel data on swept-wing jet airplanes and sent the information home. Engineers then used the recently completed Boeing High-Speed Wind Tunnel to develop and design the XB-47, with its slender 35-degree swept-back wings.

Another innovation pioneered on the B-47 was the concept of placing the engines in pods (nacelles) suspended under the wings. A pod containing two General Electric J-35 engines (GE J-47 engines for all production models) hung from each

Technical Photographic Service Section, Wright Air Development Center, W-P AFB, April 30 1952. William H. Kuhlman Jr. collection.

http://todo-aviones.com.ar/usa/b47/b47_02.jpg

http://todo-aviones.com.ar/usa/b47/b47_02.jpg

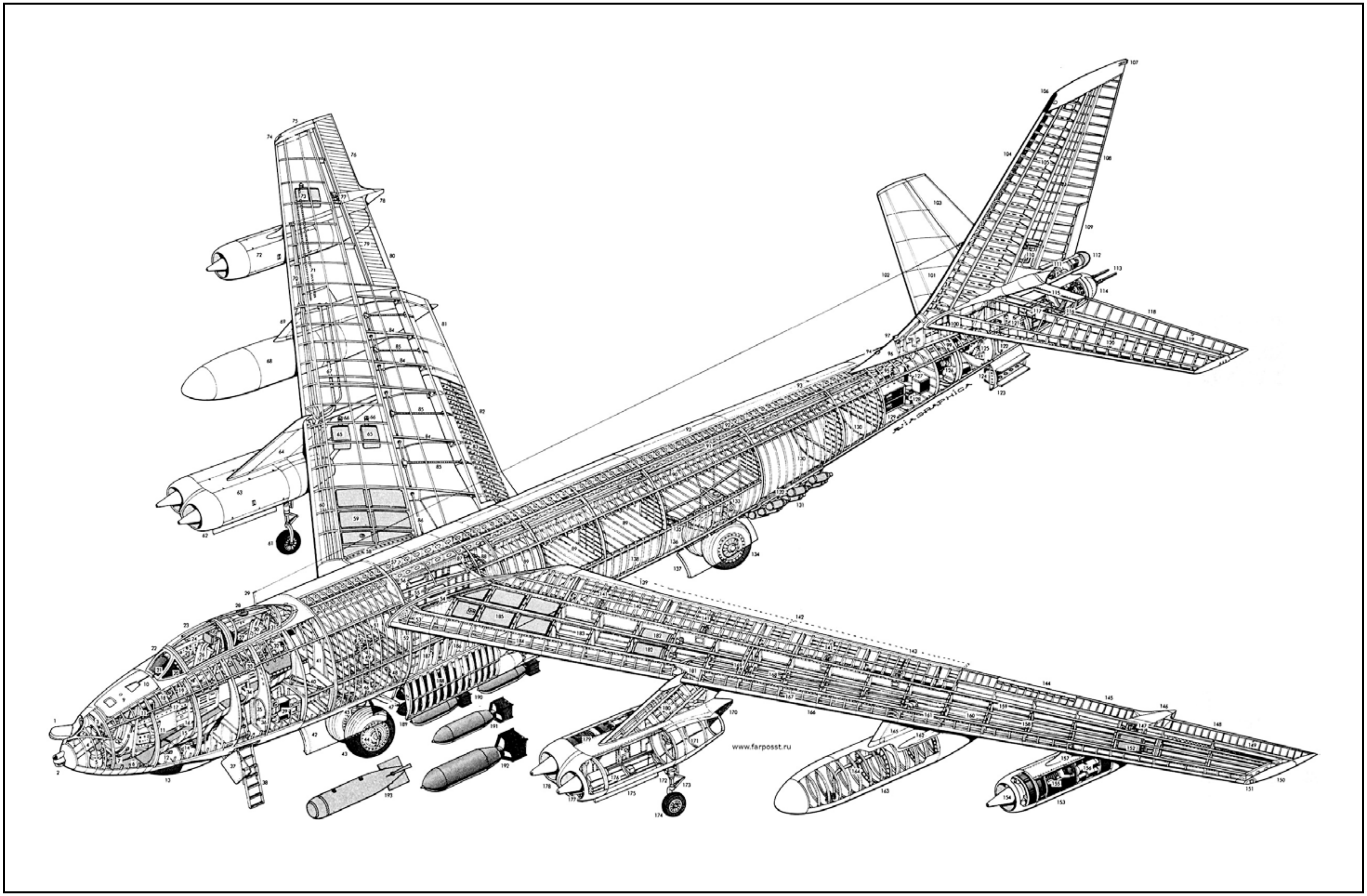
wing inboard, and a single engine hung farther out. B-47 had tandem bicycle-type landing gear under the front and back sections of the fuselage. Small outrigger wheels on the inboard engines kept the airplane from tipping over when it was on the ground.

Because early jet engines could not provide enough thrust for takeoff, the XB-47, B-47A, and B-47B had 18 small rocket units in the fuselage for jet-assisted takeoff (JATO). Thrust reversers and antiskid brakes had not yet been developed, so a ribbon-type drag parachute reduced the B-47 landing speed.

Once airborne, the graceful jet broke speed and distance records; in 1949, it crossed the United States in under four hours at an average 608 mph (978 km/h). The B-47 needed defensive armament only in the rear because no fighter was fast enough to attack from any other angle.

The B-47 medium bomber became the foundation of the Air Force's newly created Strategic Air Command, and many were adapted for several specialized functions. One became a missile carrier, others were reconnaissance aircraft or trainers or carried remote controls for other aircraft. Between 1947 and 1956, a total of 2,032 B-47s in all variants were built. Boeing built 1,373, Douglas Aircraft Co. built 274 and Lockheed Aircraft Corp. built 385.

Upper: WB-47E 51-7066 at the Seattle Museum of Flight (See RCSD October 2010.
Lower: B-47E-25-DT, performed last B-47 flight, June 1986, currently at Castle Air Museum.



https://airwingmedia.com/wp-content/uploads/2018/03/B47-Cutaway.jpg

http://todo-aviones.com.ar/usa/b47/b47x509.jpg

https://en.wikipedia.org/wiki/Boeing_B-47_Stratojet#/media/File:Boeing_B-47B_rocket-assisted_take_off_on_April_15,_1954_061024-F-1234S-011.jpg

B-47E-IV Technical Specifications

Span	116 feet
Length	107.1 feet
Top speed	607 mph
Crew	3

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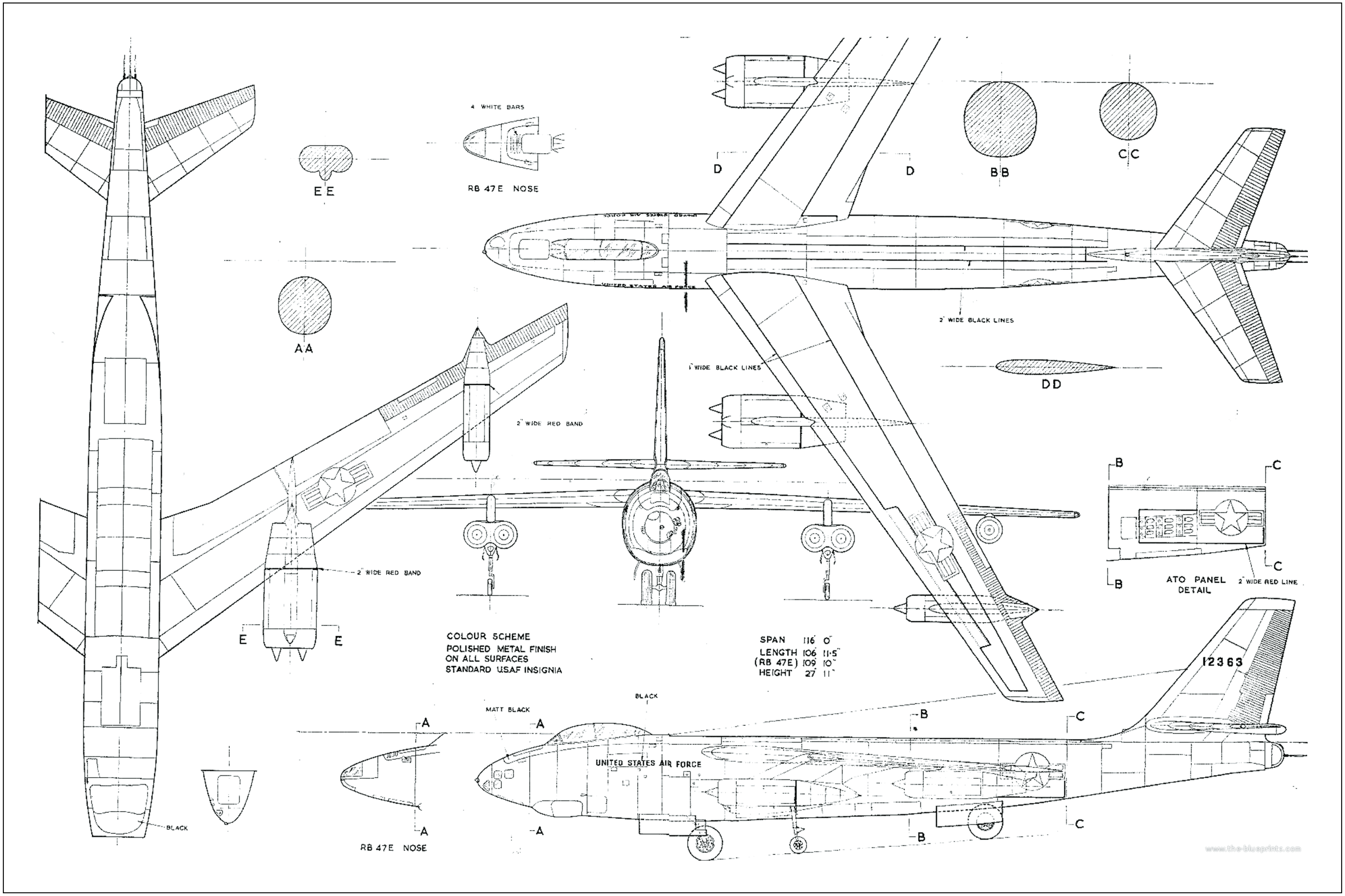
https://i.imgur.com/ML9ak4K.png



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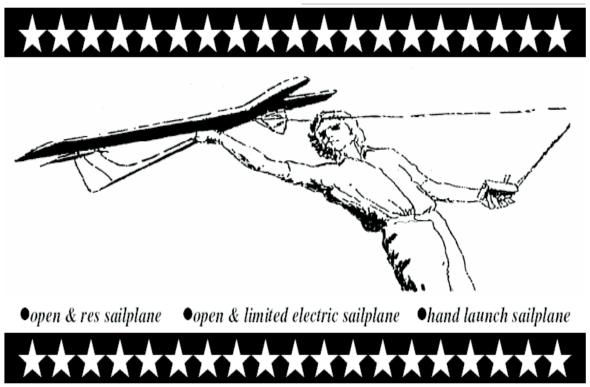


39th Armidale Sailplane Expo

January 25 to 28, 2019

Location: Warrane Road Field, Armidale, NSW, Australia

Google Maps Co-ordinates -30.444252,151.518692

New England Model Aircraft Club invites you to the 39th Sailplane Expo.

Events will be F5J and Open Thermal (combined Winch and Electric launch)

The F5J event will run from 1000 on Friday January 25 to 1700 Saturday January 26. This will be the last of the qualifying events for selection of a team to represent Australia in the first F5J World Championships to be held near Trnava, Slovakia in August 2019.

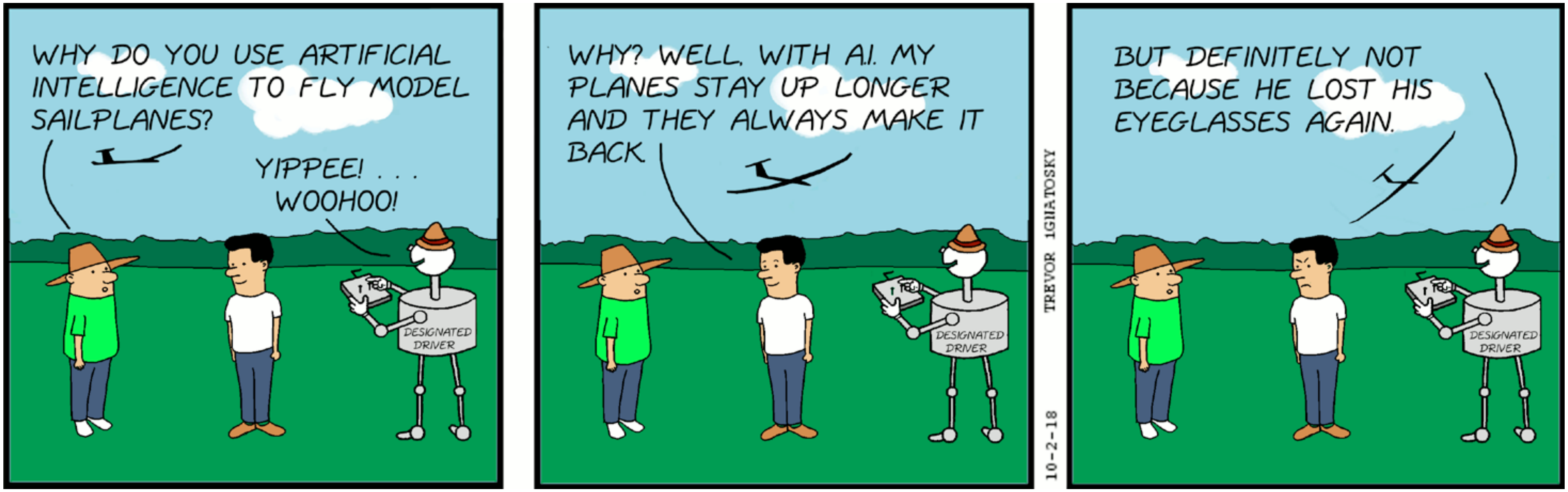
The Open Thermal event will be held from 0900 Sunday January 27 to 1300 Monday January 28. It will allow both winch and electric launch to the RCGA rules below. Note:- RCGA = Radio Control Gliding Association http://rcga.org.au/

For further information contact:

Hutton Oddy, vhoddy@gmail.com, or call 0425 285 758

RCGA AGM agreed rules - winch and electric launch rules

1. Winch launch gliders will fly to the normal 10 in 12 rules.
2. For safety reasons - electric launch gliders must launch in a direction specified by the contest director (normally into wind) with a first turnpoint also specified by the content director (eg: 100m from the launch point). The CD will determine this based on number of pilots and the conditions of the day.
3. Electric gliders will have their motor turn off after either 30 seconds of motor run OR at a height of 200 meters - whichever comes first (or when the pilot turns it off if earlier).
4. Electric launch gliders will fly 10:30 in 12 minute working time (to account for the 30 sec motor run).
5. For scoring purposes 30 sec will be deducted from the final electric flight time (eg: A 10:31 will be scored as 10:01).
6. Both winch and electric launch gliders will land to the F3J landing rules - maximum of 100 points.



Trevor Ignatosky, trevor2@optonline.net

Based on the article <https://www.theverge.com/2018/9/20/17881770/ai-machine-learning-gliders-air-currents-learning-birds>.

AI gliders learn to fly using air currents, just like birds

New research uses machine learning to teach UAVs to climb into the sky using thermals

By James Vincent Sep 20, 2018, 9:08am EDT

Birds don't always flap their wings to fly; sometimes they soar by taking advantage of rising columns of warm air known as thermals. With large wingspans, they can stay aloft for hours while expending minimal energy. Exactly how they do it — navigating tiny changes in unpredictable air currents — isn't well-known. But scientists are now using artificial intelligence to learn their tricks, and hopefully, they can teach our aircraft to do the same.

As described in a paper published this week in the journal Nature, researchers from universities in the US and Italy used machine learning to train an algorithm to control a glider to navigate thermals. It's not the first time artificial intelligence has been used for this task (Microsoft published similar work with gliders last year), but it's the first time that data from real flights has been used to update and improve an AI's performance in the field.

The work suggests that future autonomous aircraft could take advantage of thermals, rather than relying on noisy and energy-intensive powered flight. It also suggests that AI might be able to help us figure out exactly how soaring birds do what they do so well. When training their algorithm, the scientists found that some factors — particularly vertical wind acceleration and side-to-side torque — were important when teaching the system glider to navigate smoothly. The same, they suggest, might be true for birds.

(Continued with illustrations on web page.)

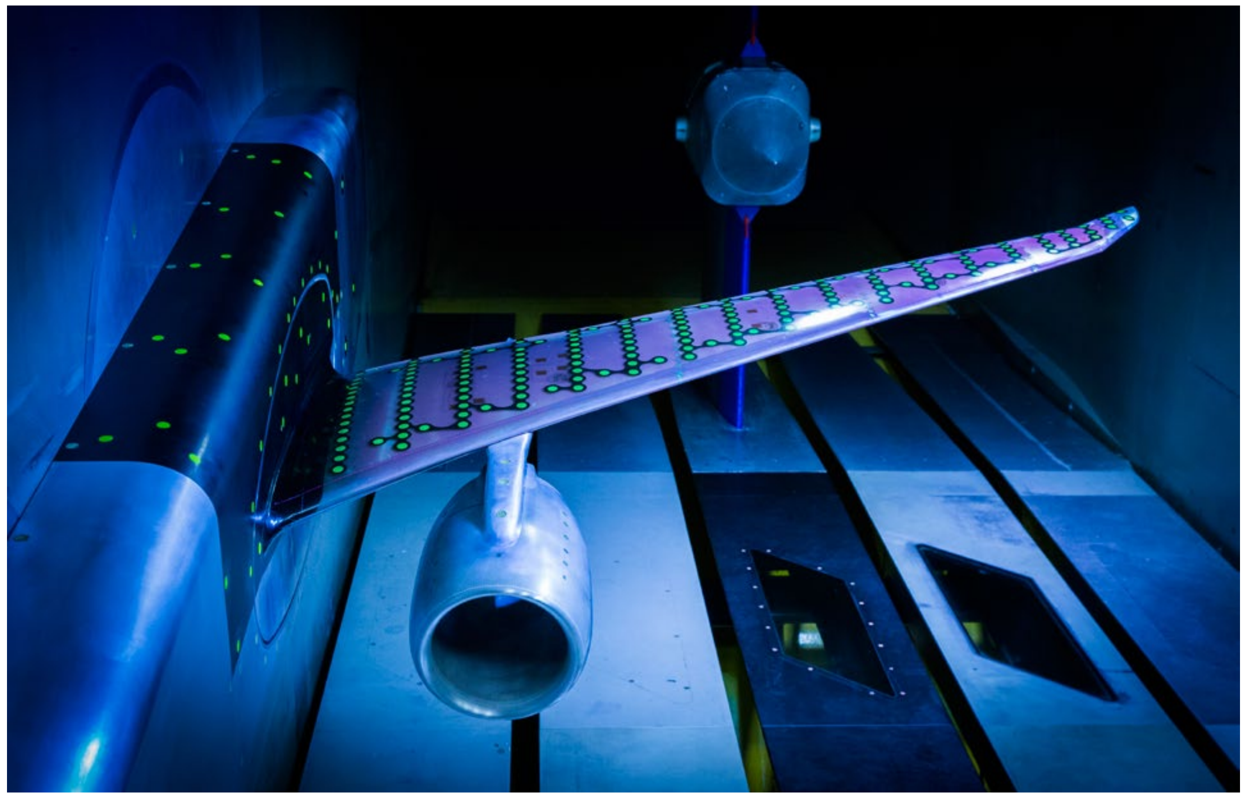
Aircraft of the future

Researchers conduct first real-time flutter analysis

https://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10081/151_read-30245/year-all/#/gallery/32352

12 October 2018

The aircraft manufacturer Embraer, the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR), the Netherlands Aerospace Centre (NLR) and German–Dutch Wind Tunnels (DNW) have succeeded in testing an innovative method for examining the safety of future aircraft. In another first, they have been able to analyse the flutter behaviour of a wing in real time.



Aeroelastics and flutter

Aircraft are lightweight constructions that are not rigid but elastic. Future aircraft will be even lighter and more flexible, but this means that the occurrence of vibrations will become increasingly significant.

The complex interaction between elastic vibrations has an influence on the aircraft's flight characteristics. The best-known aeroelastic phenomenon is 'flutter,' where the vibrations of an aircraft structure interact with the surrounding airflow in such a way that their amplitudes increase rapidly.

To prevent this from occurring and to avoid critical flight conditions, flutter analyses must be performed.

Wind tunnel test

A highly elastic fibreglass wing model, that is able to deform extensively, was constructed for the experiment. A large number of pressure sensors and strain gauges was installed on the wing.

The wing was tested from Mach 0.7 to Mach 0.9 (corresponding to air speeds of approximately 850 to 1100 kilometres per hour) for different angles of attack.

The researchers monitored the vibrations of the wing model and used a new method to analyse its eigenfrequencies and damping ratios.

In the past, the large amounts of data acquired during such experiments could only be evaluated with a time lag. An efficient method developed by DLR now allows to perform the data analysis in real time. As a result, it was possible during the test to identify exactly which safety margins remained before the onset of flutter and the resulting possible destruction of the model.

"This is a brand new method to analyse aircraft flutter," said Yves Govers of the DLR Institute of Aeroelasticity.

It should also allow future aircraft to be tested more efficiently and more quickly.

Work share

The Brazilian aircraft manufacturer Embraer initiated the HMAE1 project to test its numerical predictions for wing flutter and to make future flutter analysis more efficient.

The DLR Institute of Aeroelasticity in Göttingen and NLR joined forces for a pre-design of a wind tunnel model tailored to the surface geometry of the wing in order to meet the requirements. Detailed design of the glassfiber wing itself and the pylon-wing connection was performed by NLR, who also built the wing and created the model's built-in measurement technology.

DNW was predominantly responsible for test preparation and test execution. The actual wind tunnel test was carried out at DNW's High-Speed Tunnel (HST) in Amsterdam, using the NLR designed and manufactured wind tunnel model, with DLR conducting the data analysis in real time.

DLR video: Aeroelasticity or why aircraft are elastic
<https://www.youtube.com/watch?v=fdMlepVlpR4>

The December 2018 edition of *RC Soaring Digest* will close out the 35th year of publication and will be the last issue published by B²Streamlines.