Scale Matters

Sukhoi Su-26



Over 20 years ago when I first saw the Su-26 it captivated me due to its ability to perform powerful aerobatics along with its robust look and its unique design features. I considered it to be a very interesting and ideal aircraft to aeromodel.

The Su-26 is a single seat aerobatic aircraft that was designed and developed by the former Soviet Union. The Su-26 is considered to be the world's first aerobatic aircraft. The complete design was specified around the requirement to be "indestructible in the air". This ensures that irrespective of the flight envelope performed by the pilot it is impossible to generate loads on the airframe that exceed their design limits. The airframe was tested under static loads of up to 22.5g and the aerodynamic authority of the aircraft limits the flight loading to 18g. The operational limit of the aircraft is 12g as this is the physiological limit for the human body.

The original SU-26 was first debuted at the Hungarian aerobatic world championships in 1984. The aircraft flown by Yurgis Kairis took 24th place in the individual performance category. This provided valuable experience and the Su-26 was redesigned and fine-tuned along with weight reduction using state of the art composite materials to become the Su-26M.

Three Su-26M were produced for the 13th World Championships and the USSR pilots competed against 70 sports flyers from 16 different countries. The Soviet

pilots won first place in the team classification and took 16 of the 33 available medals. Lyubov Nemkova became the first Women's Wold aerobatic Champion.

After the 13 World Championship the Su-26M due to its amazing performance became dominant in the aerobatic seen from that time on and orders flowed from the USA and other countries. The Su-26 continued development through different versions:- Su-26M, Su-26 MX, Su-29, Su-29T, Su-31 and Su-31M.

During the 1996 World Championship more than half the contestants flew Su variants. As of 2003, there had been 153 Su brand sports aeroplanes produced, 128 of which had been delivered to foreign customers.

In recent years the aerobatic scene has been dominated by the Extra 300 series aircraft from the USA.

Interesting Innovations

To ensure that the pilot was given the best opportunity to survive this high g environment the cockpit was designed with the seat tilted back at a 35 degree angle and incorporated unique safety harness.

The wings are made with no dihedral or incidence and a specially developed wing section varies along the span with a slight concave area in the vicinity of the ailerons to increase their efficiency.

The leading edge is relatively sharper than a usually symmetric section to make the aircraft more responsive. The aerofoil section is relatively thicker than usual around the 1/3 front section. It has been said that this creates drag to slow the speed of the aircraft on the down leg to assist the Pilot with keeping a constant speed during loops by reducing nose down acceleration.

The wings do not have ribs and are constructed around a pair of spars and are covered in three-ply fibreglass epoxy with the forward boxed area being foam filled and fibreglass reinforced. The tail surfaces are constructed in a similar way.

The fuselage is constructed using light weight high-strength stainless steel welded truss sections with the front section being skinned using titanium and the rear section skinned using fiberglass epoxy and Kevlar.

The wheels are mounted on a solid titanium arc undercarriage.

The Old Days.....

RAY PERRIN Su-26M:- 1990 (Australian Kit manufacturer)

My first Su-26 that I built was based on a kit from Ray Perrin in Nambour Queensland. Ray ran a business specialising in Fibreglass Aircraft construction providing an advanced technological Service and Products to aeromodellers on the Sunshine Coast.

The specification for the kit was as follows:

Sukhoi 26M, 1/5 scale, Span: 1680mm (66"), Motor: 108-120 (17 -20 cc), Foam wings, stab, elevator and rudder, Fibreglass fuselage, Cowl and belly pan, Fiberglass composite u/cart, Clear plastic canopy, Photocopy of templates for formers etc, Drawings complete with appropriate measurements,

Price (1990) \$295.00 plus pack & post.

I built this aircraft during the late 90's and this was a very large aircraft for the time, and particularly for Canberra. The construction required the sheeting of foam core wing panels and appropriate structure and the fitting out of the fibre glass fuselage, this was effective and a common technique at the time for larger models.

The techniques used formed the foundation of very strong aircraft and if careful the weight could be kept to an acceptable level. I remember Ray was very helpful whenever I contacted him regarding any finer detail during the construction.



My daughter (now 17 years old) helping me run in the motor in the Ray Perrin Su-26M.

I developed a lot of useful techniques construction this aircraft. The colour scheme was one of my favourite from that era and is in the Proteus Petroleum colours. At the time I got a quotation for the lettering and that forced me to purchase my own Roland Sticker cutter that has paid for itself many times over. When I decided to make a larger version of the Su-26M I used the same sticker files and just enlarged them to the required percentage.



Roland Sticker cutters.



Ray Perrin 1/5 scale Su-26MX next to Model Design 1/3 Su-26MX at the NAAS field in Canberra (1/4 Scale DR1)

I only flew the aircraft on special occasions and it is still hanging in my hangar.

It flies very well as a sports aerobatic aircraft, and I have considered fitting a more modern engine than what is currently fitted and is now over 25 years old.

In the days of the NITRODUDE model aircraft shop in Canberra this model was displayed hanging upside-down from the roof above the main counter. The Internet Archive "Wayback Machine" <u>https://web.archive.org/</u> still allows you to view the old NITRODUDE web site..

H.D Model Design Pty Ltd (Australian Kit manufacturer)

The second Su-26 that I build was based on a kit from Ernie in South Australia.

The Model Design kit was very similar to the Kit from Ray but in a larger scale.

I do remember Ernie also did a smaller version of the Su-26.

The specification for the kit was as follows:

Sukhoi 26M, 1/3 scale,
Span: 2235mm (88")
Motor: 80-100cc
Foam wings, stab, elevator and rudder,
Fibreglass fuselage , Cowl and belly pan.
Fiberglass composite u/cart.
Clear plastic canopy
Photocopy of templates for formers etc.
Drawings complete with appropriate measurements.
Price (2000) \$455.00 plus pack & post.

Model Design produced a range of interesting kits and if you wanted anything big Ernie was about the only place to go. I considered the Model Design kits to be good value and allowed you to build the aircraft the way you wanted it to be. Like Ray, Ernie was also always willing to provide valuable construction advice and support. In fact I contacted Ernie the other day as I had picked up a second hand Model Design Cessna kit from a deceased estate and was missing the drawings, I had a good old chat with Ernie and he posted me the drawing and required documentation at no cost (Still providing support of his products some 30 plus years later). Model design are the agents for 3W motors and if you appreciated high quality engines then you must try a 3W. http://modeldesign.com.au/

Construction Techniques

Both these aircraft are constructed using the same techniques. The following descriptions describes some of the construction of the 1/3 scale Model Design Su-26M and would be similar for any fibreglass foam core constructed aircraft.

The cores for the wings and tail sections are cut out of solid core foam using hotwire techniques. The cores were supplied with both these kits. The cores are made either by following templates for the root and tip aerofoil sections which are manually formed using a hot wire cutter bow or using a computer controlled foam hot wire cutter following a computer aided design. I still find my computer controlled foam cutter (stepper motor controlled) that I made well over 20 years ago very useful. The software is still available through http://gm.cnc.free.fr/en/index.html which is a very interesting web site: have look.

Tail Section

The tail section is covered and fabricated in a similar way to the main wing. The covering process starts using sheets of 1.5 or 2mm balsa that are joined together to form sufficiently large sheet to cover the foam core. The thickness of the sheet is chosen based on how much sanding you may want to do to get the shape correct.

Joining balsa sheets is an acquired skill, there are a number of methods that can greatly assist, maybe this could be the subject of an additional article along with other useful foundation techniques.

I usually dope my balsa sheets to reduce the amount of epoxy they absorb before I epoxy them to the cores as a weight saving precaution. A thin layer of 30 minute epoxy is applied to the balsa sheets that are going to cover the foam core. I use old credit cards or business cards to spread the epoxy thinly and evenly across the sheets. The epoxy can also be thinned down using denatured alcohol before being applied to the balsa sheet to assist with reducing the amount of epoxy used. This helps to keep the wing light, you can make some test pieces to hone your ratios and techniques and test the bonding process for strength.

If you want to add some additional strength to the structure you can layup some fibreglass, Kevlar of carbon between the foam core and the balsa sheet in strategic positions as you apply the epoxy. Once the balsa sheet is applied to the foam core this whole assembly can be sandwiched between the surplus top and the bottom pieces of foam that the core was cut out from. Weight such as books can be placed on top of this sandwich while the epoxy sets.



Stabiliser with foam cores sheeted with bulsa.

Stabiliser

The Leading edged solid balsa strip is added to the covered stabiliser foam core. The marked construction lines can be seen on the stabiliser. The marked section of the covered foam core is cut out using a straight edge and scalpel blade to provide the separate stabiliser and elevator halves. The front of the elevator halves and the back of the stabiliser can then have the solid balsa strips glued to them to provide strength and a solid structure in which to mount the hinge.



Elevators cut away from sheeted stabiliser ready to be separated into two elevator halves.

Elevator

The solid balsa strip can be seen glued to the front of the elevator halves. The construction lines can also be seen drawn on the elevators before cutting them free. This cut line only needs to be capped with 1.5 mm balsa to finish then off.



Glassing the Stabiliser

Glassing the Stab

The stabiliser is glued into the fuselage ensuring that it is level and true. I use epoxy with micro balloons to ensure strong and fileted bond. The surface is then covered with ³/₄ oz. fibreglass cloth and epoxy. This bonds the whole structure together and provided a stable surface in which to apply the painted colour scheme.





Rudder being blocked up after sheeting

Rudder

The rudder is constructed in a similar way to the stabiliser, elevators, wings and ailerons. The rubber is tapped up as the solid balsa strips are glued to the sheeted rudder core. In the background of this Rudder image you can see the laid up wing section curing in the core halves.



Rudder post Image

Rudder post

This piece is the rudder post that will be glued into the back of the fuselage using epoxy and micro balloons. The rudder hinges will be mounted to this rudder post.



Rudder masked up for painting.



Rudder hard point for horn mounting

Rudder hard points

A hole is drilled into the rudder core and a solid hard wood dowel is glued into the rudder. This provided a strong point in which to attach the servo control horn. Other control surface mounting points are provided using the same technique.



Completed rear section of the MD Su-26MX



Main fire wall bulkhead marked up before final cutting.



Bulkhead and engine mounting plate.



Basic fibreglass fuselage.



Bulkhead

Bulkhead

The bulkhead is cut out from very strong 12 ply and glued in place using epoxy and micro balloons and captive nuts are used to attach the engine mounting plate.



3W twin mounted to the engine mounting plate with standoffs



Business end of the fuselage

With the engine mounted using this bulkhead ring arrangement the engine cooling air can also exit through specific areas of the fuselage.







Undercarriage mounting formers, carbon reinforcement can been seen laid up in the fuselage.

(This usually just means bigger bits break off, nothing can be made crash proof. We should always build lightness into our aircraft.)



MD Su-26 in undercoat.



Su-26MX outside for the first time.



Masking up as the colours are applied.



Su-26MX with colour scheme paint applied.

Painting

With my petrol powered aircraft I usually use automotive paints and this aircraft was painted using acrylic lacquer. The whole aircraft was sprayed using an automotive touch up gun. Acrylic is very easy to work with at home and can easily be repaired and touched up. The lettering and other detail is applied after cutting them out with the Roland sticker cutter. Spraying the surface with a fine mist of soapy water allows the stickers to be placed and moved around before finally sticking them down using a squeegee to remove the water from under the sticker. After a few hours the water fully dries out and the sticker are firmly adhered to the surface. A clear coat of acrylic can then be sprayed over the lettering if you desire.



Cockpit detail





MD Su-26MX alongside a YAK



Notice the lettering inverted on the left side of the fuselage, this is so that it reads correctly when flying low and inverted from left to right.



MD Su-26MX along with Maciek Ruciski's Composite ARF Extra at the NAAS field in Canberra



Matt Billett's very impressive and inspiring MD Su-26 at Shepparton around 2001

I liked the Su-26 with the Proteus Petroleum colour scheme so much I even did an indoor version. This was done by making the artwork using CorelDraw and printing onto sticker sheets with a laser printer. The stickers were then applied as water slide on just like Airfix model graphics. This is an effective technique for indoor aircraft as it is very light.



Parkzone Su-26 sitting on top of my 1/3 scale Su-26

I hope you have enjoyed this trip down memory lane and some nostalgic aeromodelling. I hope that some of your favourite models have survived the test of time, it would be interesting to see how many icons of Australian aeromodelling have survived. I still have a very nice Bolly extra...which is some more Australian aeromodelling history.

Until next time happy building and plenty of flying.