

## 40<sup>th</sup>-anniversary edition for REFLEX XTR

# Das Ugly Stik

design by Phil Kraft, kit by Jim Jensen

Phil Kraft pioneered proportional radio control and he designed Das Ugly Stik as a simple and robust test bed. In 1966 he published the plans in the GRID LEAKS magazine, and his friend Jim Jensen brought out a kit. Both the design and the kit quickly became famous, and many model flyers had one or more of the originals or the several variants coming up soon and until today.

It's not only the simplicity, but also the effectiveness of the design what made the model attractive for so many. In those early days, models and equipment were quite expensive and both had to be simple to just be affordable. Now the Stik wasn't only that, but also very versatile. The same one model could be used as a basic trainer and then converted to an intermediate and full aerobatic trainer, only by adding engine power and control throw. And it was so good-natured and robust that it really had a chance to survive the learning curve of its pilot from the beginnings to the last stage.

For me, the model is quite appealing and I thought it's a nice idea to revive it virtually, so we could see and feel how it flies – again or once at all.

## Sources

Where does all my wisdom come from? Well, credits are due to all those who published something about the Stik in the Web, may it be information, data, plans, pictures, or stories. Of course, you'll have to blame me for any errors, flaws, or misunderstandings.

The original Jim Jensen kit is out of production for a long time, though the plans are still available from R/C Modeler magazine at [this Web page](#).

The [AMA biography of Phil Kraft](#) says the plans were first published in 1965 by the American R/C Modeler magazine. But that has to be a typographical error or a mistake because the magazine only re-published the Jensen plans with building instructions, along with the original 1966 article's text, in 1985.

The RCM magazine Web site still presents several old articles including this two-part building article from the May/June 1985 issues. Phil Kraft's original article is included. See at bottom of [construction articles page](#).

Lyman Slack mentions the Ugly Stik two times on his [Web page](#) because he built it two times. Quote:

» Ugly Stik trivia: Did you know Phil Kraft had his plans for his first Ugly Stik published in GRID LEAKS magazine back in May/June '66? The plans show a Veco .45 up front surrounded by a round cow! It also had wheel brakes, a pilot, and a gun. «

The publication is confirmed in the Vintage R/C Society's [eligible planes list](#).

There was a discussion about history of "Classic Pattern" at [RC Universe](#) with several nice and interesting stories told, especially about four year old Chip Hyde flying an Ugly Stik.

Ed Moorman recommends different models for beginners at this [Web page](#) and explicitly recommends a stick type even though or just because it may seem antiquated. Quote:

» Phil Kraft's original Ugly Stik, (from the 60's expression, "It looks like it was hit with an ugly stick") has to be the most copied and cloned RC plane ever. It has to fly well or no one would buy the thing! Any of the "Stick" type planes, Big Stick, Sweet Stick, Little Stick, Middle Stick, Joss Stick, Ugly Stick, Super Stick, would be a great flier. They can change their spots from mild to wild depending on the engine and control set-up. You can learn to fly on one and then you can change to a larger engine and do anything you want and still land like a trainer. I like them built without dihedral and with a .60 in the 40-sized version. The trouble with recommending a Stick is they have no pizzaz and most have gone out of production. «

People may think differently about "Uncle Willie" and his website. But undoubtedly one of his merits is to present images of the original Jensen plans on [one of his Web pages](#) (half way down). These were of paramount importance for this project as they made it at all possible to render the model in REFLEX. And his characterization is well to the point:

» Ever since the legendary Phil Kraft designed the Das Ugly Stik in the 60's, the familiar profile of the stick has been as common as a Cub at every flying field. Now you too can own the plans to the "original" Stik and enjoy the fun of a "knock-around" general-purpose sport plane with very little investment in building time and material. The greatest thing about a Stik is that it can be mild or wild, depending on the power plant. «

Take a look at the Vintage R/C Society's Web pages [pattern sequences](#) and [Maneuver Descriptions](#). You'll find that the full pattern program could be flown with a Stik!

Eric D. Wildermuth from Brisbane, Australia, kindly provided scanned images of his copy of the 1966 Grid Leaks magazine and of the 1985 American Radio Control Modeler magazine. He also had valuable information from his rich experience building and flying several Ugly Stiks. Thank you very much!

And there was a [thread on RC Universe](#) about Das Ugly Stik. Only recently I found it and only by chance because Google didn't find it, but there's valuable information in it.

Later appeared a rather lengthy [build thread on RC Universe](#) holding some interesting information as well.

## Contributions

Well, these contributions were involuntarily, I simply borrowed some hard-to-get components of the REFLEX model from other authors. At least they should be given credit here:

Bo (Jörgen) Strömberg from Sweden made the engine for his excellent Graupner Taxi for REFLEX XTR. He published it on RC-Sim in August 2005 (see [here](#)) and later granted permission to use the engine model. Thank you very much!

The engine is especially well suited because it's a Veco, a brand which was in widespread use. Supposedly, it's a smaller size (maybe a .32), but that doesn't matter. It's enlarged a bit to mimic a .45 or even a .60 on the Stik.

The standard REFLEX propeller was replaced by a wooden Master Airscrew because an 11" or 12" diameter is needed, and - according to the Graupner Website - at 16000 rpm Nylon wouldn't be strong enough in that size. Prop size in the visual model is 11" diameter and 7" or 8" pitch. The texture is borrowed from one of the many Internet shops.

The wheel textures are borrowed from REFLEX. Oops...

The engine sounds were borrowed from Thomas Hanser (see [RC-Sim](#)) who published them with his Westerly and Extra models on RC-Sim. The idle sounds are the same anyway, only the full power sounds are different, more rpm for the "wild" and less for the "mild" model. I don't know if he recorded the sounds and from what models, and I think he will not mind that they're used for the Stik.

And yes, [RC-Sim](#) supplied these other models.

## Shape and Appearance

Because I intended to revive the original Jensen kit version, I actually didn't think of making any variants, not even the straight wing without dihedral. Of course, there are as well no other airfoils, bigger control areas, higher horizontal tail, or taildragger landing gear. These would all give noticeably different models, which would have to be especially rendered in REFLEX.

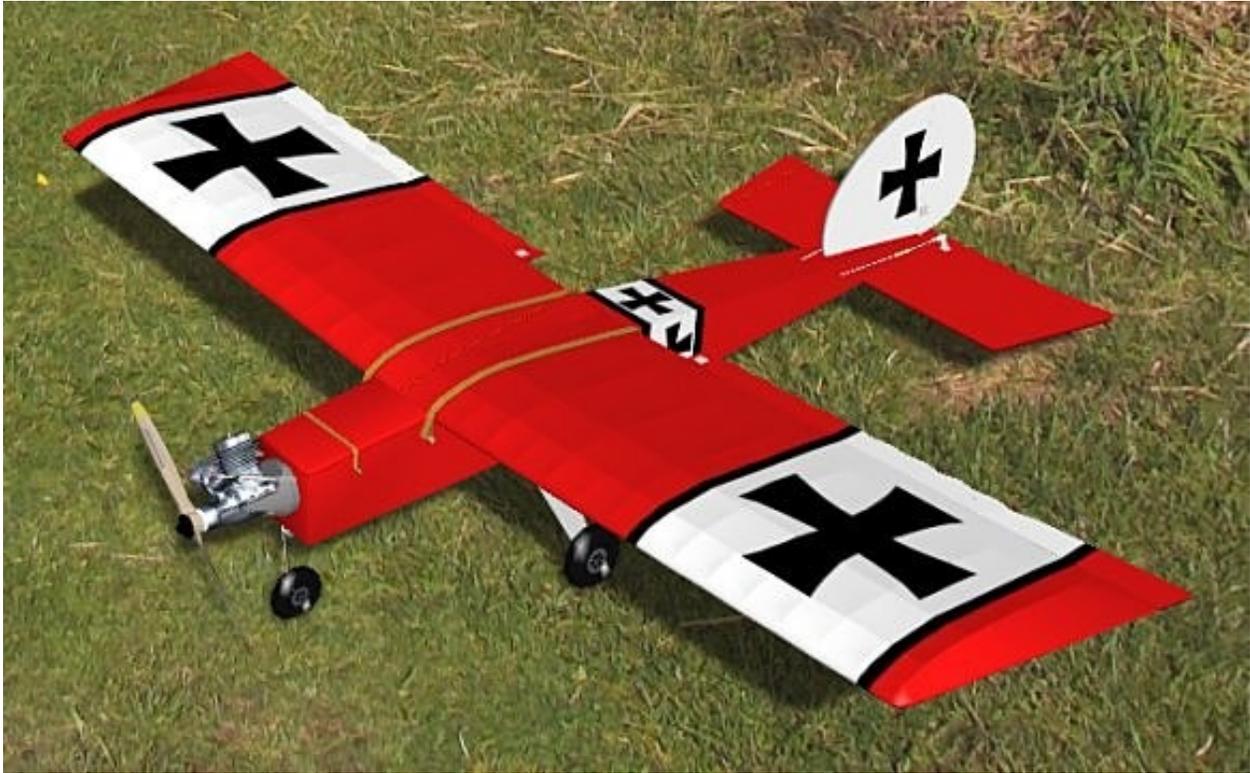
After getting the old GRID LEAKS magazine article I somewhat changed my mind. Eric Wildermuth, who provided the article for me, drew my attention to the fact that Jim Jensen or Phil Kraft himself later added the wing dihedral maybe because the straight wing looks as if it is drooping (has anhedral). Originally Phil Kraft aimed at utmost building simplicity, though. Maybe both Phil and Jim didn't bother about flight behavior, which is nearly the same at least in REFLEX. Nevertheless, now there is even a straight-wing variant for REFLEX for those who prefer it.

The shape of a model in REFLEX is made of polygons. Much polygons and work were spent on the ribs-and-spar structure of the wing. Viewing from certain angles, you'll see the wing covering denting between the ribs and spars. You'll have to keep some viewing distance, or the wing will look a bit angular and awkward.

Adequate to this viewing distance, details were applied to the raw body of the model. These are control horns and linkages, mounting dowels and rubber bands for wing, main landing gear, and nose hatch, and the antenna.

The landing gear is fully detailed and working like the real one. The nose landing gear protects the propeller, the tailskid is necessary to protect the horizontal tail in high-pitch attitudes and when bumping on rough runways. Only the wheel brakes are omitted because REFLEX can't render them.

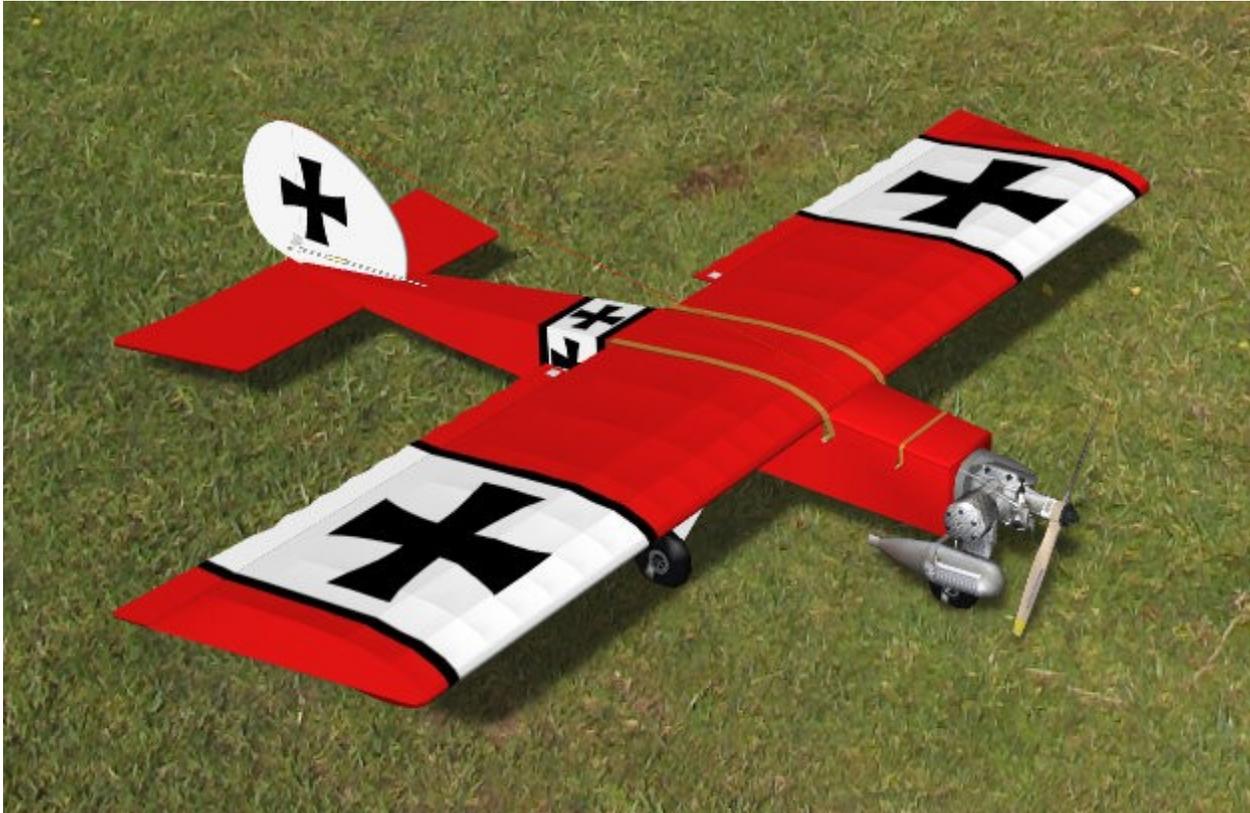
I think every Stik was different, and the Stik for REFLEX is even close to the Jensen plans in detail and texture. Only a few details are omitted to make modeling work easier, but that shouldn't matter.



German Cross or Stars And Stripes – what’s nicer? Maybe when I was young I had decided on the more aggressive look and the “wild” behavior of the first version. Now I seem to prefer the friendlier look and the “mild” behavior

of the trainer version. At least I spent hours only taxiing around, looking at the model from all viewing angles and watching how the landing gear legs are working.

By the way – of course you may exchange both looks, making the German version behaving “mild” and the American “wild”. In REFLEX, simply select the other model appearance in the model parameters dialog. But if you use the straight-wing variant of the German version at least set both dihedral and aileron differential to zero in the physical parameters dialog.



But you better leave the straight-wing variant alone because it's the special “hot rot” version. The O.S. MAX 60F SR is a powerful .60 engine of the 1970s and is side-mounted to have the carburetor and the tank level. There are several parameters different from those of the “wild” version.

## Setup

The old proportional radios were no computer radios and had neither expo nor dual rate. Things today being a radio setting required changes on the model in the old days. That's why you get different Stik versions for REFLEX, differing not only in appearance but also in setup.

Phil Kraft produced and used servos with linear actuators (not the rotary horns of today's servos). Of course, the control horns are rotating around the control axis. Thus, linkage geometry makes for some expo effect. The rotary control deflection increases progressively faster from neutral to end than the linear servo movement. In REFLEX, this is imitated by a – guessed – expo setting, smaller for the smaller control throws of the "mild" version and bigger for the bigger ones of the "wild" version.

The old radios had no aileron differential, either. Instead, only one wing servo was used and linked to the ailerons by spanwise pushrods, 60-degree bellcranks and pushrods back to the control horns. That gave a nonlinear differential, which is approximated in REFLEX by an estimated linear setting.

Maximum control throws are parameters in REFLEX, the other mentioned parameter settings depending on them. Thus, it's not possible to simply dual-rate switch between two Stik versions. Instead, a separate parameter set is needed for each version.

Only the plan published 1985 by RCM has control throw recommendations, given in inches. Converting them gives very small 11 to 14 degrees deflections. These seem to be too small even for the "mild" version, at least to me, so I arbitrarily chose sufficient deflections for this version and stepped them up by 5 degrees each for the "wild" and again for the "hot rod" version.

Other version differences are mainly in the weight and the drive parameters. Actually, weights were a wild guess, a bit more for the "wild" version with the bigger and heavier engine. But they proved to be quite correct according to Phil Kraft's article in the GRID LEAKS magazine.

The drive settings are based on power and torque measurements published in an older book. It seemed suitable to assume a 1960s .45 or a .60 O.S. engine and an 11x7" propeller for "mild" and "wild", respectively. They're working normally, but the bigger one with more power and rpm, just in the ratio of 60 to 45. So it not only has more thrust and torque but also more pep at high speed. The "hot rod" version with a 1970s .60 O.S. engine is even more powerful with the same 11x7" propeller.

No engine down thrust (to compensate for nose-up tendency) and right thrust (to compensate for torque) was applied following Phil Kraft's recommendation and both are not needed either.

## Flight Behavior

This model was a special case concerning the physical parameters. As usual, I took the geometry from the plans and put it into Blaine Beron-Rawdon's excellent Plane Geometry spreadsheets (see the overview on [his Web site](#)). The airfoil and wing coefficients were calculated in an own spreadsheet. All calculated values and the c/g position from the plans were simply transferred to REFLEX – and the model worked right away. No tweaking or fudging needed!

Of course, some values had to be guessed because I had no information about them. Some plausible assumptions were made for the airfoil, using German low-Re measurements for analogy. Later being aware of the *semi*-symmetrical airfoil, I modified the airfoil parameters from the symmetrical setup to a semi-symmetrical one, what didn't change much, though. Overall flight behavior is determined mainly by geometry, anyway.

The wing's aspect ratio is rather small (4.7), thus wing area rather big and wing loading low. This makes for good slow-flight capabilities, particularly because induced drag will be high at slow speed – no flaps needed, neither as lift enhancers nor as brakes. Induced angle-of-attack (aoa) is big, making the model insensitive to pitch changes. Due to the rectangular planform, no *tip* stall can occur. On the one hand.

On the other hand, the airfoil designed by Phil Kraft for the Ugly Stik has a rather sharp leading edge. This justifies a reasonable stall setting in the airfoil parameters. That means the model *will* stall, just good-natured and not vicious. But if rudder is applied in a stall situation, the model will also snap!

Vertically, a spin must be initiated by applying full rudder when approaching stall (like in a Cessna 172 which actually refuses to spin). Horizontally, a snap roll is initiated by applying full rudder and elevator at the same time (the old-school method).

The "mild" version does not even have enough control authority for a spin, not to mention engine power for a snap roll. So it prevents the beginner from unintentionally entering such a maneuver and crashing the model. Even though the "wild" version has both, it still won't spin or snap thus allowing to carefree knock around the plane. Not even the "hot rod" version has the required backward center of gravity, but more control throw and a straight wing and enables the expert to do any maneuver in the (Aresti) book, though it's still very hard to spin or snap-roll (only with aid of ailerons).

Also the expert might limit the control throws (with a modern transmitter even simply with the dual-rate switch) and reduce power (restraining his nervous fingers). This way he has the same unswerving and insensitive model as the beginner and may bring it in for landing with low speed and smash it on the runway like him.

Incidentally, a straight wing should be combined with no aileron differential. There is some loss of directional stability and the model is not controllable with rudder only. But there is virtually no roll-to-yaw coupling and the roll rate is slightly increased.

This whole behavior is what I would expect of a model having the Stik's geometry. REFLEX is amazing because it credibly renders all this flight behavior. I think the Stik is simply the type of model REFLEX was initially made for – nearly 15 years ago now. And that's why I think this rendering is very realistic – though I don't know for sure, of course.

## Conclusion

Yes, I know the REFLEX model isn't *completely* correct, but it's *quite* correct. If you notice the deviations from the real model you're simply too close or too critical. Just relax and enjoy the look and feel of this great classic!

But if you're one of those veterans having own experience flying the original Ugly Stik, I'd surely like to hear from you any corrections or suggestions.

Enjoy!

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<http://time.fh-augsburg.de/~erd/Modellflug/textReflex.html>

More REFLEX models and the latest versions are on my page

<http://time.fh-augsburg.de/~erd/Modellflug/textDownloads.shtml>

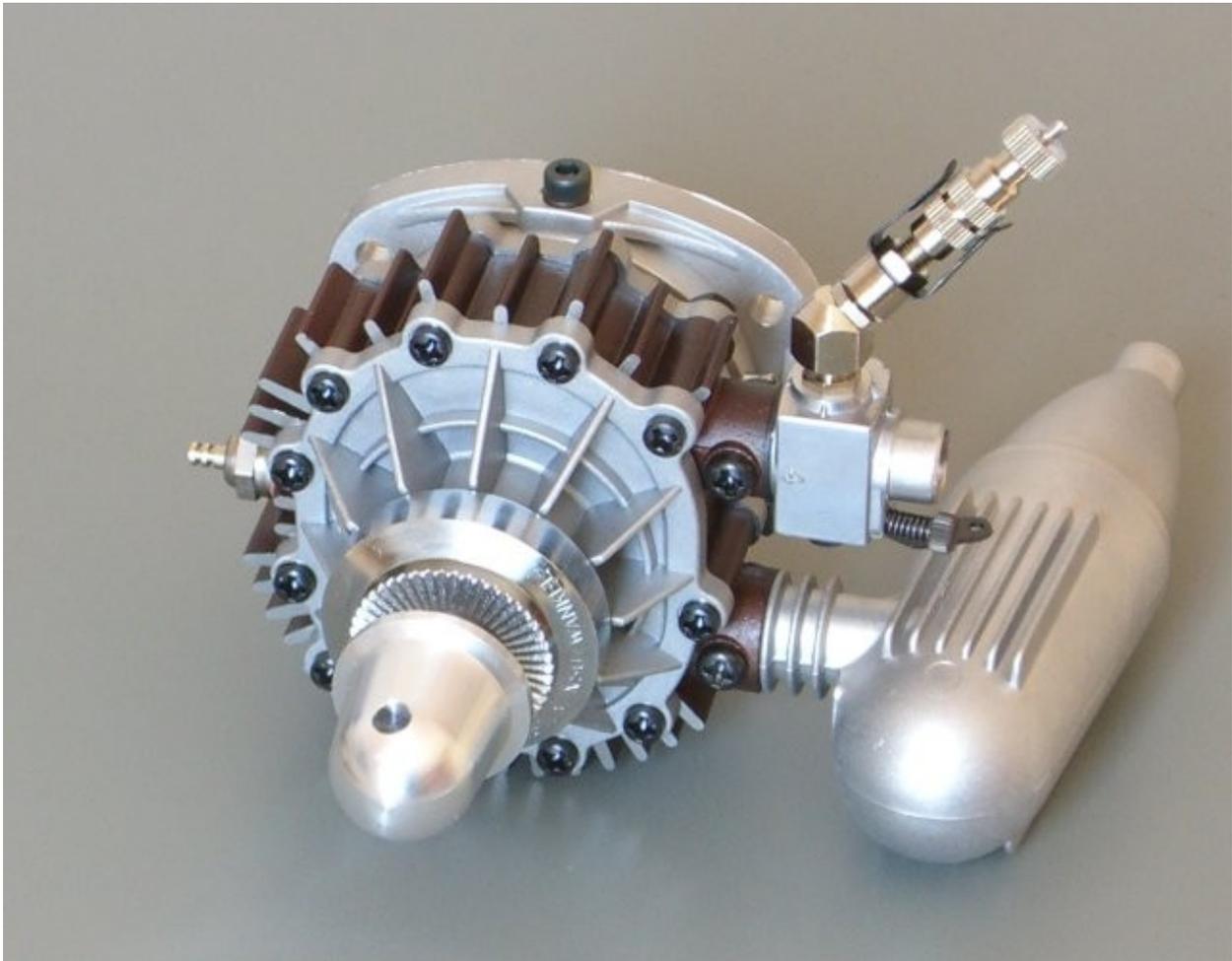
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## Addendum 1

# Rotary Engine Version

system NSU/Wankel, by Graupner/O.S.

The Graupner/O.S. rotary engine 49-PI is one of the very few rotary engines produced for a long time. Since 1970, when production started, it had only few but devoted users. After one single redesign in 1982 it was rated as a 4.97 cm<sup>3</sup> / 0.303 cin glow engine, performing astonishing 0.94 kW / 1.27 hp at 17000 rpm and weighing only 395 g / 13.9 oz including muffler and mount. As from 2006 the engine is no longer available, but O.S. brought out an enhanced successor (RE 49 PI-II) which is heavier (450 g / 15.9 oz) and less powerful (0.81 kW / 1.1 hp) but hopefully more reliable.



It's a perfect match for Das Ugly Stik, though. Even Graupner had a Middle Stick kit for this engine since 1970, but that was the first version with a power output of only 0.63 hp at 16000 rpm. Since the early 1980s it had the same power output as an O.S. MAX 60F SR of the 1970s, just at 1.25 times the rpm and with 0.7 times the weight. Now it makes the full-sized, original Ugly Stik a really "wild" model, only slightly different from the O.S. 60 of the 1970s, but thus 25% more powerful than the .60 engines of the 1960s. With a hot fuel it would even go up to 1.5 kW / 2 hp at 20000 rpm.

I own a Graupner/O.S. 49-PI just as a technical marvel, not for use on a model. And I felt there's another connection to Das Ugly Stik. Felix Wankel, the inventor of the rotary engine, wasn't an engineer whatever but a self-made man, just like Phil Kraft, the designer of Das Ugly Stik and other famous models as well as some of the first proportional radio control devices. For me, it was just the obvious to combine the model and the engine.

## Engine

Biggest advantage of a rotary<sup>1</sup> engine is that it's nearly free of vibrations<sup>2</sup>. R/C components in a model are delicate instruments and have to be carefully protected from vibrations. Maybe that's why Graupner – market leader at least in Germany – was interested in the rotary engine as early as 1960 and kept up development till 1970 and production until today.

Further advantages are power output and compactness. The engine is small and fits well in a fuselage cowl or a nacelle. Compared to a "normal" engine (a two-stroke glow engine for model aircraft) of same displacement it has twice the power and half the weight. The Graupner/O.S. engine showed that only after the redesign, though, when technical problems were solved.

There are disadvantages – you guessed. One point is high rpm, what means less thrust and makes the engine more suitable for ducted-fan applications. The small torque makes aerobatics more pleasant, though, even if the high

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<sup>1</sup> Rotary engine is an English designation. In German, engineers distinguish between rotating-piston engines and revolving-piston engines (hopefully correct translation). Felix Wankel, who systematically invented piston machines and the necessary sealing, developed the former. The first and most important licensee of his patent was NSU, a company producing motorcycles and small cars in the 1950s. The chief engineer obviously didn't like the rotating-piston concept and modified it to the revolving-piston concept. All production rotary engines are designed this way and still often called Wankel engine. Graupner/O.S. correctly call their engine „system NSU/Wankel“, though.

<sup>2</sup> Different from a reciprocating-piston engine, there are only *rotating* parts which can be balanced completely, so there are no radial vibrations. Of course there are torque vibrations as in any combustion engine, but the rotary engine has three ignitions per piston revolution, equivalent to a three-cylinder two-stroke engine. Besides, the ignitions are not that violent.

flight speed would better fit a “rocket” model of the 1980s than a Stik. And even though the engine is quiet (compared to two-stroke engines), the prop is very loud at 17000 rpm what excludes the rotary engine from use at many model airfields.

More disadvantages are fuel consumption and exhaust emissions<sup>3</sup>. The recommended 11 oz tank gives only 10 to 12 minutes flight time, meaning a fuel consumption 50% higher than that of the 60F SR. Incompletely burned parts of fuel and the Castor oil are thrown backwards by the engine, and it needs much of this oil. So the model has to be carefully sealed and impregnated and must be cleaned after each flight.

## Model

On the 3D model, the Veco engine is replaced by the Graupner/O.S. rotary with a smaller 9x6” propeller. Dowels and rubber bands are replaced by modern bolts. The rest is virtually the same.



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<sup>3</sup> Due to heat losses through the big combustion chamber surface, efficiency is bad. That's also why the model rotary engine gets really hot and needs much cooling by rich fuel-air mixture! Due to the complex shape of the combustion chamber and difficult sealing, the engine exhausts incompletely burned fuel, and the model engine exudes the oil through all pores. Only Castor or synthetic ester oils sustain the high temperature.

But I couldn't resist making a new livery. As the rotary engine is a German invention, the model has a German patriot skin. These are our modern flag colors – but not bad at all (though the form maybe suggestive of a bat). And the German cross is drawn according to the modern regulations.

Phil Kraft was inspired by a Fokker Eindecker (German for monoplane) in a Red Baron trim, though Richthofen was flying an Eindecker only for a short time and surely not a red one. And I don't know why the German Cross is so popular outside of Germany. If you would like to know more about it, you should look at [www.wikipedia.org](http://www.wikipedia.org) for 'Iron Cross', that's the correct name.

The parameter setup of this rotary version is virtually the same as for the "wild" version; only the drive parameters are modified. More thrust and less torque are set compared to the 1960s .60 engine of the "wild" version. The lesser weight is reflected in less overall weight, and the smaller frontal area in less drag.

I have no clue if the parameters are realistic. But realistic engine sound was borrowed from two sources. While the engine sounds like a racing car at full power, the rattle of the rotor gearing and maybe the apex seals determines the idle sound. Smoke density is set to a high value to render the dirty exhaust of the engine.



To acknowledge the Graupner Middle Stick featuring the new rotary engine in 1970, this model was built as well and clothed in the original checkered style livery. This is a design typical of the 1970s but still looking good today.

The Middle Stick is “middle” regarding the physical parameters. The first version of the rotary engine called “1 49” was not that powerful, but the Middle Stick was somewhat smaller (55” instead of 60” wingspan) and lighter (81 oz instead of 100 oz weight) than an Ugly Stik. The control throws are set as in the original Ugly Stik version, allowing no snap or spin. As an original Middle Stick, this model has a wire main landing gear and a straight nose landing gear as well as a Graupner Super Nylon propeller. The second version rotary engine is shown because the first version was not available for copying.



There’s also a floats version of the Middle Stick, and even though it’s equipped with a conventional (reciprocating piston) engine it’s described in this section just because it’s a Middle Stick. The rotary engine with its high rpm and small propeller makes the Middle Stick a quite fast model. For a floatplane, more thrust from a bigger and slower turning propeller is needed so the rotary engine is not suited.

Still the Middle Stick is a good floatplane because it is able to fly slowly and is very well behaved. This model clearly shows what floats do to an airplane. The weight is now 95 oz and the floats produce much drag both on take-off and in the air. So the model has to fly faster to carry the additional weight and on the other hand flight speed is lower due to the bigger drag. Floats just reduce an airplane’s speed range, but Middle Stick is still a lively performer and able to do basic aerobatics with the .40 engine used on it.

The floats are simple (29” long) round-top flat-bottom floats with wire struts. Even though there is no true “water” in REFLEX they are reasonably realistic in a suitable scenery. The water rudders are not functional in the simulator.

## Sources

Comprehensive information (and a nice animation) on rotary engines in general has Wikipedia in a [special article](#).

A site devoted to rotary engines in aviation describes the Graupner/O.S. 49-PI as "[the smallest Wankel of them all](#)".

Alan Marr had some information on his [Wankel web pages](#).

Manfred Mornhinweg even wrote a whole [story about his 49-PI engine](#), comprehensively and competently discussing all technical aspects.

A website about O.S. engines is run by Hobbico. The "Manufacturing Timeline Gallery" shows the first rotary version as 1970 "1 49" in the [1969-1975](#) part and the second version as 1982 "49 PI" (peripheral intake) in the [1982](#) part. The [official Japanese O.S. Web site](#) disagrees on the year of introduction.

Maybe the full-power sound originally came from Graupner. Now there's a [model racing-car Web site](#) offering the sound as a curiosity. And an [Audi car history Web site](#) links to this sound as a curiosity as well and calls it beastly. The car freaks find the sound similar to that of a formula-1 racing car.

The idle-power sound was extracted from a video Paul K. Johnson has on [his Web page](#) about his very nice rotary-powered self-designed Stik 30 model. Interesting site, by the way.

All information about the Middle Stick came from Roman Traussnig's excellent [Web pages on old Graupner models](#). There are not only many pictures but also an [exploded drawing](#) and a [three-view drawing](#).

## Addendum 2

# Electric Drive Version

direct-drive AXI outrunner motor and LiPo battery

In the last few years, electric drives got applicable to nearly all types of models, and they already seem to be standard not only for parkflyers but also for sport models. Now what type of model is Das Ugly Stik? Exactly!



Especially ModelMotors in the Czech republic has a fair market share with its AXI line of brushless outrunner motors. And especially the AXI 4120 is often used to electrify sport models formerly powered by a glow engine. This picture is borrowed from the ModelMotors website where the motor is recommended for "sports aerobatic models up to 3000g".

Like all outrunners, these motors produce high torque at low rpm so no gear is needed. Weight is low and efficiency is high what applies also to the propeller. And with a rear mount the motor simply fits to the front bulkhead.

## Drive

AXI motors and Jeti speed controllers are like twins, both made in the Czech republic and both quite cheap for their performance and quality. Moderately priced LiPo batteries, with a good capacity to weight ratio, perfectly match this pair.

The motor weighs even less than the rotary engine (320 g / 11.3 oz), the 13" diameter propeller only 25 g / 0.9 oz. The 6000 mAh 4s2p LiPo battery is estimated to 680 g / 24 oz, the speed controller to 55 g / 2 oz. The overall weight of the drive should be 1080 g / 38.1 oz.

This might be even slightly more than the weight of an old .60 drive with engine, propeller, muffler, mount, servo, and tank with fuel. But instead the modern r/c components are lighter than the old ones. So the overall weight of the model is assumed to be slightly lower than that of the "wild" version.

But the performance of the electric drive is even better than that of the (old) glow drive. The electric drive still costs more than the glow drive, but that's just changing, and there is no expensive fuel needed.

Obviously, we are witnessing a revolution in model technology. If prices get lower, more and more people will become a convert to electrics. No more oily (and hurt) fingers, no refueling and complicated engine start-up, no needle valve adjustment and engine stop in flight, no awkward model cleaning, no noise problems and even more powerful drives could be too tempting. Supposedly even Phil Kraft would have converted, how Hal deBolt reportedly did. And converting the Ugly Stik is no sacrilege, it's just logical!

## Model

The more "modern" rotary version of the Stik for REFLEX was taken and both engine and livery were replaced.

Unfortunately, I had no good idea how to design a new skin for this version. Since all three previous versions utilized some national symbols, one idea was to pay tribute to the Czech contributions. On the other hand, I was too lazy to draw a complex texture. The Czech flag with its blue triangle nicely fits the round vertical tail of the Stik. The flag structure could also be used for wing and horizontal tail. It looks as if they were swept forward, but it's not bad at all. At least one can distinguish left and right side in aerobatics.



## Sources

Information about the “Czech flag” is found via Google using just these two words.

Motor picture and parameters are taken from the [ModelMotors website](#).

The motor was modeled using the drawing on this website, and the propeller was modeled after a real APC sport propeller.

The drive parameters for REFLEX were calculated in my own spreadsheets. Not this case but similar drive calculations are available on [my download page](#).

The sound is borrowed from REFLEX, it’s the generic electric sound because I have no better one.

## Addendum 3

# The Original Das Ugly Stik

GRID LEAKS magazine article and Jensen kit

Many modelers had the kit of Das Ugly Stik made by Jim Jensen. That mainly determined the image that people had of the Stik. Though several modelers built the Stik after the original plan published 1966 in GRID LEAKS magazine, obviously far more noticed and appreciated the kit that was available for a long time, and the Jensen plans re-published 1985 with instructions.



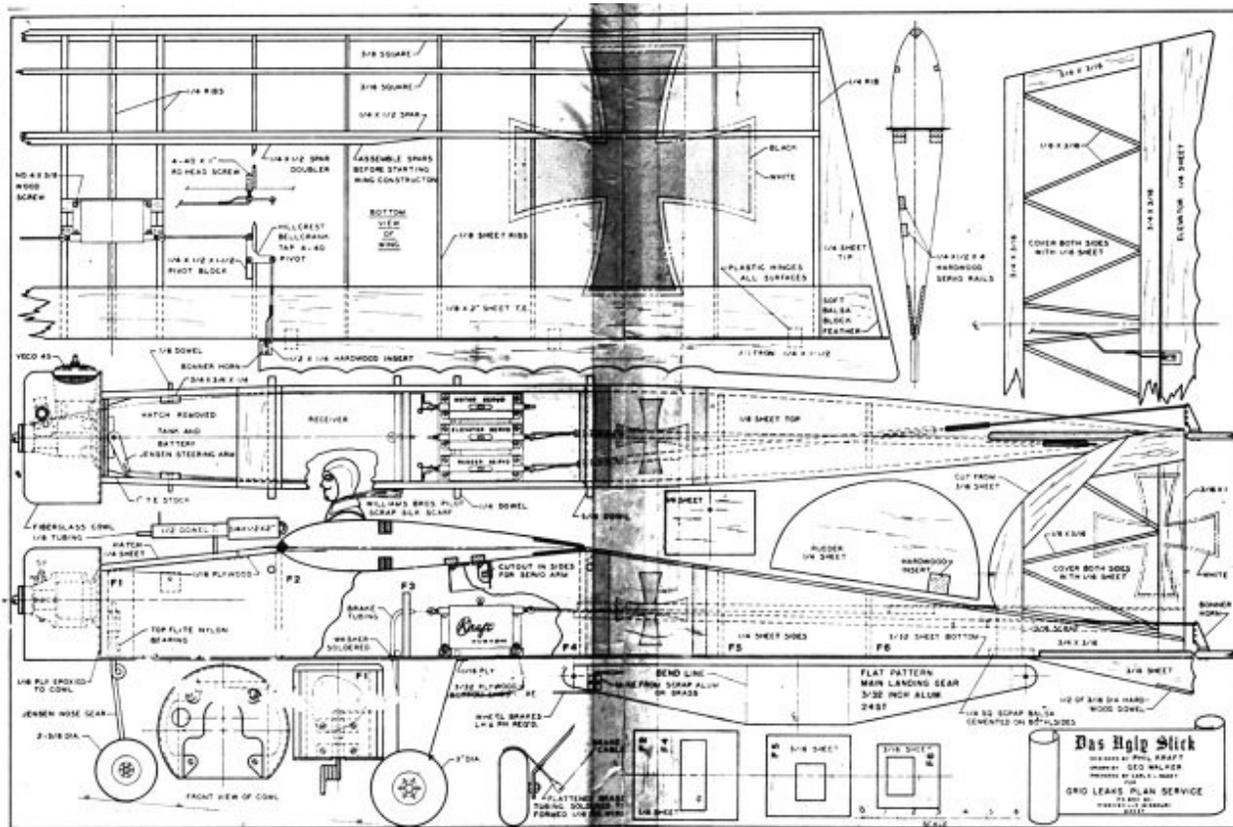
This must be the cover of the Jensen kit. It shows the model in the most popular paint scheme being suggestive of a German WWI airplane. This goes back to Phil Kraft's published plans, but the fancy "decorations" - engine cowl, pilot and gun - are omitted. Maybe it was Jensen who added a second paint scheme following American WWII trainer airplanes. This may be adequate to a trainer and sport model but obviously never became popular. Moreover, using an ancient-style font - aptly named Gothic - for the model's name on kit and plans, the first paint scheme became *the* livery of Das Ugly Stik.

Besides omitting the decorations, Jensen or whoever worked in the customary three degrees of dihedral. Because Phil Kraft's original version without dihedral had perfect flight behavior, this must have been done

for another reason. Likely, Jensen simply felt the model looks better with dihedral. The "Fokker-type" wing planform may let the straight wing look as if it had some anhedral. Nevertheless, several modelers (like Ed Moorman, see above) preferred the straight wing for its simplicity and slightly better aerobatic performance. Anyway, the Ugly Stik for REFLEX was initially made after the Jensen version, but now additionally after the original Kraft version.

## Phil Kraft's original publication

The 1966 article by Phil Kraft himself was very short but informative. There were no real instructions for the one-sheet plan. It's only mentioned how the model was designed for utmost building simplicity. No jig is required for both fuselage and wing. To this end, not only the wing is straight but also the ribs have a flat lower edge from the main spar to the trailing edge spar.



The plan published in May-June 1966 GRID LEAKS magazine (please ignore traces of usage).

Engine cowl, pilot and gun were intended as pure frills. Whereas Phil Kraft obviously liked pilot and gun but few other people did, he probably disliked the engine handling complicated by the cowl and soon omitted it. But the cowl belongs to the characteristic look of the model and so it is drawn in the plan as well as the German insignia.

## Model

The "German" version was taken as a basis for the original version of the Stik for REFLEX XTR. The wing was straightened and the engine cowl was added. The paint scheme was left unchanged and white color used for the cowl. The Veco engine now has no muffler. It's rear-mounted as in the plan, with the cylinder horizontally on the right side.



The pilot - even with scarf - and gun are only frills making for an interesting look. More important are the external aileron linkages omitted in the other REFLEX model versions for simplicity. Though they are mostly invisible under the wing, they make a difference to the Jensen Version.

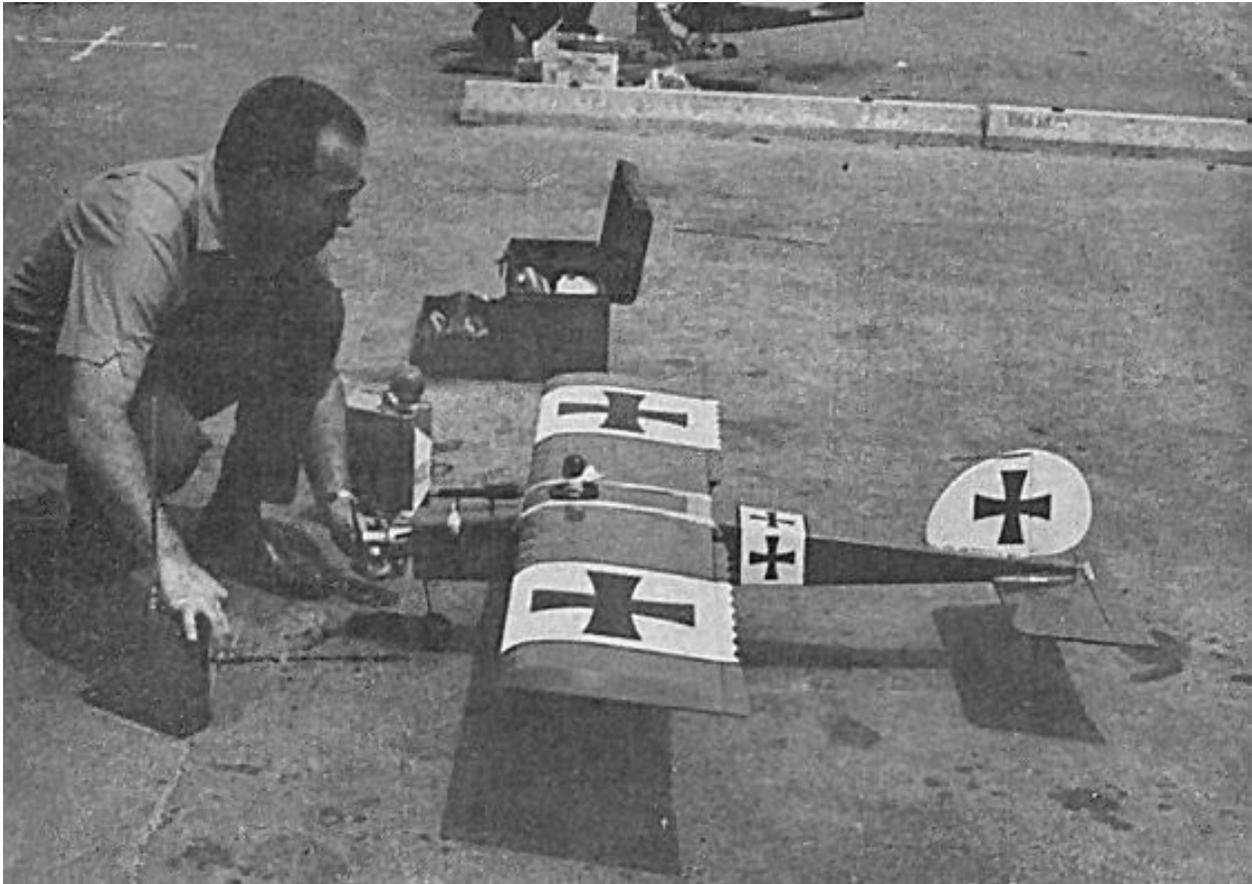
Because the bellcranks are rectangular and not 60 degrees as in the Jensen version, there's no aileron differential. That is reflected in the physical parameters but has only a small effect on flight behavior in REFLEX, as well as the straight wing without dihedral.

There are other details making a noticeable difference. In addition to the "semi-symmetrical" airfoil caused by flattening the ribs' lower edge, the plan shows a wing incidence angle of about 0.5 degrees. This is also the decalage. Setting that in the physical parameters, along with slightly "asymmetric" airfoil coefficients and a small amount of airfoil pitching moment, resulted in an even more credible and realistic flight behavior than in the other versions of the REFLEX model (which were readjusted after this).

Phil Kraft writes that no engine right or down thrust was used. Setting also that in the parameters gives a surprisingly neutral flight behavior. You have to apply right rudder during the take-off run and in the high-lift parts of a loop, but that's normal for aerobatic models.

This version has .45 size engine power and quite big control throws, so it will fly lively but neither spin nor snap. That should match the intentions expressed in the article and the plan where the Veco .45 is drawn. Because there was no muffler, the louder sound of the "wild" version is used.

There's even a variant of this version. In the 1966 article, Phil Kraft is shown preparing an Ugly Stik. The model's vertical tail is substantially further ahead than depicted in the plans. You may yourself compare the picture below to the plan above. This forward vertical tail position is not mentioned in the article. Maybe it should make room for more elevator deflection, or yaw behavior should be modified. Maybe as well it was simply the first design later modified for the publication.



Phil Kraft preparing an Ugly Stik. Note forward position of vertical tail.

Anyway, in the REFLEX model variant not only the forward vertical tail is rendered visually, but also the physical parameters are adjusted. Yaw effect and yaw damping are smaller than in the other versions. Not only elevator deflection is now huge because the rudder is no longer an obstacle, but also rudder and aileron deflection are even bigger than in the "hot rod" version.

The drive parameters are set for a .60 engine because in the article Phil Kraft recommended .56 to .60 engines. So this variant is basically a "wild" version with straight wing where the big elevator deflection is really justified whereas it would not in the other ones. Weight is 6 pounds as also recommended for best flying characteristics.

Though all other versions can have only 30 degrees elevator deflection they might spin and snap quite well if only the center of gravity would be quite far back. This variant spins and snaps well, but due to its big elevator deflection. Snap rolls turn out well only to the left, though, assisted by the propeller torque. I have no clue if this behavior observed in REFLEX is realistic.

## Sources

Eric D. Wildermuth from Brisbane, Australia, kindly provided scanned images of his copy of the 1966 Grid Leaks magazine article and also had valuable information from his rich experience building and flying several Ugly Stiks. Thank you very much!

Some members of the Vintage R/C Society scanned all old Grid Leaks issues and put them on the Web. Look [here](#) for volume 7 number 3 to find the Ugly Stik article with plan. It was also shown without plan in an [Ugly Stik thread](#) on RC Universe.

The image of the Jensen kit cover was presented by "Uncle Willie" at [his website](#) (half way down).

The pilot is taken from a Fokker DR-1 model published [on R/C-Sim](#) in 2004 by Eric Fague. He converted it from an FMS model made by "[Logic Wizard](#)".