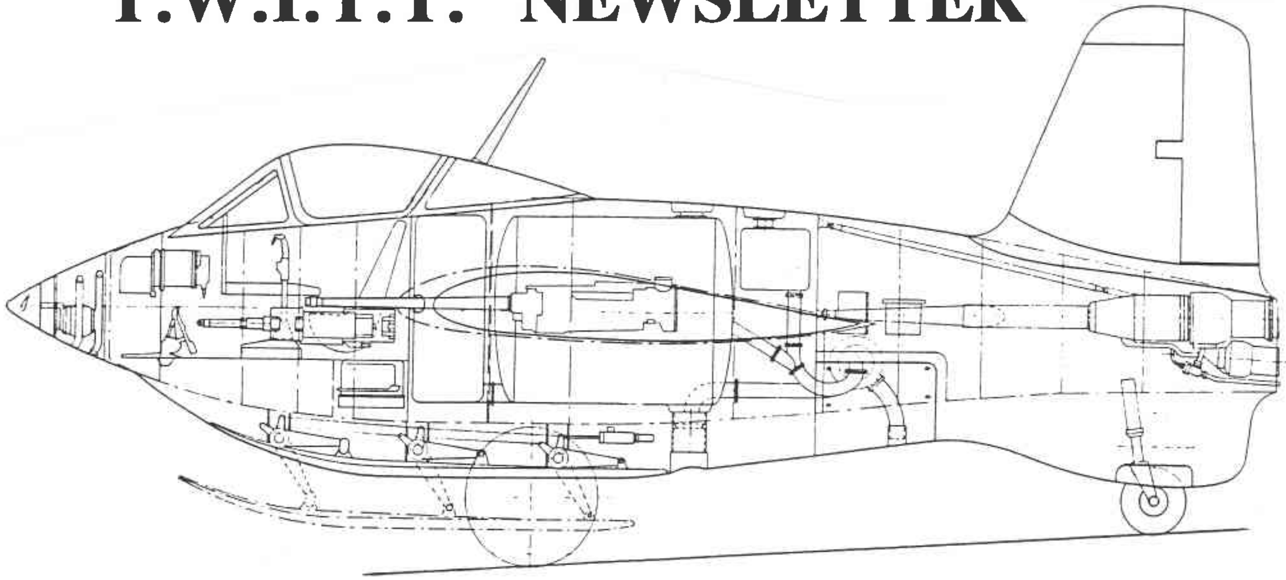
No. 98 AUGUST 1994

T.W.I.T.T. NEWSLETTER



Manufacturers drawing of the Me 163C from the year 1944.

Side view of the Me 163C from Messerschmitt Me 163 "Komet", Vol. II, by M. Emmerling & J. Dressel, Schiffer Military History, West Chester, PA, 1992, p. 40. (An example of the type of material available in the series of books published by Schiffer on the Komet and Lippisch designs.

T.W.I.T.T.
The Wing Is The Thing
P.O. Box 20430
El Cajon, CA 92021

The number to the right of your name indicates the last issue of your current subscription, e.g., **9408** means this is your last issue unless renewed.

Next TWITT meeting: Saturday, September 17, 1994, beginning at 1330 hrs at hanger A-4, Gillespie Field, El Cajon, CA (first hanger row on Joe Crosson Drive - East side of Gillespie).

TWITT

THE WING IS THE THING

THE WING IS THE THING (T.W.I.T.T.)

T.W.I.T.T. is a non-profit organization whose membership seeks to promote the research and development of flying wings and other tailless aircraft by providing a forum for the exchange of ideas and experiences on an international basis. T.W.I.T.T. is affiliated with The Hunsaker Foundation which is dedicated to furthering education and research in a variety of disciplines.

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Meetings are held on the third Saturday of every other month (beginning with January), at 1:30 PM, at Hanger A-4, Gillespie Field, El Cajon, California (first row of hangers on the south end of Joe Crosson Drive, east side of Gillespie).

TABLE OF CONTENTS

PRESIDENT'S CORNER

As you have probably already noticed, this newsletter is slightly late. I just didn't have time to get it ready before going on a week's vacation, but fortunately there was no meeting this month.

I am looking for some more new material for the September newsletter. The letters sort of slowed down this cycle (I guess we didn't have anything controversial enough to generate your writing juices). But seriously, please let us know what projects you are working on and how well they are coming along.

I received a last minute note from Kevin Renshaw letting us know that Dr. Karl Nickel's book Schwanslose Flugeuge will be available in an English version in September under the title Tailless Aircraft in Theory and Practice. It will be published by the American Institute of Aeronautics and Astronautics (AIAA). I will publish the price and ordering information in next month's newsletter since there is no room for it this month.

I hope we will be seeing some of our west coast members at the upcoming SHA Western Workshop in Tehachapi over the Labor Day weekend. This event always has something for everyone, so you ought to try and attend at least one day. Bruce Carmichael has worked hard to put together an excellent program again this year. (For more information, see the announcement later in this issue.)

As you can see from the minutes, we had an excellent, impromptu program. The information was especially valuable to anyone looking to increase horsepower without a significant gain in weight. The tuned pipe method seems like a reasonable alternative to a bigger engine.

Well that's about all I have for now. Please keep those letters coming, even if it is only to express an opinion or ask a question that has been puzzling you.

Andy

SEPTEMBER PROGRAM

As of publication time Bob is working on two different programs, since one of them hinges on the return of an aircraft from Oshkosh to make it a real crowd pleaser.

Both programs should be excellent, and we will definitely have a formal announcement in the September newsletter. In the mean time, make sure to mark your calendar for September 17th and come join your fellow TWITT members in an exciting program.

MINUTES OF THE JULY 16, 1994 MEETING

The meeting was opened by Andy welcoming everyone to our eighth annual birthday celebration.

The first order of business was thanking Chris Tuffli for his donation of four books to the TWITT library covering the Northrop flying wings, Me 163 and other Lippisch designs (see Additions To The Library later in this issue for a full listing of these books). Andy reminded everyone that the library is for their use and was not meant to be a dead end collection file. If there is something you see going into the library that you would like to read or have a copy of (other than regular books), drop us a line or come by the hanger and we will arrange some type of transfer.

The raffle prizes for the day would be a choice of a flashlight set or a set of different types of pliers. The eventual winners were: Chris Tuffli - flashlight set; and, Wendell Lundberg - pliers set.

Andy welcomed Wendell Lundberg, who had flown down from Chico, CA, to join us after having been a member for about a year. Of course he is interested in flying wings and hopes to be able to come down again in the future. He is a rice farmer and brought along some samples of his products, which he handed out.

Bob Chase passed around some pictures he had taken at the recent Northrop Flying Wing Contest (models) at Taft, CA. He didn't know the names of the pilots or the aircraft, but did say most of the flying was very interesting. (We will try to let you know early enough next year so that you will be able to attend.) Andy indicated he would try to put several of them in the newsletter as general interest items. *(ed. - they are scattered throughout the following pages.)*

Bob met a gentlemen by the name of Bill Hammer who was building a Mitchell B-10, which he has almost completed. The interesting thing about it was going to be the engine, a single cylinder, water cooled, Honda motor scooter engine. It produces between 15 and 25 horsepower and should allow the aircraft cruise at about 50 mph for up to five hours.

The last thing Bob had was a short recap of his recent trip to the Owens Valley (around Lone Pine) to crew for an fellow ultralight pilot. The aircraft were getting to at least 15,000' and were having a hard time getting out of the lift to get back down to earth.

Andy then introduced our main speaker for the day, Don Westergren, who has been with us before talking about scale modelling, his Voyager project, and his Space Shuttle model. Today he would be telling us about quarter scale unlimited racing.

Don began by explaining how the current pylon racing aircraft came into being about three years ago. They are supposed to be scale models of an aircraft that has raced in the annual Reno Air Races, so there is some limitation to the aerodynamics that can be used.

Don had brought along the latest version of his group's P-51. This one replaces the Miss America version that was destroyed at last year's race. That aircraft has been radar speed checked at 169 mph just before entering a pylon turn, and speeds in the 1994 races are expected to be even higher.

The aircraft pulls about 12g's going around a 120' radius turn, and looses approximately 30 mph. They accelerate along a 1600' straight away and reach just about max speed just before the turn. Don used this flight profile information to develop an actual pylon course on his computer to provide a simulation for making a better aircraft, engine and propeller combination.

The new P-51 will be coupled with a more powerful engine, smaller cockpit profile, and no belly scoop, and is expected to reach speeds in excess of 200 mph. This will be necessary in order to be competitive with what other builders are developing.

Don then showed about a 12 minute segment of a longer video of the race series in which the Miss America version of his model won. Each heat involves five planes running the course simultaneously (these are radio controlled models) so there are occasional crashes as the aircraft round the pylons. Each pilot has a spotter who calls the turn based on a light system operated by other people down by each pylon. The idea is for the spotter to anticipate the light and call the turn early late enough to clear the pylon, but early enough to minimize the distance around the pylon.

The racing is as close as you would see if you attended the regular Reno races. A slight bobble on the course will probably cost you the race and possibly your aircraft.

The thing that really wins the races is the power that is developed by the engines. With that in mind, Don introduced Paul Leary who was to tell us how to go about hopping up an engine through the use of a tuned exhaust pipe system.

Paul explained that the model's engines

started as single cylinder 100cc chainsaw motors. Two of these were then joined together through a special crankcase to get an opposing engine that produced about 16-19 hp in a stock configuration. Paul's job was to find more horsepower from the engine in order to achieve the necessary speeds to win the races (there is a cash prize, so money's at stake here).

(ed. - Rather than transcribe what Paul said to the group, I will reproduce his written explanation of how all this tuned pipe stuff works and then relate some of the questions that were asked by the group as he went along.)

No single item has more influence on the performance of a two-stroke motor than an expansion chamber. Given two engines identical in every detail except their exhaust systems, one with an expansion chamber and the other a straight pipe, the former can generate up to 100% more horsepower than the latter. For those of you who are somewhat familiar with four-stroke principles, a comparison to an expansion chamber can be readily made. "An expansion chamber is to a two-stroke, what a camshaft and turbocharger is to a four-stroke." How does the addition of a few pounds of sheet metal make all this possible?

In a properly designed exhaust system operating at its designed rpm range, the following takes place. As the exhaust port begins to open there is a sudden release of pressure that creates a very substantial compression or pressure wave. As this pressure wave travels down the pipe an expansion wave is generated which not only aids in the extraction of exhaust gases, but assists in drawing fresh fuel from the crankcase into the cylinder as well. It is so effective in pulling in the fresh charge, a large quantity of the charge escapes from the cylinder and out the exhaust port. Just prior to the exhaust port being closed, the pressure wave returns from its travel down the pipe and pushes the escaped charge back into the cylinder and holds it there until the piston closes the port. To better understand these phenomena, we need to learn some basic pressure wave characteristics and how each part of a two-stroke exhaust system utilizes these principles for horsepower enhancement. (Refer to Photo 1)

A pressure wave will travel back and forth through a pipe at approximately the speed of sound. Due to the elevated temperatures in the pipe, the speed of sound will vary between 2,000 and 2,400 ft/sec depending on the exhaust gas temperature. While turns and bends may hamper exhaust gas flow, they do little to affect the pressure wave. What does influence it are changes in cross-sectional area, the greater the change, the greater the effect. The pipe's rate of change is usually described in degrees of taper and consequently called a cone. A pressure wave that passes through a pipe that is **increasing** in size, e.g., the diffuser cone and headpipe, will generate an expansion wave over the entire length of the cone. This wave also travels at approximately the speed of sound but in the opposite direction and signal strength. It is this reversal in signal strength that accounts for the extraction of gases and the reduction in cylinder pressure to half an atmosphere. With the crankcase reaching pressures of 1.4 atmospheres and the cylinder pressure being reduced to .7 atmospheres, a substantially larger charge can pass through the transfer ports than without the benefit of the expansion wave. Studies have demonstrated peak torque generally occurs when this wave arrives at the cylinder with the piston at B.D.C. (Bottom Dead Center). This is easily understood when one considers the transfer ports are fully open at this point in time.

As the pressure wave passes through a pipe that is **decreasing** in size, e.g., the baffle cone, a large dent, etc., a wave is reflected over the entire length of the cone. Like the expansion wave, the reflective wave travels in the opposite direction. This wave is unique, however, in that it still retains a positive signal strength. The best example of this reflection wave is an echo. Few of us can say they have not experienced hearing their voices bounce off the walls of a canyon, sides of mountains, or buildings. The principle is exactly the same. With the pressure wave having its direction reversed, it now begins its travel back toward the exhaust port. As it arrives at the exhaust port, its intensity is not only of sufficient strength to stop the escaping of the fresh charge from the cylinder, but also capable of reversing the flow back into the cylinder and maintaining up to 2 atmospheres in the cylinder until the exhaust port is closed. This activity is not unlike the turbocharging effect previously discussed. The camshaft effect comes from the combined effect of the chamber's shape and length. Each component will have its greatest effect at a particular engine rpm. Therefore the designing of a pipe must have a particular purpose in mind since compromises must be made. A high rev pipe is not capable of giving a strong bottom end nor a low end pipe capable of a killer top end. Nor can a mid range pipe be capable of a tractor bottom end with an arm wrenching top end.

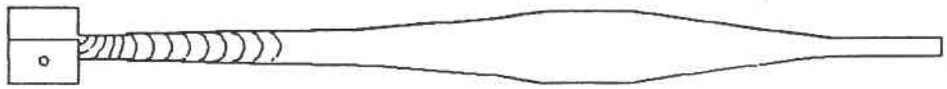
A tuned exhaust system can be broken down into six components. They are: 1) the exhaust port tract; 2) the headpipe; 3) the diffuser cone; 4) the constant; 5) the convergent or baffle cone; and, 6) the stinger. (Refer to Photo 2)

The exhaust prot to exhaust flange section is established by the engine manufacturer and as a rule needs little changing. The designer is well aware of the flow requirements of the exhaust port and usually incorporates a mild taper to aid exhaust extraction. This normally results in an outlet size that has an area 10-25% larger than the exhaust port depending on the application. Peak horsepower will generally favor the smaller difference.

While some designs may incorporate a headpipe with no taper, pipes are normally found to have a 1-3° taper over its length. As previously explained, this aids in the

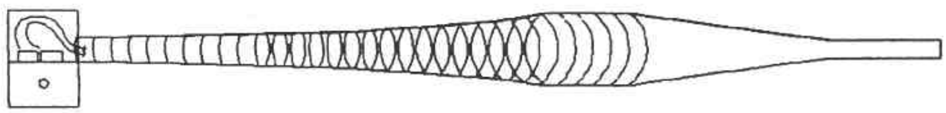
Photo1.

AS EXHAUST PORT OPENS:



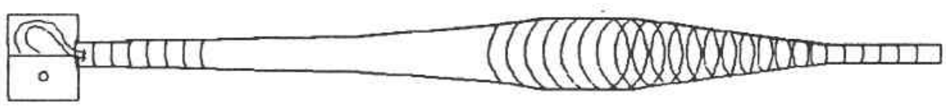
The sudden release of combustion gases causes the formation of a compression or high pressure wave.

DURING BLOWDOWN AND BDC:



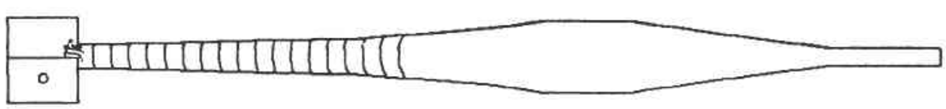
As the compression wave travels through the headpipe and diffuser cone, part of its energy is converted to form an expansion or low pressure wave. The expansion wave travels in the opposite direction of the compression wave and will aid in the extration of the remaining exhaust gases and the drawing in of fresh fuel and air.

DURING AND AFTER BDC:



While the expansion wave continues to pull in additional fuel and air, the compression wave has reflected off the baffle or convergant cone and is on its way back to the exhaust port.

AS EXHAUST PORT CLOSES:



Arriving at the exhaust port, the compression wave reverses the direction of the escaping fuel charge and pushes it back into the cylinder. It will hold this compressed charge until the exhaust port closes.

extraction of exhaust gases especially during blowdown. Blowdown is the period of time between exhaust opening and transfer opening. As for diameters, the entrance should match the outlet of the cylinder with the exit being determined by the taper selected by the designer.

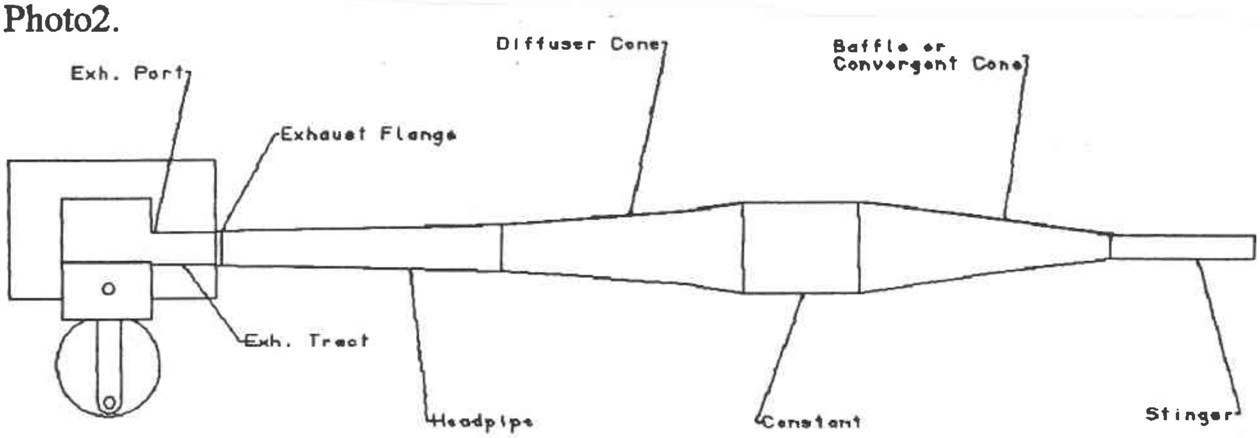
The next section that assists with the extraction of gases is the diffuser cone. Like the headpipe, this section is also built with a taper except much more profound. Depending upon the application, a single taper diffuser cone may have angles from + 5 to 10°, however, 2 or 3 angled diffuser cones are more common. Design and placement of the diffuser are extremely critical for its primary purpose is to enhance the pumping action from the crankcase into the cylinder. The lengths and taper of this section will control the strength and duration of the most significant portion of the expansion wave. While the beginning diameter is obviously identical to the ending diameter of the headpipe, the ending diameter will usually vary between 2.25 and 3.25 times the exhaust port diameter. The smaller value would be best suited for broad range power and the larger multiplier for peak power. Manufacturing a diffuser section with a short length and steep taper provides a very strong expansion wave but at the expense of having a relatively short duration. A pipe of this configuration is conducive to peak horsepower but at the expense of having a very narrow power band. Needless to say, a close ratio gear box would be required to stay within such a power band. Broad range horsepower would dictate a different construction; the diffuser would be longer in length with a shallower taper. This construction would provide a wider effective rpm range, however, at the expense of peak horsepower.

As we continue toward the end of the pipe, we encounter the straight section commonly known as the constant. The constant's primary purpose is to separate the diffuser and baffle cones. With the proper separation, one is able to eliminate the overlapping of the expansion and reflected compression waves generated by each respectively. Its diameter is determined by the ending diameter of the diffuser cone and its length will usually be the result of subtracting the combined total of the pre-determined lengths of the exhaust tract, the headpipe, the diffuser section, and the baffle section from the tuned length of the pipe.

Up to this point of our discussion, we have covered those components that have the greatest effect on the power curve from idle to peak horsepower. The power curve from peak horsepower to the end is controlled by the baffle cone. Unlike the diffuser cone, the baffle cone normally incorporates a single taper. As with the construction of the other components, the designer is again faced with the decision to achieve broad range power or highest specific power output or somewhere in-between. To acquire maximum output at the sacrifice of range, a steep angle baffle cone would be incorporated. Not only will this construction enhance peak horsepower but it has the side benefit of limiting the rpm to as little as 500 rpm beyond the peak. This may be quite useful if the engine is known to be somewhat fragile at elevated speeds. In contrast, if one is willing to sacrifice a few horsepower for range, the shallow taper will meet the designer's needs. This is especially useful if the engine is utilizing a wide ratio gear box. As for the diameters of the baffle cone, these are controlled by the constant and the stinger which we will discuss next.

The stinger's sole function is to act as a relief valve. Based upon the application, its diameter must be sized large enough to release the pressure buildup in-between cycles but small enough to provide sufficient back pressure from BDC to the closing of the exhaust port to prevent the escape of the fuel charge. Fortunately, years of experimentation have established the range multipliers for designers to follow. They are .6 for Grand Prix, .65 for motorcars, and .7 for enduro, times the exhaust port diameter. While they are not final word, they provide an excellent starting

Photo2.



point. The proper selection of diameter and length will provide a power increase over the entire power band. Too small of a diameter or excess length will cause an overheated condition.

Hopefully, this discussion has given the reader some insight as to the activity taking place in the expansion chamber and a better understanding as to its benefits and limitations. While specifications supplied can be construed as generalizations, they are sufficiently detailed to provide the reader a base for more advanced discussions yet to come.

Bruce Carmichael asked if there was any jet thrust available from the exhaust stinger. Paul commented that there was probably very little, since the stinger was mainly there to provide a restriction while still allowing the hot gases to escape. He mentioned that two stroke engines work better with some restriction rather than none, and that horsepower is higher with the restriction of the stinger.

In addition to the expansion chamber pipe, Paul will also work on increasing the size of the ports to allow for more fuel to enter the cylinder and move more efficiently.

Ralph Wilcox asked if the pistons used rings to hold in the higher pressures, and Paul indicated the engines did have at least two rings. Some smaller two stroke engines have used lapped piston systems, but these are generally too small for this type of racing application.

Andy asked if the cylinders fired simultaneously or in an alternating fashion. Paul stated his engines fired simultaneously and that the exhaust pipes were carefully joined into a single expansion chamber rather than run two pipes. This saved weight and the results at the exhaust ports of the return wave were the same as it would have been with two pipes. (He work out a computer model to get the dimensions and pipe lengths just right between the cylinder and joint with the expansion chamber.)

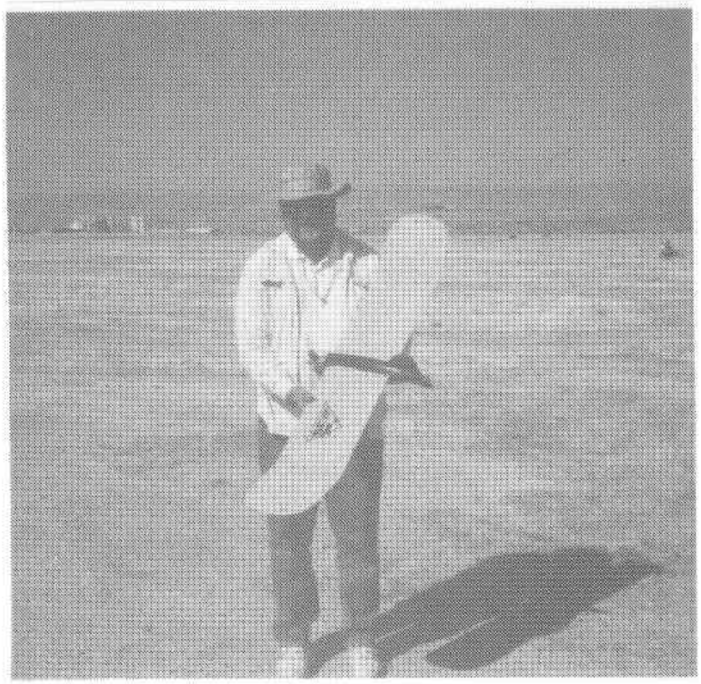
Ralph asked if you should use a high conductivity metal in building the expansion chamber. Paul indicated this was not the case since you want to maintain as constant a temperature as possible throughout the pipe because the sonic wave's speed was sensitive to temperature. For pre-race preparation they actually put a thermal blanket on the pipe to keep it hot so that it will get to peak operating temperature as quickly as possible during the short engine warmup period just before takeoff.

Budd Love asked if the tuned pipe provided very much silencing effect. Paul explained that if the stinger were placed right at the end of the pipe the decibel (db) levels would probably reach close to 120. However, if you take the same length stinger and slip in into the chamber until the inside end is at the widest part, then the noise level can be reduced to about 90-95 db. This is because the inside end is at the lowest pressure point in the chamber and is acting only as a relief value rather than a transmitter of the sonic wave's noise.

Bruce asked about the difficulties of building in-line engines and whether it would reduce the weight of the pipes. Paul indicated that in-line engines were harder to build pipes for and that two pipes would be necessary since the cylinders would have to fire alternately. There is also some additional air cooling problems associated with in-line engines that they would rather not have to deal with.

After Paul finished, Andy asked Budd Love to briefly tell the group about what the results were after his attendance at the recent

AIAA International Powered Lift Conference in Santa Clara, CA. He was somewhat disappointed in that there was little response to his paper. Bruce offered a possible explanation in that all the models can make the system look good, but when you actually get into building the aircraft you find there are too many losses in other areas (fuel, mass air flow, etc.) that offset any gains. Other new developments, like the fan jet engine, which produces more power, pushes back the need for coming up with high lift devices.



Budd indicated that what is really needed is to perform a wind tunnel test of a small wing section to show the actual lift produced. He has met an individual who has contacts with the NASA Ames Research center and is willing to pass on Budd's paper for consideration in their advanced systems reviews.

After the raffle, Andy adjourned the meeting for cake and ice cream, and some good old hanger flying with the speakers and other members.

LETTERS TO THE EDITOR

7/26/94

TWITT:

Please send me the three audio tapes of presentations by Don Mitchell at the Sept. '91 SHA Workshop and his March '92 presentation at the TWITT meeting.

Also, I would like any info on Don that is available. I have most everything, but just want to make sure.

By the way, I will be setting up a new shop within the next few months, and will be flying the Mitchell wings and making available kits and plans.

Keep up the good work.

Best Regards,

Richard Avalon

(ed. - Hopefully, by the time you receive this newsletter your tapes will be on the way (but don't hold my feet to the fire, what with vacation and all).

You didn't mention where you would be setting up shop, so when you get settled in drop us a line with your new address and phone number.)

7/16/94

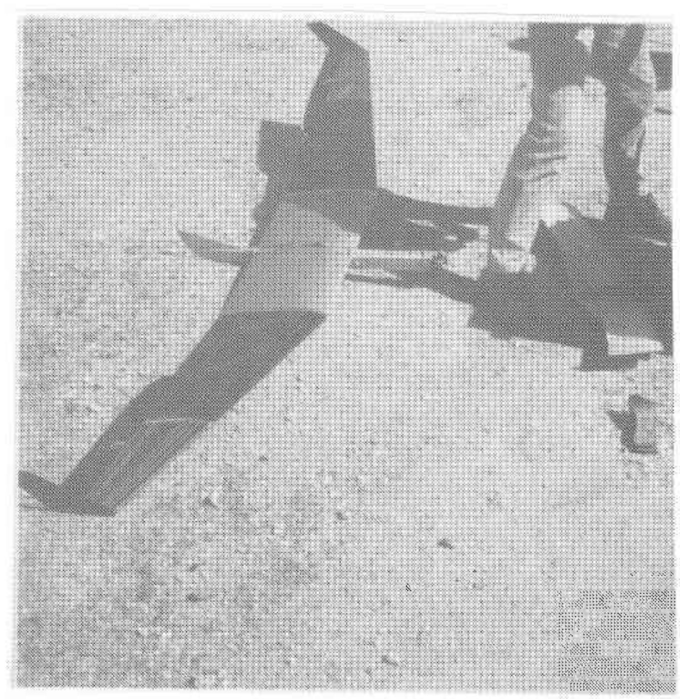
TWITT:

Please sign me up for membership in TWITT. I have seen your aid in R/C Soaring Digest for about 1½ years and finally made it to my desk to write this letter (I would have joined long ago if you would have just signed me up and then sent me the bill!).

My interest is in small, simple R/C model aircraft. I have been building and flying models since the late 60's.

Thanks,

Bruce Rose
8820 S.W. Grabhorn Road
Aloha, OR 97007



(ed. - Welcome to TWITT, Bruce. I am sorry we don't offer the billing service you suggest, but this whole operation is strictly volunteers so we try to keep the bookkeeping as simple as possible (that's why your renewal date shows on the mailing label rather than you receiving an annual billing).

I have included your address so others with a similar interest can correspond with you, or learn that you are in their general area.

We have had many issues with model information in them, since many of our members are modelers, or modelers and full size enthusiasts. Hopefully, you are interested in flying wings, because that is what you will get with this organization. They are simpler to build and can fly just a well as their tailed counter parts.

We hope you enjoy your membership.)

SHA WESTERN WORKSHOP
Tehachapi, California
September 3 - 5, 1994

This year's 15th annual Workshop will include lectures in the morning and the demonstrations in the afternoon in Jeff Byard's hanger. There will be an auction again so if you have something you would like to donate (funds raised go to the SHA treasury), please bring it along.

For those of you who are really into building your own aircraft, this is a must weekend of information gathering from some of the best homebuilders around today. It is always an excellent program, but together by TWITT member Bruce Carmichael.

So, make sure to mark your calendar to come at least for one day, since it is within easy driving distance of most locations in Southern and Central California.

Pre-registration will save $10 over registering at the door. Rates are:

	Pre-Reg
Non-member	$25
Member SHA, SSA, VSA	$20
Member SHA & SSA or SHA & VSA	$15

Send pre-registration to:
Helen Burr
223331 Pinto Way
Tehachapi, CA 93561

Make checks payable to:
Sailplane Homebuilders Assoc.

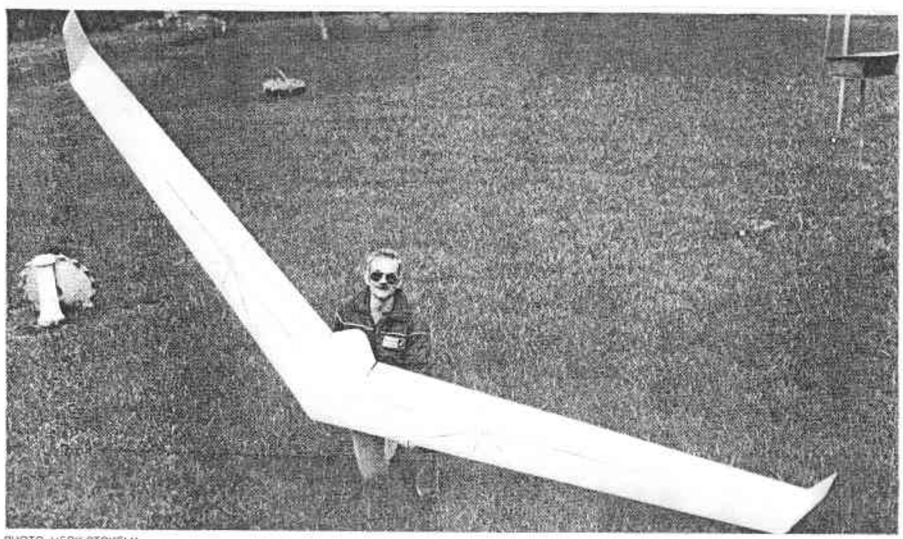


PHOTO: HERK STOKELY

ADDITIONS TO THE LIBRARY

Chris Tuffli has graciously donated the following four books to the TWITT library. We would like to thank him for this excellent material.

The Flying Wings of Jack Northrop - A Photo Chronicle, by Garry R. Pape, with John M. Campbell & Donna Campbell, Schiffer Military/ Aviation History, 77 Lower Valley Rd., Atglen, PA 19310, 1994. 77 pages of excellent photographs of all of Northrop's flying wing designs. Limited amount of text, other than that accompanying the pictures and three-view diagrams.

Lippisch P13a & Experimental DM-1, by Hans-Peter Dabrowski, Schiffer Military History, Atglen, PA, 1993. 47 pages of good quality photographs with explanatory sections on the two aircraft.

Messerschmitt Me 163 Komet, by Mano Ziegler, Schiffer Publishing Ltd., West Chester, PA, 1990. 47 pages of photo chronicle on Lippisch's designs leading up to the Me 163. Photo quality is good and there is a good amount of text explaining them.

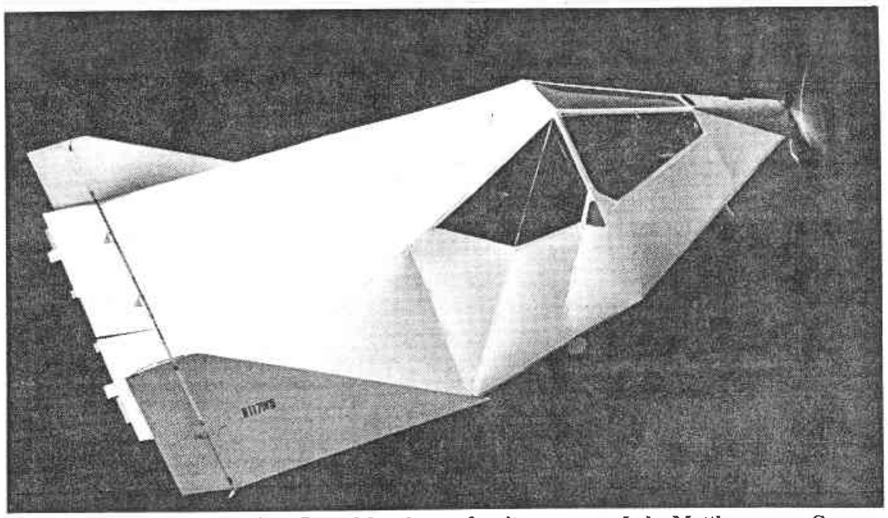
Messerschmitt Me 163 Komet, Vol. II, by M. Emmerling and J. Dressel, Schiffer Military History, West Chester, PA, 1992. 47 mores pages of photos and text on the Me 163 and 163C. Photo quality is not as good as Vol. I due to the age of the originals, but the book is very informative.

Contributor known:

"The Birdwork's R/C Gull", by David Garwood, Flying Models, May 1993, pp. 34-37. A product review of the R/C Gull designed by Steve Hinderks. This is a flying wing with the fiberglass body of a seagull, with a wing span that looks to be about 36+"

"R/C Soaring", by Herk Stokely, Flying Models, May 1993, p. 60. Picture of an extremely large R/C flying wing, *Ultrasaur*, designed and built by Mark Kummerow (see above). The caption indicated Mark was thinking of publishing a newsletter for those who love flying wings, but there is not other material in the accompanying article to explain who to get a hold of him. If anyone has come across Mark, please let us know.

"Facetmobile (?)", by Frank Mormillo, Pacific Flyer, February 1994, pp. B3-B6. An article with pictures of Barnaby Wainfan's FMX-4 proof of concept vehicle that looks like a homebuilt stealth fighter (or perhaps a paper airplane that got out of hand). This is a delta shaped flying wing made up of multiple faceted panels that create a lifting surface. Barnaby has taken it to Oshkosh this year.



WAINFAN'S FMX-4 really does fly and here's proof as it soars over Lake Matthews near Corona, Calif. Covered in fabric, this is probably a true stealth machine, the kind of plane they invented transponders for. "It looked like too much fun not to do," Wainfan says in explaining himself.

Sailplane Builder, Issue $7-94, July 1994, p. 8. Short review of Alain Mirouze's foot-launchable prototype of an inflatable wing (exhaust gases for inflation). The weight is only 45 lbs with a span of 21', and a takeoff speed of just 15mph. Built of white polystyrene foam over an aluminum tubing frame and covered with packaging PVC adhesive tape. Cost $200, building time 100 hours (see page 10 for photo).

AVAILABLE PLANS & REFERENCE MATERIAL

Tailless Aircraft Bibliography

by Serge Krauss

4th Edition: An extensive collection of about 2600 tailless and over 750 related-interest listings. Over 15 pages of tailless design dates, listing works of over 250 creators of tailless aircraft, and the location of thousands of works and technical drawings for the Ho 229 (IX), Me 163, & Me 262.

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Order from: Serge Krauss
3114 Edgehill Road
Cleveland Hts., OH 44118

Tailless Tale, by Dr. Ing. Ferdinando Gale'

Consists of 268 pages filled with line drawings, tables and a corresponding English text. It is directed towards modelers, but contains information suitable for amateur full size builders. Price is $38, postage and handling included (also applies to Canada and Mexico).

You might also want to purchase his new book **Structural Dimensioning of Radioguided Aeromodels**, priced at $18.00.

On The Wing...the book, by Bill and Bunny Kuhlman (B^2) is a compilation of their monthly column that appears in RCSD. Many of the areas have been expanded and it includes coding for several computer programs to determine twist and stability. Priced at US$28.00.

All these are available from B^2 Streamlines, P.O. Box 976, Olalla, WA 98359-0976, or (206) 857-7249 after 4pm Pacific Time. Orders shipped elsewhere will be sent surface mail unless an additional $10 is included to cover air mail postage. Washington residents must add 7.5% sales tax.

VHS VIDEOS AND AUDIO TAPES

VHS tape containing First Flights "Flying Wings," Discovery Channel's The Wing Will Fly, and ME-163, SWIFT flight footage, Paragliding, and other miscellaneous items (approximately 3½+ hours of material).

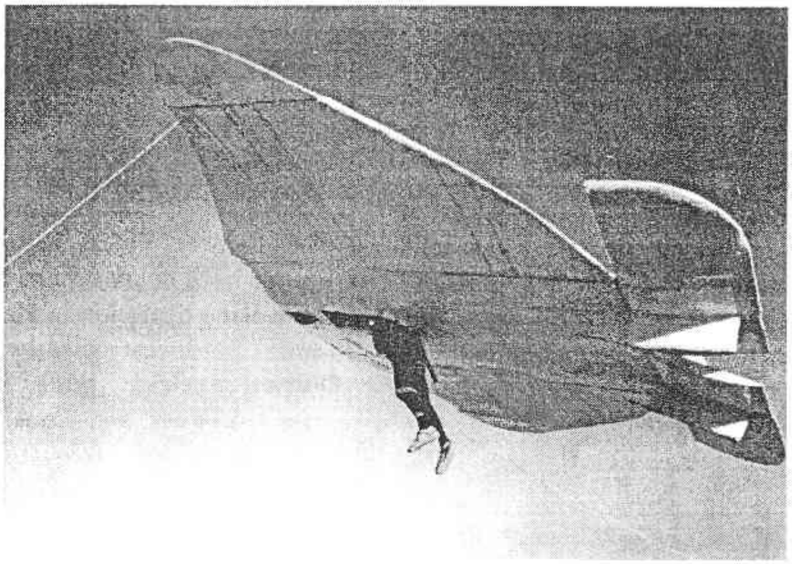
Priced at: $8.00 (postage paid)

An Overview of Composite Design Properties, by Alex Kozloff, as presented at the TWITT Metting 3/19/94. Includes pamphlet of charts and graphs on composite characteristics, and audio tape of Alex's presentation explaining the material.

Priced at: $5.00 (postage paid)
$6.50 foreign (postage paid)

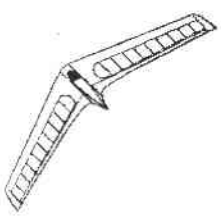
Audio tapes of presentations by Don Mitchell at the September 1991 SHA Western Workshop, Tehachapi, CA (1 cassette), and his March 1992

presentation at a regular TWITT meeting (2 cassettes).
Priced at: $3.50 (1 cass.)
$4.00 (2 cass.)
Add: $1.00 for foreign postage



Alain Mirouze's Footlaunchable Prototype.

FLYING WING SALES



The A-10/T-10 Mitchell Wing motor gliders are well-proven designs, ready to fly, with an aluminum clad wing giving aerodynamic cleanliness. These are fully trailerable, with flight instruction provided in a T-10 by a C.F.I. Major components are available for the homebuilder.

Information pack for $10.

For more information contact:

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Box 4
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(913) 256-6029

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The purpose of SHA is to foster progress in sailplane design and construction which will produce the highest return in performance and safety for a given investment by the builder. They encourage innovation and builder cooperation as a means of achieving their goal.

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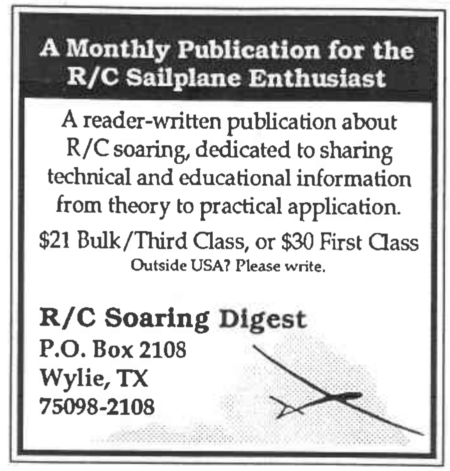

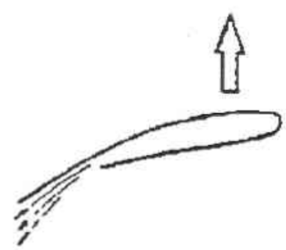

THE HIAM AIRPLANE NEEDS YOUR HELP

For those interested in assisting Budd Love with the future development of his High Internal Air Mass (HIAM) project, he would be glad to hear from you. This concept has some potential to include design of a Horten type flying wing utilizing HIAM technology. (See Dec '92 newsletter, page 4.)

Contact: AIRLOVE, LTD.
6423 Campina Place
La Jolla CA 92037
(619) 459-1489

BELOW: An example of the type of drawings available in the The Flying Wings of Jack Northrop, published by Schiffer Military/ Aviation History. This is the N-9M, twin engine testbed aircraft. There were four versions built, all with differences in control surfaces, radio, and electrical equipment.