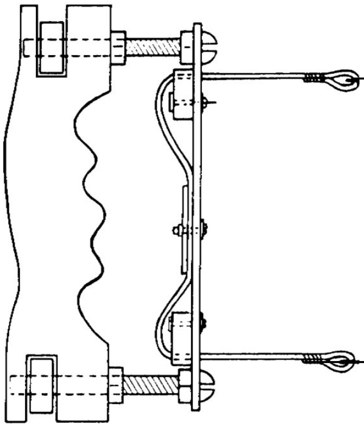

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THE VOICE OF CONTROL LINE AEROMODELLERS FROM AROUND AUSTRALIA

Number 265

Produced by the Victorian Control Line Advisory Committee

July 2021

INSIDE THIS ISSUE

PRODUCTION SPECIFICATIONS

Please send any submissions for publication by CD/memory storage device or use Email.

Contest results should be tab delimited, i.e. use a single tab between each column of results, if submitted by disk or email. This makes formatting much easier on the editor.

COMING EVENTS

VICTORIAN CONTROL LINE CONTEST CALENDAR 2021

DATE	EVENT	CLUB
Jul 11	**Combined Speed,** Classic Stunt.	CLAMF
~~Jul 7-14~~	~~1st West Wyalong Nationals~~	Postponed
Aug 8	Carrier Deck, 27 Goodyear.	CLAMF
~~Aug 9-14~~	~~FAI F2 World Championships.~~	Cancelled
Sep 12	**Combined Speed**, Vintage Combat.	CLAMF
Oct 2-4	NSW State Champs. Racing and speed.	Albury
Oct 17	Corflute Combat, F2B & Classic Stunt.	CLAMF
Nov 14	**Combined Speed,** Warbird Stunt and Nobler Stunt.	CLAMF
Dec 12	Vintage A, Classic B, **Classic FAI.**	CLAMF

Events will be flown in order of printing. Events in **Bold type** will be flown over hard surface.

CLAMF Frankston Flying Field, Old Wells Rd, Seaford (Melway 97J10), GPS -38.086777,145.148009
10.00am start
Contact :- Secretary, H. Bailey (03) 5941 5978
Email :- clamf@ozemail.com.au
Web site :- http://clamf.aerosports.net.au

KMAC Stud Rd. Knoxfield
(opposite Caribbean Gardens) (Melway 72 K9) 10.00am start
Contact: President:- Reeve Marsh 0405 001 008
Email:- knoxmacvic@gmail.com
Web site :- https://sites.google.com/view/knox-model-aircraft-club/home

CLAG has monthly fly-ins at the Moe Race Track every first Sunday of the month.
Contact :- Reeve Marsh 0405 001 008

COMING EVENTS

C.L.A.S. CONTEST CALENDAR 2021

DATE	EVENT	CLUB
Jul 4	KMFC AGM.	KMFC
~~Jul 7-14~~	~~1st West Wyalong Nationals. Control Line and Free Flight.~~	Postponed
Jul 25	F2B Aerobatics.	KMFC
Aug 1	F2B Aerobatics.	Doonside
Aug 8	Peacemaker Day.	KMFC
Aug 15	Classic Stunt.	SAT
Aug 28-29	Oily Hand Diesel weekend.	Cowra
Sep 12	Slow and Vintage Combat.	KMFC
Sept18-19	Classic B Team Racing and Fun Flying.	Rocky Rally
Sept 26	Gordon Burford Day.	KMFC
Oct 2-4	NSW STATE CHAMPIONSHIPS. Racing and Speed	CLAS NSW at Twin Cities Albury
Oct 17	F2B Aerobatics.	SAT
Oct 31	Classic Stunt.	Doonside
Nov 7	Festival of Speed.	KMFC
Nov 14	F2B Aerobatics	SSME
Nov 28	KMFC Christmas Party and Fun Fly.	KMFC.
Dec 5	F2B Aerobatics.	Doonside

KMFC - (Ku-ring-gai Model Flying Club) - St. Ives Showground, Mona Vale Rd, St. Ives.
SAT- (Sydney Aeromodelling Team) - "Duck Pond", Ashford Road, Milperra.
SSME - (Sydney Society of Model Engineers) - Model Park, Luddenham Road, Luddenham.
DOONSIDE- Baseball diamond, Whalan Reserve.

CLASII IPSWICH QUEENSLAND CALANDER 2021

Sep 25-26	QLD State Champs, All grass Racing Weekend 2.5 Simple Rat, Vintage A, Classic B, 27 Goodyear, Classic FAI, 21 Bendix.
Nov 6	27 Goodyear, Classic B
Dec 11	Christmas Breakup, Vintage Combat.

Does anybody know of a Bill Newton?

He has paid a newsletter subscription fee by bank transfer but has not provided an email address or contact information.

If you know of him, please pass this information on to him.

New In the Box Engine. Fitting up a motor!

By Matt Korhonen.

Time for some advice rather than suggestions on thought patterns.

After this it will be assembly, which might be a little more involved than just bolting the motor back together.

I have seen way too many engines that were damaged because they were run out of the box. Yes, you should be able to do so. Unfortunately the reality is that this is a great way to damage your engine.

A) Swarf or left over metal particles from manufacturing.

A lot of engines are not cleaned properly and have little metal particles floating around inside. These can damage the piston/ cylinder or your bearings. Or worse!

B) Burs, sharp edges.

Model aeroplane engines are machined, and some times those machined edges are not cleaned as well as they should be. They can sometimes have burs and more often than not those edges are as sharp as a knife edge.

C) Turning over the new engines to see what it feels like could also be a great way of damaging it.

This is why I always just rocked the engine around bottom dead centre and never tried to turn the motor over.

With a New In Box engines the first thing I used to do was remove the back plate and then spray the engine with WD40 to remove as much unwanted crud form the internals as possible. There was always metal particles. Then I would remove the head and pull the cylinder out. Then pull out the piston / rod assembly and put them aside.

Now comes the removal of the crank shaft. I would tap it gently with a bit of wood (the front where the prop goes) to try and loosen the prop driver. If being gentle did not work then I would apply some heat so as to expand the prop driver and then gently tap the front of the shaft again. This was enough to get them separated most of the time.

With the shaft out of the engine, I would suggest most people do not try to remove the bearings. Rather soak the crank case in petrol for a while and then blow out the bearings with some WD40. You might go through an entire can of WD40 if the engine is dirty enough.

Cylinder Mods.

I got myself a relatively small / thin carbon rod a long time ago as it would fit the inside of a 2.5cc motor. I used this carbon rod to deburr / micro bevel all the ports in my engines. I don't want my bye passes or exhaust port to be so sharp as to shave the piston. With all the ports cleaned up and micro bevelled, it's time to work on the piston.

Piston Mods.

There are 4 surfaces that need cleaning. Both edges of the wrist pin hole, the bottom of the skirt and the top edge of the piston. Again I micro bevel these. The top edge of the piston I generally bevel to the point it is visible to the eye. My rule of thumb here was, if I can make the piston jam up against the exhaust port when the cylinder and piston assembly are in my hands, then I haven't bevelled the top of the piston enough.

The crank shaft.

Depending on the crank design, the crank web might need to be bevelled so that it does not eat the con-rod. Also the hole through the crank may need to be micro bevelled / deburred. And on the intake side the induction hole in the crank shaft would want to be cleaned / micro bevelled.

Crank Case.

The last thing that might need to be deburred. You will want to examine the crank case very carefully for any burrs or protrusions (poor casting) that might cause an issue down the line. It can pay to micro bevel the internals of your crankcase.

With everything cleaned up, a can of WD40 used up and thrown away. It might be time to assemble the engine.

Next time (assembling the engine)

Control Line Aircraft Society's NSW State Championships 12 – 14 June 2021.

Following a break enforced by that Covid pandemic, CLAS were please to welcome entrants from Queensland and ACT to vie with NSW fliers to contest the State titles in Aerobatics and Combat.

The weather for the Queen's Birthday weekend is often unfavourable but this year gave next to perfect if somewhat cold conditions.

F2B Aerobatics was held on Saturday and Sunday in near perfect air and after 4 rounds the results were:

Expert

1st	Murray Howell
2nd	Brian Eather
3rd	Bruce Hoffmann

Advanced

1st Steve Thomas

2nd Geoff Van Kampen

3rd Don Keysekker

Monday saw the Classic and Vintage models line up in continued great conditions.. The results were:

Classic

1st Reg Towell

2nd Garry Lynch

3rd Geoff Van Kampen

Vintage

1st Brian Eather

2nd Frank Battam

3rd Don Keysekker

Like the Stunt planes Combat started in ideal conditions on Saturday, results were:

Slow Combat

1st Maryann Stewart

2nd Trent McDermott

3rd Bob Phippen

F2D

1st Rob Owen
2nd Mike Comiskey Sen
3rd Trent McDermott

Open Combat

1st Rob Owen
2nd Mike Comiskey Sen
3rd Trent McDermott

1/2A Combat

1st Richard Justic
2nd Rob Owen
3rd Ross Middleton

Vintage Combat

1st Bob Phippen
2nd Mike Comiskey Sen
3rd Maryann Stewart

Photos by Sara Siwaporn and Greg Ardill

Here are the results from the first round of an **International postal competition for Classic FAI team race** that was organised by Norman Kirton.
He has decided to extend the ROUND 2 period so that you all have from AUGUST 1st until OCTOBER 31st to put in three attempts.
Good luck and lets see some more teams entering.

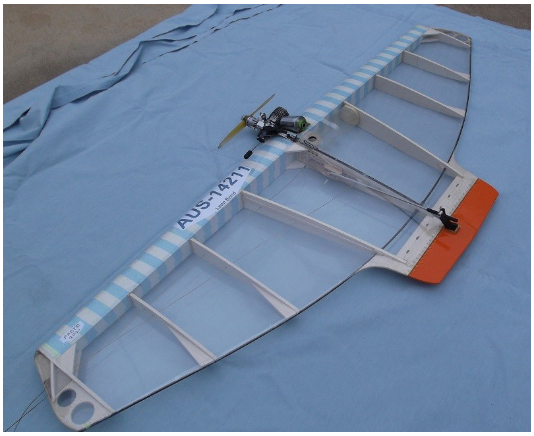
Times in RED used pressure refuelling and have 10 secs added

COUNTRY	TEAM NAMES	HEAT 1	HEAT 2	HEAT 3	PLACING
Australia - WA	R. Bellis/D.Gannon	04:43.74	04:36.34	04:29.57	7
28/03/2021	A. Zomalyi/R. Morrow	**06:38.51**	**07:16.38**	**06:15.00**	15
	B. Bellis/I. Thompson	39 laps	DNF	04:41.84	9
	Sherburn/Sherburn	05:09.09	05:09.76		12
	Letchford/Walton	**04:46.41**	8 laps		11
Australia - VIC	Nugent/Ellins	04:20.27	04:10.71		3
2/04/2021	Cameron/ Fitzgerald	04:04.04	DNS		1
	Bailey/Hunting	DNF 64	04:28.54		6
	Justic/Baddock	04:42.48	DNS		10
	Wilson/Barker	04:56.49	04:26.55		5
	Owen/Owen	04:49.81	04:18.10		4
New Zealand	Rod Brown	04:27.76	04:10.93	04:06.94	2
3/04/2021	Brendon Robinson	04:48.88	04:33.89		8
	Bryce Gibson	25 laps	05:17.91	05:12.05	13
	Andrew Hanson	05:39.14	05:33.71	05:18.88	14

NB: NZ entries only show entrant as, apart from F2C, this is the way they do it, I'm told.

F2D Combat Notes

By Leon Baird



Some F2D history - or how we managed to arrive at where we are now.

In the interests of your entertainment, I will also include some of my own F2D career history and other anecdotes in the following discourse.

Over the decades, there has been a significant evolution of the sport of F2D Combat. In the mid 1970's, when I first entered FAI (F2D) Combat competitions, all that was needed was a couple of robust diesel engine powered models which would likely see you through, with only minor repairs required to be ready for the next competition. Of course all models were home built in those days, and were almost invariably standard British designs or slightly modified versions of them. Most popular were the *Liquidator*, *Ironmonger,* and later designs such as the *Hornet.* The British were the Combat gurus' in those days, and we followed to the letter everything that was said and done according to *Aero Modeller* magazine.

In 1978, the first official F2D World Championship competition was held in Woodvale, Britain. Reading the classic *Aero Modelle*r report of this event, even after all these years, is (at least for me) fascinating. It was a time when although glow engines were beginning to dominate, there were still plenty of diesel powered models at major competitions, and a wide variety of model types, construction methods and materials. It was a time of great change and experimentation.

In Australia, we always seemed to lag a few years behind the rest of the World in adopting the latest Control Line developments, and in F2D it was no different. I assume this was in part due to our small competition scene, and the desire of competitors to consume their old stock of models and equipment before considering anything new, not to mention the 'short arms' of the cash strapped. But by the late 1970's, with the widespread international introduction of glow powered lightweight models of all, or part foam construction, things began to liven up. Model designs such as *Zingers* and early version *Boomerangs* come to mind. Frank Coombs, whom attended a Vic. State Champs in those days, saw Nico Van Zyp (from The Netherlands) fly an all foam Rossi powered F2D model in a demonstration flight which shocked everyone. Quoting Frank: 'As soon as it took off, people ran from everywhere to get a closer look'.

During the flight, so high was the model/pilot performance standard, that people were awestruck. They had simply never seen anything like it. Years later, I thought perhaps seeing Nico flying on the occasion was the tipping point which provoked people from their F2D complacency, inspiring them to build superior performing models, to acquire better engines and equipment? Certainly, the local F2D scene did see a performance standard lift from that time, as new people entered the game and older flyers adapted to the new technology. I was not there on the occasion, but I did later meet Nico at the 1983 Richmond Nationals where I saw him defeat all comers with his superb Rossi powered *Super Boomerang* models. I can see that Nico had certainly inspired the local scene during his years in Australia, showing us all how F2D was done.

In the early days when still learning to fly combat, I would sometimes 'tent peg' my model during practice flights; gradually diminishing occurrences of which persisted into the 1980's. The humour over this expression was enhanced by observing the degree of 'squareness' the protruding rear end of the 'tent pegged' model formed with the turf, and also by the fact that it would invariably happen near the end of the engine run. I always knew that the classic expression came from a 1970's Combat competition report I had read in *Aero Modeller* magazine, but it wasn't until more recent times when I happened to re-read the said report, that I realized it was referring to Nico Van Zyp himself. For me, a complete irony. It was the one and only time the expression was used in a Combat report. *(in the Nov. 1970 issue, for those whom may be curious)*

In the early 1980's, when I returned to F2D flying, there had been a progression in the Australian scene, and all foam or part foam/balsa models were the rage. The idea was to build quite a number of large area (450 sq. Inch) models as light as possible, and with minimal strengthening. The absurdity being that it was all important to have maximum speed and turning performance at the complete expense of model durability and combat survivability. Since turning and sensitivity was paramount, despite their spectacular manoeuvres, it looked to me that most of these models were virtually uncontrollable. It seemed that being able to actually fly these models was of secondary consideration? Far from learning to develop effective combat flying skills, each flight was more a battle for control and to avoid hitting the ground, or to otherwise simply land the model in one piece should something go wrong with it during the flight.

So extreme and fragile were some of these models, it was thought that you could not test or practice fly them much, if at all, since during every flight, there was a high risk of a 'blow up'. Of course, I saw at least one test flight where the engine and its mount tore away at high speed, while the engineless (and wrecked) model fluttered slowly to the ground in a cloud of spraying fuel, foam and balsa debris. As Frank said at the time: 'they are one way trips', which indeed they mostly were. In S.A, people such as Maris, Robin, Ian and Greg N., all built their own versions of these 'one way trips'.

Even I got caught up in the madness, building *Taipan* gold head powered, cowled engine foam/balsa models for the 1983 season, including the Richmond Nationals competition. Unlike some however, my models did include a little critical strengthening, and consequently survived slightly better - I was even able to trim them over a couple of initial test flights. To be honest, with the small 2" Bellcrank combined with the wide spaced *Aero-Flyte* handles I was using, my models were right at the edge of the stability envelope, and a nightmare to land in windy conditions. Years later, I fitted a large, low geared Bellcrank to a remaining model, and even with the wide spaced handle it was delightfully controllable to fly.

For sure, those were the 'Mad' days of F2D, with high nitro fuel, large venturi sizes, open exhausts, reserve models with running engines on the ground during the entire bout (or until needed for a launch), and the destruction of large numbers of lightweight 'one way trip' models. Mostly, even the slightest mid-air glance, or contact with the ground caused a model to 'explode'. Noise levels and carnage were at times unbelievable, and the model carcases and debris left over at the end of a competition was quite a sight (requiring some effort in cleaning up the beads of foam).

I was so disappointed over my F2D competition results during 1983, using my version of the 'one way trip' models, and after so much effort in building them, that I went back to using G20-15 diesels, but this time with new all balsa models of generous wing area, strengthening and with 76mm Bellcranks. As a result, in 1984 I was much more successful using these reliable, controllable (slower) models, even scoring a first place at the SA State Champs, against the glow powered fragile foamies. It confirmed my theory at the time, where I believed that using reasonably strong, good turning yet controllable models that could be relaunched after surviving a ground hit, would be a big advantage. In fact I subsequently used different versions of this model design for some years, until I finally built the new Russian style, large Bellcrank, chicken hopper tank, all balsa, diesel models in 1993.

In those days, what I liked about using diesels was that they would perform well using the 4.0mm Venturi (introduced in the late 1980's), and even more so when the silencer rule came into effect in 1993. Both of these rules greatly affected the performance of glow engines, so airspeeds were slower, and hot restarts were all but impossible.

By 1992, I was using CS AAC diesel engines which were faster than the G20-15 diesels of old, were of modern design and were lighter. Since diesels were exempted from requiring silencers, their airspeed was similar to that of the glow engines, with far greater reliability. For the 1993 Wagga Nationals, Greg Pretty and I both used the CS diesels to good effect, we were more than competitive against the all foam model competition, with a resulting second place for my efforts, and a third place for Greg. We were the only competitors to use Russian style models, and also were the only diesel users. It seemed no one else was yet ready to try Russian style models.

I then had a break from Control Line for some years, returning again during the early 2000's. By then of course, the wheel had definitely turned for F2D. The Russians and Ukrainians by then enjoyed an established commercial market in supplying the world with high quality RTF F2D models, engines and all the other equipment necessary to fly them. These services probably arrived just in time, as from the 1980's, building the required number of the increasingly complicated yet essentially disposable models had been taking its toll on the sport, and contestant numbers fell.

In 2007, after I 'borrowed' a couple of Peter Norries' *Fora* powered commercial 'Triangle' models for my use in the SA State Champs F2D competition, I was hooked. I just 'had' to buy my own engines and models and get into this. Very kindly, Robert Owen sold to me 2 x new PC6 engines and 3 x new 'Triangle' models to get me started. I used this equipment at the NSW State Champs later that year. I had resisted for so long, but now found myself being dragged (without the kicking and screaming) into the modern F2D world. My diesel F2D Combat days were finally over.

With the collapse of the Soviet Union, initiated in 1989, resulting in huge social/political/economic turmoil and change, it was inevitable that in the developing Capitalist economies of those former Soviet Nations, some enterprising people would begin marketing Control Line models and equipment to the world. So successful has this been over the years that now, it has become almost routine to buy all such F2D (and F2A, F2C and F2B) related equipment. The models, engines and equipment commercially available today are highly developed and state of the art. Apart from rare exceptions of home built models, everyone now buys their equipment, which in some respects is a good thing.

Without this availability of equipment, I wonder if competition F2D flying world-wide would now be long gone? We have come a long way, welcome to the era of off the shelf, standardized RTF F2D models, and equipment.

In F2D, has experimentation, innovation, development and improvement of the state of the art stalled?

Since the Russians revealed to the world their highly developed and innovative models in 1989 - apart from some refinements in construction/materials and the later trend to Integral Elevators - not very much has changed aerodynamically in the world of commercially available F2D models.

Of the early pioneer models, most well known is the BV-255 model by Vacheslav Beliaev, which was of huge wing area of some 510 sq. Inches, featured external controls, and was powered by a lightweight, powerful *Stells* engine. Details of this model and of two other similar models of other designers, were first published in *Aero Modeller* in Jan. 1990. In Australia, these very strong, high performance models did not catch on for some years, with competitors largely still preferring their fragile foam models.

The strength, rigidity and performance of these early models represented a paradigm shift in the world of F2D. The use of foam, tapered Softwood main Spars, and softwood L. E. spar forming a triangular construction, together with a Soft wood/balsa Centre Rib, thread (Kevlar) binding on L. E. and elsewhere, tapered softwood T. E., outboard Softwood tip Rib and Tip, resulted in a strong and crash resistant model. Commercially available Russian RTF F2D models appeared in the early 1990's, so, what has changed in commercial F2D model design since then?

These days, the commercial Ukrainian and Russian models are still very similar in basic design, although there is widespread use of Carbon Fibre in areas such as Spars and T. E. Some have Carbon Fibre Centre Rib construction; a few specials even have Carbon Fibre Ribs and other parts. Carbon Fibre is light, and adds strength and rigidity to the structure, at the expense of brittleness. Because of this brittleness, lamination/binding with Softwood or other materials is best. There is also use of Fibre Glass in some models, although strong and more flexible than Carbon Fibre, it carries a weight penalty.

Other changes include: internal controls, fitting of internal Shutoffs (on some models), and integral Elevators, verses the original detachable type, known as 'Triangle'. Other changes in more recent years include how the main Spar is now constructed. This is now typically a separate assembly consisting of a balsa core which is laminated/bound top and bottom with Carbon Fibre flat (usually 5 x 1), or F. Glass for some models. This very strong laminated main Spar is then glued to the rear of the foam L. E. profile (and further bound/ paper covered), whereas the original type with the tapered Softwood Spar sections, were simply glued to the cut outs (top and bottom) at the rear of the foam L. E. profile, meaning that beyond the strength of the foam itself, plus a few Ribs which butt onto its rear, and the subsequent binding/paper covering, there was very little holding it together. These original type Softwood spars would often spit away from ruptured foam sections resulting from mid-airs or heavy visits to the ground. Having said that, some suppliers even today, still persist with the original and weaker type main Spar, so be wise. The newer laminated Carbon or F. Glass type is vastly stronger and better in all respects - a major improvement strength wise.

We can see that apart from changes to accommodate internal controls, Shutoffs, and the Integral Elevators, nearly all changes concern construction/materials, for better strength/combat survivability (which have also increased costs).

So, since the early days of commercially available F2D models, has experimentation, innovation, development and improvement of the state of the art stalled?

In terms of Construction and materials, there has been progress, so the answer is no.

In terms of aerodynamics, I believe it largely has stalled, yes.

Some observations and experiments:

We have seen that since the Russian paradigm shift in F2D development, there have been a number of changes in the construction methods/materials employed by the commercial suppliers, and also those in response to rule changes. These are construction changes, but what aerodynamic changes have taken place over the years?

Certainly, we should first consider the change to 'Integral' Elevators, which occurred some years ago now. This was an aerodynamic change, but not a significant one, as these had been in use in various F2D designs since the 1960's. Let's examine the differences between 'Triangle' and 'Integral' Elevator type models, their different flight characteristics, and reasons for the change.

The advantage of the 'Triangle' model is that the Elevator is easily replaceable and that the model is more user friendly should Mylar re-covering become necessary. In my view, in flight, no model changes direction as quickly, or turns as small a radius as a 'Triangle' model and still be in a stable trim. The downside is that they are not perfectly accurate when attempting to exit a turn at a precise point, and when following an opponent's model during a bout.

The 'Integral' model on the other hand provides more of a problem when it comes to replacing an Elevator, or when re-covering becomes necessary. In my view, they are smooth in flight, exit turns more accurately and can follow an opponents' model more easily than the 'Triangle' model, at the expense of a wider turn radius when balanced for a stable trim. Generally, they are more user friendly, especially for new pilots.

Having said that, there is not a lot of difference between them in the real world - I am happy flying either type. As far as to why the change to 'Integral' Elevator type models? Well, no F2D model supplier to my knowledge has ever given reasons for this. I can only assume it is for the slight advantage in controllability and accuracy they offer?

<u>Plan view and aspect ratio of the models:</u> The newer 'Integral' models generally have longer span and shorter Root Chord than the earlier 'Triangle' type. The differences however are not a lot, with the 'Triangles' typically at 1160 span and 'Integrals' at 1180 span. Root Chord is typically 340 - 350, and 320 - 325 respectively. So we see that there has been a trend to a higher aspect ratio over time, and a higher aspect ratio is supposed to be more efficient?

But I have noticed that this shorter Root Chord, which is certainly less than that for previous generations of F2D models, provides a mediocre turn radius. I consider that reduced Root Chord is a mistake, and is detrimental to model performance. However, some commercial models are now indicating a degree of change in this respect, an example being the *Yuvenko* '*Rastenis*' design, which has a tail extension, and a Root Chord of 330, a modest increase of 5 - 10mm. In recent years, I have built several prototype 'Integral' models with longer than standard Root Chord of up to 375 and more, and I have been rewarded with a tight turning yet very stable platform. More on this later.

<u>L. E. section and aerofoil:</u> Very little has changed in this respect over the years. What works best is a reasonably blunt L. E. section, with a short parallel section behind it, followed by a curved section tapering to the T. E. The actual aerofoil profile used is not critical, but using a sharp L. E. profile is a no no, as this makes for an unstable model. I used an over blunt L. E. profile for my 1983 'one way trip' models and although they were stable aerodynamically, and turned well, they had high drag, resulting in lower airspeed. The sharpest L. E. profile I have seen on an F2D model, is of those built by Andrew Linwood. I have a repaired example of one such model, and I can say that it flies really well.

<u>Wing section thickness and Aerofoil percentage ratio:</u>

For some time, I have noticed how excessively thick (in my view) F2D wing sections are on commercially supplied models. This is necessary at the Centre section to accommodate the Bladder Compartment and to therefore maintain an unspoilt aerofoil. So, the usual 42 - 44mm is the correct thickness range at the Centre section. Section thickness at the Tips is usually 26 - 28mm. Both Centre and Tip sections remain unchanged since the early days of Russian models. So, why discuss wing section thickness? Well, because it has a direct effect on airframe drag, model performance and speed. As we know, drag (and lift) increase with greater wing thickness, and conversely, airspeed decreases as wing thickness/drag increases.

My recent prototype models all feature Centre sections thicknesses in the range of: 43 - 46mm, tapering to 19 - 20mm at the Tips. I have settled on a 43mm Centre, and 20mm Tips for my latest model, which I consider to be about optimum. I like to see what I call aerodynamic harmony in a model, and I think my experiments have shown how to make incremental design improvements in attempting to approach this ideal. I believe that reducing the tip section thickness as I have described, is the way forward in gaining an increase in model performance.

Another advantage to be gained from the reduction of Tip section thickness, is the better harmonization of airframe wing section thickness percentage ratio. This is the ratio of wing section thickness compared to its Chord. To explain this, let's compare a recent commercial model with my latest prototype model:

Yuvenko Integral Model:

Centre section thickness and Root Chord: 43 and 325

43/325 = 13.23% thickness percentage ratio.

Tip section thickness and Chord: 28 and 145

28/145 = 19.3% thickness percentage ratio.

Prototype Integral Model:

Centre section thickness and Root Chord: 43 and 335

43/335 = 12.83% thickness percentage ratio.

Tip section thickness and Chord: 20 and 140

20/140 = 14.28% thickness percentage ratio.

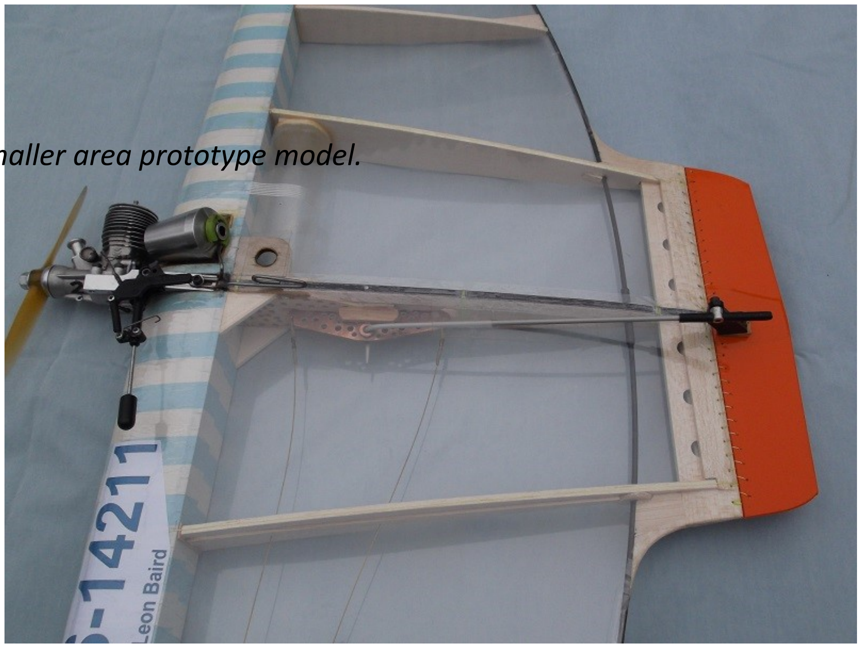
Normally, a clearer picture of wing thickness percentages is revealed when data from additional stations along the span are included, but for our purposes, the Centre section and Tip data only will be sufficient. What we see here in the case of the *Yuvenko* model, is the significant percentage thickness differences of Centre section and Tip: 13,23% and 19.3% respectively, which is more than 6% variation. The prototype model however, shows a 12.83% Centre and 14.28% Tip, which is only a 1.45% variation, Centre to Tip.

What I am aiming to show with these figures, is if we can design a wing which closely harmonizes the thickness percentages across its span, then we will have a more efficient and faster model which wastes less engine power. Simply tapering the aerofoil thickness from around 43mm at the centre, to 20mm at the tips achieves this beautifully.

Wing area and wing loading:

Beginning in the mid 1970's, the search for ever greater flight and turning performance led to competitors building larger models, and by the late 1970's and early 1980's 'mad' days, some were as much as 500 sq. Inches. Other than for a few 'die hard' diesel users, glow engines completely dominated the world scene. We have seen that Beliaevs' 1989 Russian model at 510 sq. Inches, continued this trend, as did many of the other early Russian designers' models.

Today, the average commercial F2D model is some 448 sq. Inches in area and weighs around 435 - 440 g RTF, less Bladder and fuel. You will notice I have used both Imperial and Metric measurements, which could be confusing, right? To calculate wing loading, we could instead either use all Imperial measurements, or we could use all Metric measurements. Without delving into this too far, let's consider the Imperial method, which is Ounces per sq. Foot, or the Metric version which is Grams per sq. Decimetre. Starting to sound meaningless already isn't it? I think most people will be more familiar with sq. Inches? So, getting back to my Imperial/Metric version, let's see if it makes any sense for our purposes?



Recent, smaller area prototype model.

Our average commercial F2D model weighs let's say 435 g, and is 448 sq. Inches in wing area (Elevator is not included). So, we divide 435 by 448, which works out to a wing loading of: 0.970 Grams per sq. Inch. The clincher here, is the fact that both numbers are close in value, which makes the resulting wing loading number close to 1.0. In fact, I use this easy to remember round number as a ball park value for F2D model wing loading. How I look at it is like this: A very lightly built F2D model might have a wing loading of less than 1.0 g/sq. Inch, and an average one 1.0 g/sq. Inch, and a heavier repaired one at up to 1.05 g/sq. Inch or more. Get the picture?

Generally, a new model will have a wing loading of 1.0 g/sq. Inch or less, but I consider that any F2D model with a wing loading of 1.05 g/sq. Inch or less, is going to be a competitive model. When the wing loading is 1.05 - 1.07 g/sq. Inch, it is beginning to become less so, and if more than 1.07 g/sq. Inch, useful for practice flying only. However, like in most things, there will always be exceptions to the rule - e.g. the Andrew Linwood model (416 sq. Inches, 452 g) comes in at 1.086 g/sq. Inch, and is nice to fly, and my very overweight 2019 proto model is, ahem 1.16 g/sq. Inch, yet it also flies nicely. Using suitable props for the high wing loading models, I would happily use both in competition.

Is it time to re-think model size?

For some time now, as a result of some thinking directed toward the issue, and because of information gained from model experiments both past and present, I have become a tad suspicious that commercial F2D models carry too much wing area. A couple of larger area (458 sq. Inches), low wing loading prototype models I built in 2020 did not show any significant improvement over standard area models, further confirming this to me. Have we overshot the mark? There is a need for a balanced trade off in any design input, and in the case of F2D models, I believe we are not yet at that optimal balance point; that there are incremental improvements yet to come? Perhaps there is room for considering a downward adjustment of wing area, to gain the benefit of better model performance?

Power to Weight ratio:

Instead of focusing only on wing loading, we should also consider the overall weight (Mass) of a model. A smaller model may have a slightly higher wing loading, yet be somewhat lighter in weight, and therefore have a higher power to weight ratio. It follows that a smaller, lighter model will accelerate out of turns more quickly than a standard model, may have a turn radius equal to that of a standard model, and due to having less drag, be faster both in level flight and manoeuvres. A smaller model will generally be stronger and more combat survivable.

In the light of these considerations, let's look at the specs of my recent prototype model more closely:

Wingspan: 1040

Root Chord: 335

Bellcrank: 90 x 17.5

Section thickness: 43, and 20 at tips.

Wing area: 378 sq. Inches

Weight RTF: 392 g

Wing loading: 1.037 g/sq. Inch

The performance of this model is outstanding, and the speed has increased by around 1.0 sec/10 when compared to a standard commercial model. Acceleration, speed in turns and turn radius are all excellent, there is a noticeable difference when flying this model compared to an as new commercial model (using the same engine). I have also noticed that it is confidence inspiring and predictable during manoeuvres. I am impressed.

Control Systems:

Since 1984, I have used large Bellcrank control systems on my Combat models. I consider that the 'traditional' 2.0" and now 50 - 52mm Bellcranks commonly seen on commercial models, to be inadequate, both in leverage/power and in the limited Push Rod travel they produce. Recently, I have settled on using a 90 x 17.5 Bellcrank, which works well, and has the correct gearing when coupled with a 30mm Elevator Horn. The Bellcrank rotation is stop limited to give about 20mm Push Rod travel (full up to full down), and 52mm total Leadout travel, which is slightly more than my usual 48mm set up. Elevator movement is 18 degrees each way, up and down when using the top hole Horn position. With the 79mm spaced Handle I use, the gearing of this system is relatively low and provides a nice, accurate model control. It is important that the control system geometry is error free, to avoid asymmetric Elevator movement. Incidentally, some commercial suppliers have recently been using a slightly larger 62mm Bellcrank in their models, which I consider to be a step in the right direction.

I use a handle with an adjustable leader wire, as attempting to use a fixed system rarely provides a neutral Elevator/neutral Handle harmony, except when there is the coincidence of Leadouts and line length errors cancelling one another. Recognising this problem, commercial suppliers now provide adjustable handles. However, although an improvement, these offer only a partial solution, since the rigid adjustment elements introduce handle asymmetry. I am poised to try out a home-made handle with a very short leader wire set up of limited adjustment range, for use with standard length commercial line sets, which will avoid my having to make custom length lines in future.

F2D Engine and Model set up tips:

Engine compression ratio:

More than a year ago, I began to look more into how I could better set the compression ratio for my *Fora* engines, instead of simply assuming that a standard gasket set thickness would be about right for all engines. The usual method was to start with a 0.38mm gasket set, and leave it at that. This did seem to work OK for some engines, but not for all. Some of my engines had a problem - they didn't tune well, were unhappy and relatively slow. To cut a long story short, I realized that this was a result of them having a too low compression ratio.

It is assumed that batches of precision made engines which are assembled with the same gasket set thickness will all have the same compression ratio? This can be the case sometimes, but due to accumulated tolerance errors of the individual parts that make up the engine, not always. The differences are even wider when we compare engines from different years of manufacture, and also engines of different production batch lots.

So, then it dawned on me that I needed to directly measure the Head volume of an engine, in order to set the gasket thickness required for that particular engine. I found out that the standard Head volume for a *Fora* engine was 0.170cc, which according to calculations, gave a 15.55: 1 compression ratio. I disassembled the top end of the engines one at a time, cleaned the parts, and reassembled them with the gasket set they already had, and with a prop fitted, and no Glow Plug, brought them up to TDC. I then took a 1.0cc Syringe (graduated in hundredths of a cc), with needle attached, and drew up into it over 0.30cc of Sewing Machine oil. Then, up-ending it to expel any trapped air and forcing some oil out so that the end of the plunger lined up exactly with the 0.30cc line on the body. Holding the engine upright, I carefully fed the oil, a drop at a time through the Plug hole until it filled the chamber up to the bottom of the Plug seat, taking note of the expelled oil volume reading from the markings on the Syringe body.

Not perfect, and not easy, but it worked. I would often do this twice to confirm the readings, after washing out the oil with solvent. According to Andre Bertelsen (see his *You Tube* blogs), the Head volume can be set as low as 0.120cc, but personally, I set my engines to 0.135 - 0.150cc which works well. I found that many of my engines were way under compressed, with one originally showing a reading of 0.230cc. With all engines set correctly, their gasket set thicknesses ranged from 0.08mm to 0.30mm. So much for the theory of standard gasket set thicknesses?

Naturally, each engine is individual, no two will show the same results, and my suggestions are a guide only, so if after setting the head volume, the engine blows a Plug during a run, then you will need to add 0.03 to the gasket set, and try again. Once an engine is set up correctly, it will run well and tune well, not blow Plugs, and will not need any more adjustments. Of course, record the details of the final Head volume and gasket set thickness for each engine.

Props:

Due to the 2011 rule change which brought in the Muffler 6.0 outlet hole size, and the more recent reduction of fuel Nitro content to 5%, F2D engines have less power and torque output than previously. This means they need to have smaller diameter, low pitch props to maintain revs, and give best performance. In my experience, props like the *Seryogin* Blue (164 x 94) and NN (159 x 94) do not work well (unless the engine is exceptional) due to their high pitch. This over-loads the engine during manoeuvres which causes the revs and speed to fall. I find that props with pitch in the 87 - 90 range work far better.

However, not all the props work well as they are, and need to be re-worked and trimmed. As an example, one well known and well regarded prop is the *S-163* (163 x 88) which has rather thick and wide blades, making it a high load prop. Solution: Trim diameter to 158, file new L. E. sweepback profile to reduce blade area, and thin/re-profile aerofoil on outboard 1/3rd of blades. Yes, there is some amount of work required, but the resulting performance is excellent.

Control System set up:

I have mentioned the use of large Bellcranks, but no matter what the control system is on a model, there are gains to be made when it is set up and adjusted properly. As a matter of routine, I always ensure that the Clevis pivot point on the Elevator Horn is forward of the hinge line, and forms a 90 degree angle with the Push Rod and hinge line. This is to avoid asymmetry in the controls and so provide a nice balanced system. I achieve this by re-mounting the Horn on a tapered pine wood wedge shaped spacer, which cants the horn forward. Also, if the Elevator does not achieve the necessary 18 degrees up, and 18 degrees down travel when using either the top or second from top hole Horn position, then something else is wrong, such as insufficient Bellcrank rotation. Avoid using a lower than second from top hole position on the Horn to compensate (especially when the Bellcrank is small) because that will cause the system to be over geared, making the model more difficult to fly accurately.

Horn mounted on tapered spacer for correct system geometry.

Bladders:

I have found that the commercially available Bladder tubing provides too much fuel pressure, resulting in over sensitive Needle setting problems. This also makes the Needle Valve very intolerant to the slightest amount of dirt in the fuel, which can on occasion, create a partial blockage and lean engine run. Some flyers fit after market, fine thread Needle Valves to their engines in the hope of overcoming these problems.

Solution: Instead, use a lower pressure tubing. I have recently been using 6.0 ID x 9.0 OD 'Spear Gun' Surgical Tubing, which works reasonably OK and is cheap, but it delivers less than constant fuel pressure during the run. As a consequence, I am still searching for an alternative. I welcome any suggestions or recommendations from readers?

My thoughts on the future of F2D will be in next months edition of ACLN.

SHOP TALK

Some old news from March 2020.

We inform our customers that NOVAROSSI WORLD S.r.l. it will remain closed from 12 until 22 March 2020 due to the health emergency due to coronavirus.

Apparently they never re-opened and more recently Mark Greenwood (an administrator on the Facebook Control Line Racing group) posted this message.

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Be considerate with phone calls. I am in WA & there is a time difference from Eastern States.

U.S. Hard rock maple bearer wood, precision cut and machine sanded.

Cost $4.50 each plus postage. All lengths 12"

Sizes: 3/8"x3/8"
3/8"x1/2"
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Also, I now have a stock of 3/16" sq. and 1/4"sq rock maple spars.

All spars are precision sanded with 150 grit. $4 each plus postage.

TCA Italian glow plugs in Australia.

I have for sale a large range of TCA glow plugs.

TCA supply Luca Grossi the current F2A European champion.

There are std type 1/4x32 thread, Nelson style tapered seat with flat coils and the "turbo style" tapered seat.

Italian made TCA Nelson type combat plugs arrived for those that might be interested, $8 each plus postage.

email: aheath296@gmail.com

Speed pans for sale. 2cc size ($25) and 21 size. ($30)
Also small amount of Nelson type T/R pans. ($25)
All pans in the "as cast" state. Not finished.
Andrew Nugent. andrew.n5@bigpond.com

For Sale.
38µ (micron) Mylar laminating film (heat activated adhesive).
Suitable for C/L combat models, great for F/F models.
Even better with tissue doped over it for a 'vintage look'
This is very close to the 'Oz Cover' that was sold by Saturn Hobbies many years ago.
1m x 5m $20 + postage at cost.

feraldoghunter@gmail.com
Danny Mz mob # 0477224751

I can now produce wings and tailplanes that are shaped on a Computer Numerically Controlled (CNC) router and can be any planform and shaped with any section although I have my favourites. The finish and accuracy of these products has to be seen to be believed.

They have laminated leading edge and reinforced front panel on the outboard wing for catching.

Internal control grooves and bellcrank assembly are also part of the package. They are ready for glassing as supplied. A shut-off actuator can be supplied as part of bellcrank assembly if required.

I can also supply spruce for leading/trailing edge etc. cut to any section size.

I can be contacted via Facebook or

Mobile 0404205562

Ray Harvey

I am chasing a Gillott Rossi, MK2 or MK3 for Goodyear T/R, not worried about condition as long as it is complete.

Email me at weapon61@yahoo.com.au

Cheers Neil Baker

Wanted.
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Kim Laughton Mob Tel:- 0403 327 311

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