Trainer and utility model for REFLEX XTR²

Telemaster

design by Karl-Heinz Denzin, rights Alexander Engel

»Nothing, nothing, nothing flies like Senior Telemaster!« Of course, this enthusiastic exclamation is advertising, but it should be sincere as well, even more than only a little. It's quoted from the defunct Hobby-Lobby web page (in Web Archive) about the Senior Telemaster (here's the newer one about the re-designed "version 2" by re-named Hobby Express). Designed probably 1968/69, then redesigned 1975, 2011, and again 2018, this model is still available (now by Carolina Custom Kits) and still has enthusiastic owners.

Telemaster was designed by Karl-Heinz Denzin, a well-known German model designer. The rights on the model had Alexander Engel, who produced it in his own factory in Germany. Later (in 1975), he gave license to Jim Martin, owner of Hobby-Lobby International, who had the model redesigned and produced by the well-known Joe Bridi. This story was told by Jim Martin himself in a Mini Telemaster review.

Originally there were three sizes, the "standard" Telemaster, Senior Telemaster and Junior Telemaster. They had 1.8 m, 2.4 m, and 1.24 m wing span (6 ft, 8 ft, and 4 ft). Later, there were also Mini and Micro Telemasters and even the 12 ft Giant Telemaster. The standard (6 ft) Telemaster 40 was often used as a trainer model, but maybe the typical version is the Senior Telemaster, probably because in the old times it was big compared to most other models and even called a behemoth (in a 1973 magazine article).

This is an old advertising picture; see transparent covering and vintage transmitter. Jim Martin's wife is there to give an impression of the model's size.

Note the controls, set off by blue color. They are rather small; after all the model is from the late reeds and early proportional R/C era. Note also the very lightweight construction.

The Senior

»Senior Telemaster is so lightweight that we've found it flies beautifully with a .45 size engine.« What a surprise! But sarcasm aside, again there's some truth in this discovery. Recommended were .35 to .61 glow engines for a 2.5 to 5 kg / 5.5 to 11 lb all-up weight, meaning 9.5 to 19 oz/sqft wing loading. Maybe the designer kept the model just within the 10 ccm / 0.61 cuin engine displacement limit and the 5 kg / 11 lb weight limit we had in Germany for all models. The plane was built sturdy enough to carry up to 5 lb payload, but the 1960s engines weren't that powerful. Later engines were, so a .45 should be very well enough.

»With flaperons it nearly hovers into landings!« That's another modern thing. It may be even easier to drive each aileron with its own servo than to build the old bellcrank linkage. All but the cheapest transmitters have mixers to deflect both ailerons as flaps and superimpose the aileron deflections. It's true, the model really floats, but it's hard to control. Better build smaller ailerons and separate flaps (see below).

What is so special about the Senior Telemaster? Well, I think its sheer size in the first place, because in the 1960s nearly all models were smaller than 6 ft. Even today when we have many really big models, these are all 3D aerobatic monsters or scale models but not simple utility airplanes. Big size and low wing loading have some effect: »The Telemaster takes off like any trainer, but it seems to do it in slow motion.« says a review.

That "nothing flies like Senior Telemaster" just isn't quite true. All pilots of a Piper Cub model will know *similar* flight characteristics, at least if their Cub has low wing loading, because both airplanes have similar configuration and a similar airfoil. Due to the Senior's size even full-scale Piper Cub pilots should find it familiar, and each single-engine Cessna flies similarly as well (regarding only the main characteristics, of course).

Better forget aerobatics! Even though some simple aerobatics are possible, the calm and steady flight predestines the model as a trainer or as a utility model for all sorts of tasks. Especially aerial photos and videos come out in good quality without blur because heavy high-quality equipment is smoothly carried by the Senior Telemaster. You may simply drop a lot of candies as well or use the model as a glider tug.

Such a model appeals to pilots who are able to appreciate its abilities; it won't appeal to the average pilot who's searching for a thrill. The seasoned pilot, who has a task for the model, be it photographing or dropping or towing, will appreciate the model's benefits. If the task is teaching to fly, he will even appreciate the model's flight characteristics as such and for his own enjoyment. An experienced model and full-scale pilot wrote in a post at RC Groups: »To me, the unique thing about the Telemaster design is that I have never gotten bored with flying it.«

Sources

Credits are due to all those who published something about the Telemaster in the Web, may it be information, data, plans, pictures, or stories, or provided such things. Of course, you'll have to blame me for any errors, flaws, or misunderstandings.

There was Hobby-Lobby's Web page on the "original", glow-powered Senior Telemaster, now in the Web Archive. Aero Craft Ltd produced Telemasters for Hobby-Lobby at least for some time (pages in Web Archive as well).

There are reviews in the E-Zone Web magazine sponsored by Hobby-Lobby, and to each review a RC Groups discussion thread is appended. There are reviews of the Senior Telemaster ARF Electrified, the 6 Foot Telemaster Electro ARF (with the discussion of Telemaster's trainer abilities), and the Mini-Telemaster (with Jim Martin's story).

Eric D. Wildermuth from Brisbane, Australia, kindly provided images of the Senior Telemaster plans scanned from the original October 1975 issue of the RC MODELER magazine. Thank you very much!

Brad Nichols from the US contributed the plans for the original Telemaster, Senior Telemaster, and the RCM plans, as well as a characterization of the design and an explanation why Joe Bridi modified it, based on his wide experience of building and flying Telemasters. Again, thank you very much!

Both RCM magazine articles and both plans (1973 and 1975) are available at the Outerzone vintage plans website. The whole April 1973 and October 1975 RCM issues are at the sister site RCLibrary.

Contributions

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

Bo (Jörgen) Strömberg from Sweden made a Veco .21 engine for his excellent Graupner Taxi for REFLEX XTR². He published it on RC-Sim (defunct now) in August 2005 and later granted permission to use the engine model. Thank you very much! The engine is scaled to mimic a .45 on the Telemaster.

The glow engine sound was borrowed from *Thomas Hanser* who published it with his Westerly model on RC-Sim (defunct now). I don't know whether he recorded the sound and from what model, and I think he will not mind that it's used for the Telemaster.

The payload variant has the sound of a JBA .56 ABC glow engine, just to be different. The sound was extracted from a video *David Vaught* presented in his review on RC Groups.

The four-stroke variant has the sound of an RCV 91-CD rotating-sleeve engine. This sound is very similar to that of the 58-CD, the power of which is assumed in the parameters. The characteristic sound was extracted from a video *Rich Noon* presented in his review on RC Groups.

The electric motor parameters were taken from the ModelMotors Web site. 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 using Drive Calculator.

The electric sound is borrowed from REFLEX, it's the generic electric sound of the pre-5.05 versions because I had no better one.

Of course, owners of the recent REFLEX versions may use the new and better stock sounds. (Hit F5, select "Engine sound" from "Sound Library".)

Shape and Appearance

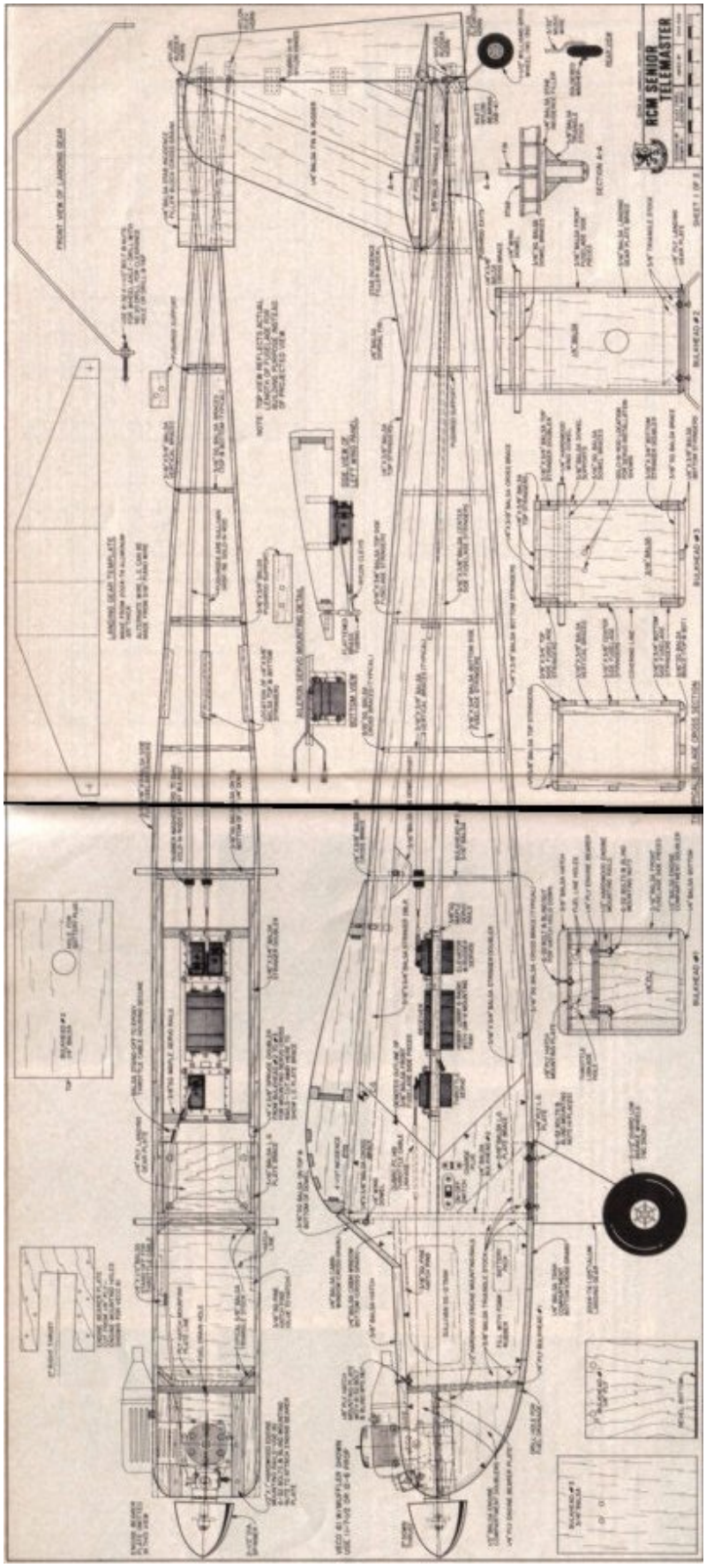
On the plans, the model looks quite boxy and almost ugly. In reality or in the simulator it isn't that ugly due to clever curvature and paint scheme.



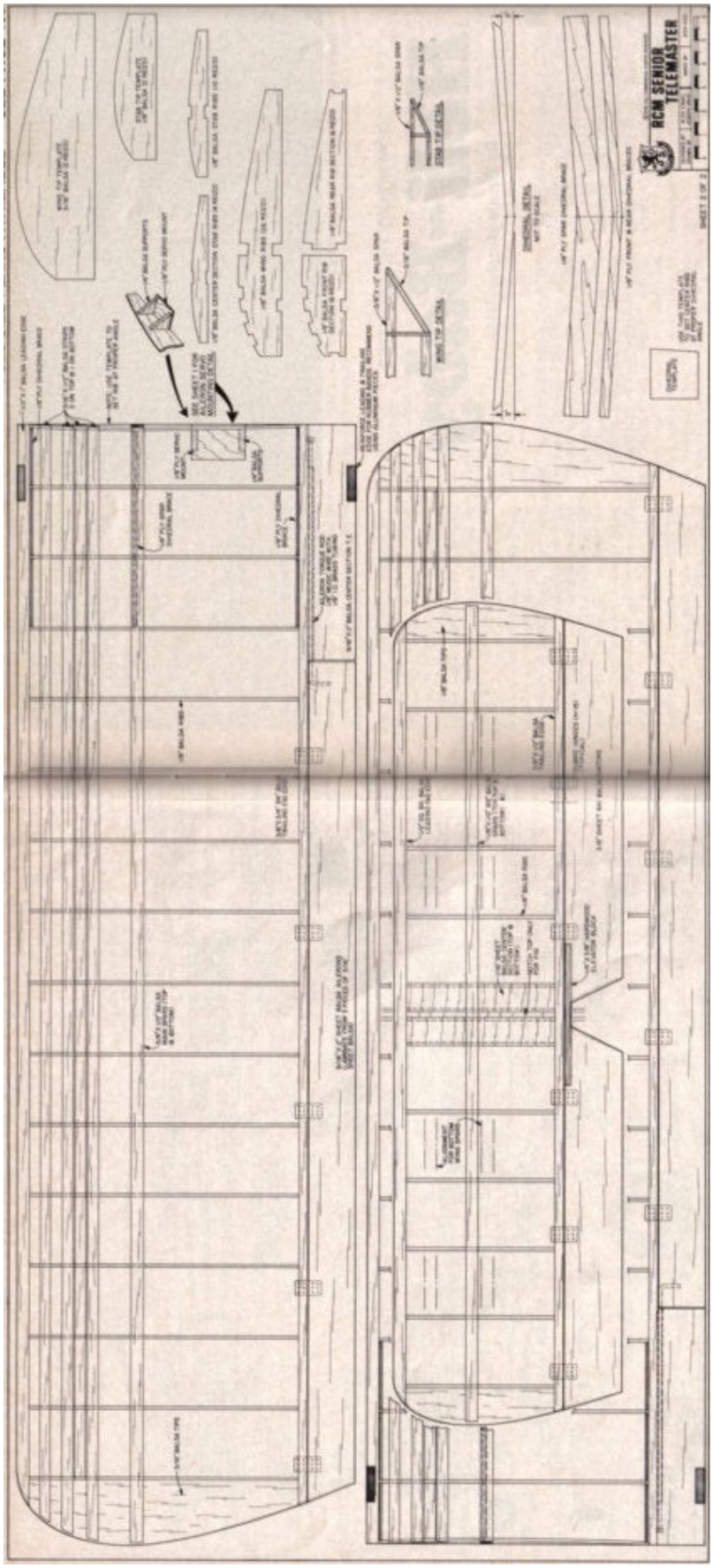
Pictures are borrowed from the old Hobby-Lobby web page about the Senior Telemaster.

The fuselage is boxy, but it isn't a box. Instead, it's built up from longerons and bulkheads. Only the front part consists of slab sides and a balsa bottom. Seen from a side, this front part is nicely curved. Fin and rudder are plain slab balsa and are tapered and rounded for better look. Wings and horizontal tail are built up without sheeting or even a D-tube. Instead, there are several spars on the top front side of the wings, acting also as turbulators. The wing and stab tips are beveled giving a nice round tip without carving and sanding balsa blocks. There are simple strip ailerons and elevator.

The simulator model was built "on the plans" so it should be really true to the original. The plans in the RCM magazine are each spread over two pages. The halves were stitched together (using Panorama Tools) so that correct dimensions were achieved. You still see the fold or even a black gap in the following two plan sheets. There's also some crucial information in the plans.

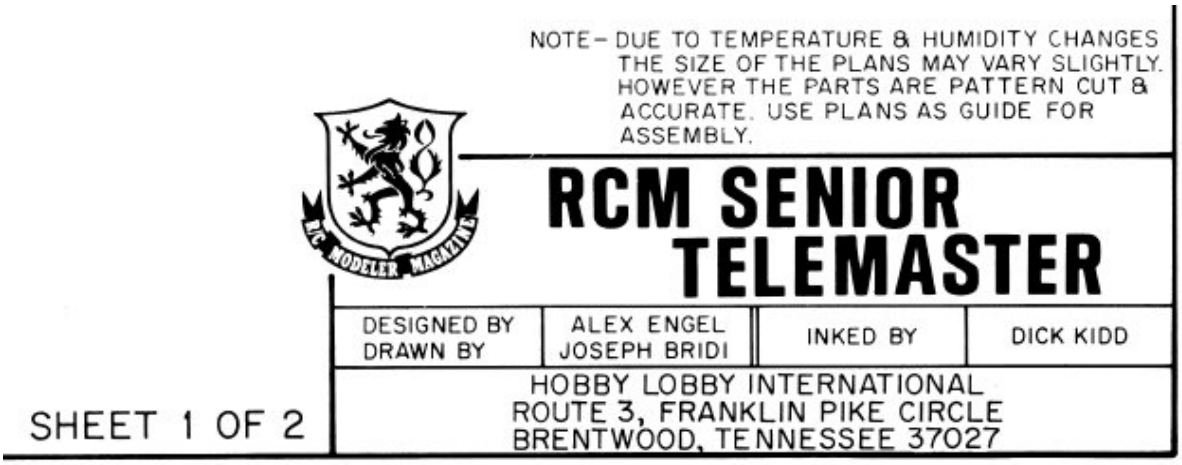


The fuselage sheet shows the airfoils of wing and horizontal tail. Additionally, the wing and stabilizer incidence angles are given as 4.5 and 2 degrees. Interesting are also the 12 oz tank and the 3½” wheels. The Veco .61 with muffler should have a 11x7½” or a 12x6” propeller with a 2½” spinner. The engine bearer plate is made for 3 degrees down thrust and 2 degrees right thrust. Note also the complete definition of the landing gear.



The wing sheet also shows the horizontal stabilizer drawn into the right wing. The rib templates were not needed for the REFLEX model as well as the braces. But the small front view shows the correct dihedral angle, though it is not to scale. The outer ribs simply have to be 3” higher than the center rib, giving 3.9 degrees.

By the way, the full-size plan shows one diagonal brace ("geodetic angle brace") in each wing rib bay for better torsional rigidity. Seems to be a good idea, but it's not known why they are missing in the article plan.



That's a full-size plan sheet's title block. Remarkable is not that this plan was inked, after all CAD was not in common use in 1975. Remarkable is that Alexander Engel is called the designer even though he only had the rights to the design. Jim Martin told this in a story about Alexander Engel who was his friend and licensor for the Telemaster. Designer of the original 6ft Telemaster was Karl-Heinz Denzin, who was very well known in Germany for his excellent designs. Someone else scaled the design up to 8ft – the Senior.

Likewise remarkable is that the RCM plan was drawn by Joe Bridi who was a well-known, excellent designer himself. He did this redesign and produced the kit from then on – for Hobby Lobby, owned by Jim Martin.

In a post on RC Universe, the Telemaster Story as told by Frank Schwartz is quoted. Joe Bridi somewhat simplified the design, especially the wing, for his kit produced for Hobby Lobby. He replaced the sheeted D-tube by stringers and the barn-door ailerons by strip ailerons. Both strength and aileron effectiveness were reduced, but this design was retained from 1975 until the end. The redesign was done for lower cost. A foreign exchange loss for the dollar and a balsa shortage coincided in the 1970s.

Finally, remarkable is that RCM magazine published the model with plans and called it the RCM Senior Telemaster, their emblem in front of the name, even though a kit was produced by Joe Bridi, and the distributor Hobby Lobby with full address is stated in the title box. Obviously, they deemed this marketing move necessary or at least useful.

Anyway, the REFLEX model was made to show not only the general outlines but also the ribs-and-spars structure of wing and horizontal tail. It would be even possible to render the internal structure and a transparent covering (as I did for my Brummi parkflyer), but that was simply too much work. Still you will see the wing covering sagging between the ribs and spars when you're viewing from certain angles. You'll have to keep some viewing distance, or the wing and tail will look a bit angular and awkward.

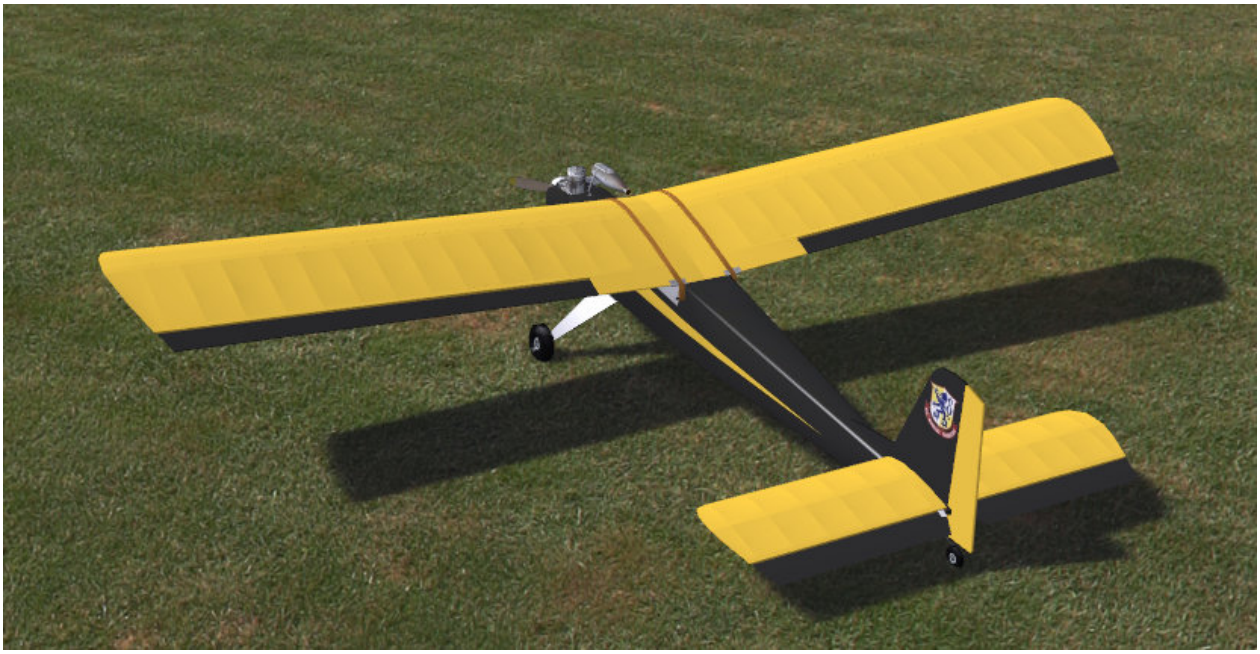
Adequate to this viewing distance, details were applied to the raw body of the model. These are control horns and linkages for rudder and elevator, mounting dowels and rubber bands for the wing (even with aluminum edge protectors), and the nose hatch with a fastening bolt. The antenna is hidden in the long fuselage, as well as the aileron bell cranks. I didn't bother about making control horns and linkages for flaps and separate ailerons. In the electric version, the wing dowels and rubber bands were replaced by Nylon bolts. The glow engines and the electric motor are detailed as much as possible. Of course, the landing gear, main and tail, is fully functional and detailed; the wheels are textured.

I didn't invent the Senior's paint scheme, I just borrowed it. No paint scheme shown in the advertisements and in the Web forums was really exciting, except one. It was only one picture in a RC Universe post (another) where a modeler presented his Senior Telemaster, but this one picture was enough.

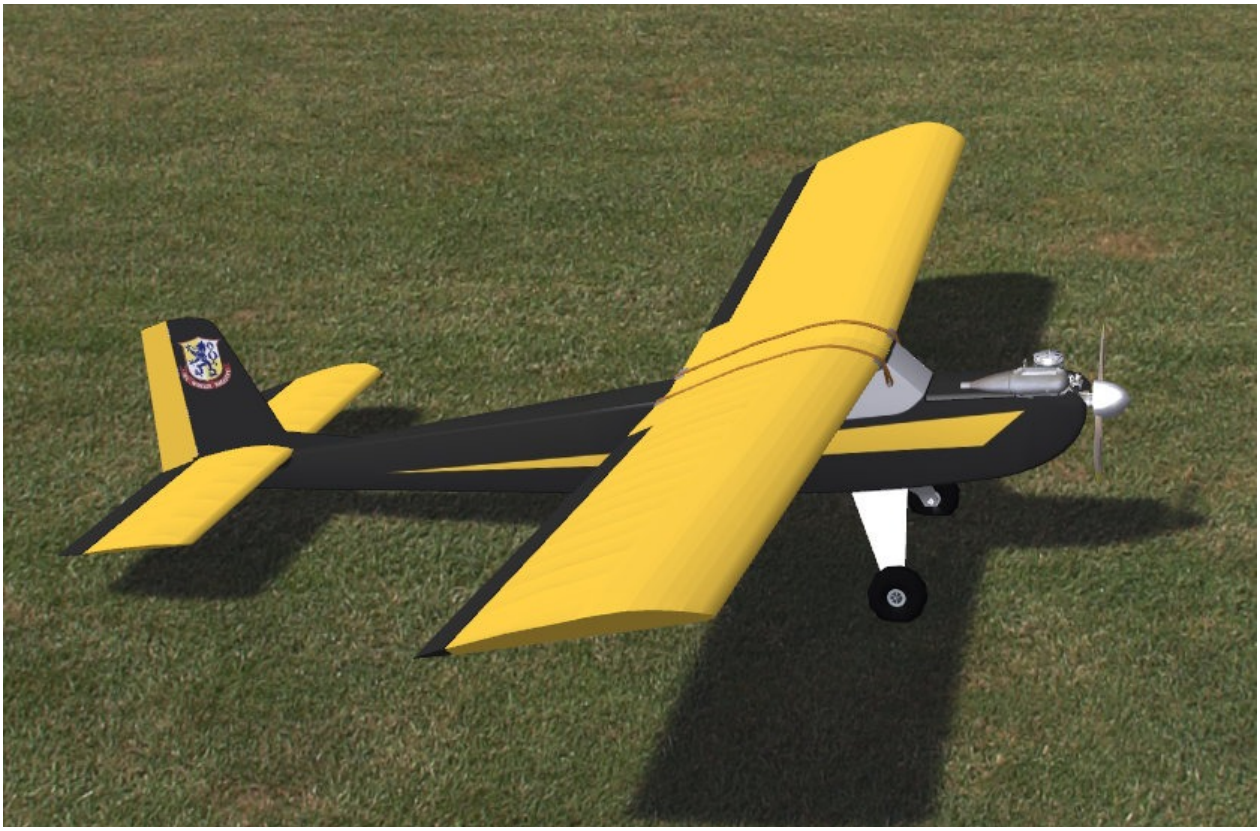
In the first place, I adopted not only the outlines but also the blue colors. After a while I realized that especially the outlines and the color gradation are very well suited to the Telemaster. Now I simply varied the colors from blue to red and yellow. The two different colors in the scheme are actually the same hue but different saturation and lightness. Clever trick!

Depicted are here the three versions of the Senior Telemaster I made for REFLEX. The blue one has the O.S. MAX 60S-FR engine I made for my Kwik-Fli for REFLEX. It's a good replacement for the Veco .61 mentioned in the plan. The red version has Bo Strömberg's Veco .21 engine, which was sized to mimic a .45 and later even a .20 engine on this model. The RCV 58-CD of the red four-stroke variant was rendered using review pictures. The yellow version is the electric one with an AXI 4120 outrunner motor and an APC 14x10 Sport propeller I rendered after drawings.

Each version comes as at least two variants. The first is made as to the plans, featuring strip ailerons beginning at about 20% of a wing's span (shown in the blue version above). The other variant has shorter ailerons beginning at 50% span, and flaps from near the fuselage (to leave room for the rubber bands) to the ailerons (shown in the red version above). Of course, the different drives and wing configurations are reflected in the physical parameters.



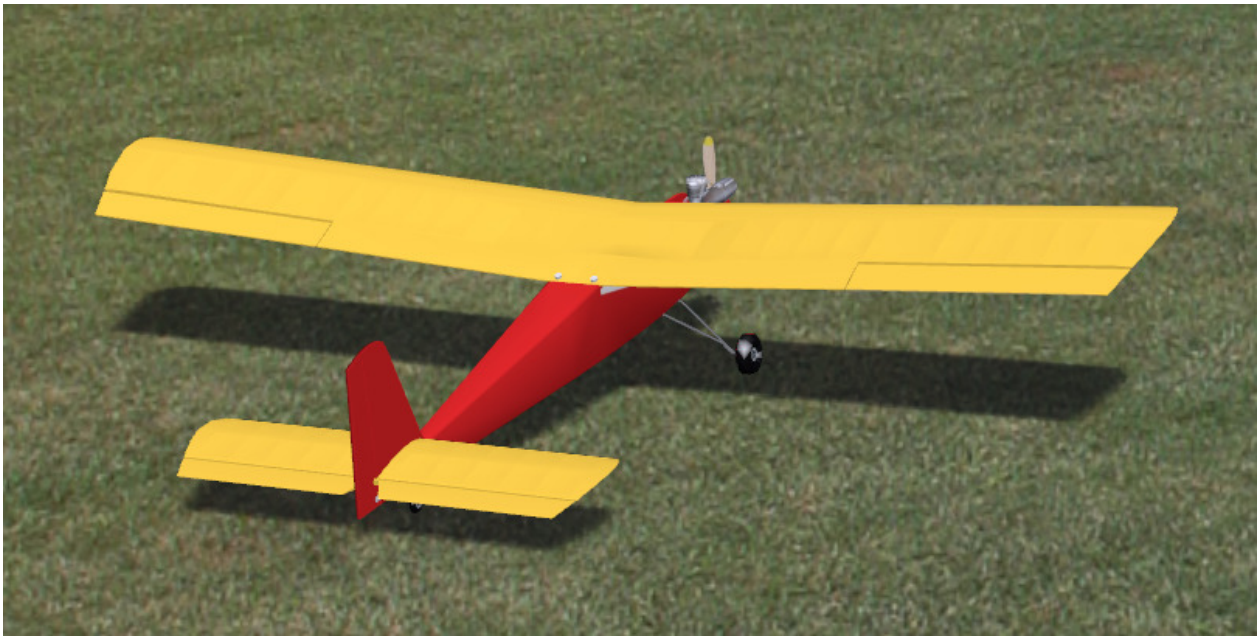
The October 1975 issue of Radio Control Modeler magazine introduced the Bridi / Hobby-Lobby version of the Senior Telemaster under the headline "RCM SENIOR TELEMASTER". They built and pictured the model with this paint scheme and specified 104 oz all-up weight. It has been reproduced in the simulator (demo flight at YouTube) as well as a fictitious variant with a tiny (compared to the model) .20 engine and accordingly only 92 oz weight.



This is how the *original* Senior Telemaster looked like on the kit box produced by Engel in Germany and imported into the U.S. by Hobby Lobby. RCM magazine built and reviewed the model in 1973 but with a different paint scheme. This one is especially simple and well visible and that's why it's used here.

This version had wire landing gear, the *fixed* (not steerable) tail landing gear in front of the tail feathers, and no dorsal fin. Above all, it had barn-door ailerons. These are complemented here by equally wide flaps to demonstrate their effect. This simulator model is somewhat "modernized": there are no dowels and rubber bands to fix wing and landing gear, and the tail landing gear is steerable.

There are variants of this version with a .61 glow engine (picture), with a .35 glow engine, a .19 glow engine, and an electric motor.



Originally, the designer (Karl-Heinz Denzin) had meant the Telemaster as a new, "modern" (in 1968) trainer model. It has 71 in wingspan – a good deal more than contemporary trainers – and a very lightweight structure to carry heavy R/C equipment and yet have a low wing loading (13.5 oz/sqft). The Senior is merely a scaled-up version (1:1.33, increasing wing area 1:1.78).

New was learning to fly with rudder, elevator, *and ailerons* from the start. Barn-door ailerons were chosen not only because they are more effective than strip ailerons but also because they make for less adverse yaw.

The simulator model got the same red-yellow paint scheme as the original Senior Telemaster because it is adequate to a trainer airplane. The engine is simply a scaled-down .60 glow engine. Dowels and rubber bands for wing and landing gear simply have been omitted. The tail wheel is steerable.

The variant 'Original .30 Engel' is assumed to have only 70 oz weight what seems ambitious but achievable. There is a 1960s .30 glow engine with muffler and a 10x4" propeller, which was seen as typical for multi-trainers (multi meaning all three controls and throttle) back in the 1960s and is more than adequate giving a 0.7 static thrust/weight ratio.

The variant 'Original .35 Engel' is assumed to have 88 oz weight what is more typical for this size and well achievable but results in a noticeably higher wing loading (17 oz/sqft). There is a .35 glow engine with muffler and 12x4" propeller, which is actually far too powerful for a trainer.

Setup

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) to get most of the physical parameters. The airfoil and wing coefficients were calculated in an own spreadsheet. All calculated values and several values from the plan were simply transferred to REFLEX. The model worked right away, so no tweaking or fudging was done.

Rendering a model like the Telemaster in a flight simulator is a case study. After all you won't do any kind of airwork in a simulator; the only purpose of the model would be enjoyment. For me, more than half of that is to understand how such great old designs actually work. And seeing how well the flight characteristics are rendered is part of the enjoyment as well though it's not my merit. Basically, it's all about correctness.

It should be self-evident that a model's geometry has to be correctly entered into the corresponding parameters. Some other parameters depend on the geometry, for instance damping or downwash coefficients. There are formulas to compute the values, some complicated and accurate and others simplified and giving only estimates. But anyway the physics model of a simulator is simplified as well, so the simple estimates are good enough.

Several parameters depend on several other parameters, especially the airfoil coefficients. Since the 5.01.xx versions of REFLEX they seem to be no longer airfoil coefficients but wing coefficients. That means you have to calculate the drag coefficients including the induced drag and the angles-of-attack (AOA) including induced AOA. They depend on the airplane's configuration, weight and speed, and there's no choice – just physics. The wing coefficients are calculated from the airfoil coefficients, and here's where guessing begins.

There are not many measurements of airfoil coefficients for the low Reynolds numbers models fly at. If there are measurements these are often lacking stall values or moment coefficients. There are programs to calculate the coefficients, but they are not reliable especially for the extremes like stall and for the moment coefficients. Unfortunately, just these values have a big effect on a model's flight characteristics, so we need sensible estimates.

Now let's look at the Telemaster. Its wing and horizontal tail both have a typical flat-bottom airfoil as used since the 1930s. Thickness is 13.2% for wing and 8.5% for tail. The most similar airfoil I have measured values for is Anderson SPICA. These values are reliable because they are well-tried for the Brummi parkflyer I own as a real model (special page) and for the Graupner Taxi that Bo Strömberg has. The coefficients for the effects of flaps and ailerons are not known but only best guesses though proven as well.

The C/G position was taken from the plan where it is depicted below the wing's main spar. The engine's right and down thrust were set exactly as given in the plan (see above). Even the angles of incidence for wing and tail were taken from the plan and not from the calculations, but they had to be processed for REFLEX.

The angles in the plan are referred to the flat bottom, whereas the parameters are referred to the airfoil chord line. The differences were measured as 1.5 degrees for wing and 1 degree for stabilizer. While the zero-lift angle of the wing is reflected in the wing coefficients, REFLEX assumes a symmetrical stab airfoil. Thus, a zero-lift angle for the stabilizer airfoil was simply estimated using the thickness ratio and added to the incidence:

	wing	stab	decalage
flat-bottom incidence	4.5	2	
+ chord-to-flat-bottom	1.5	1	
= geometric incidence	6	3	3
- zero-lift angle-of-attack	-2.5	-1.5	
= aerodynamic incidence	8.5	4.5	4

After several experiments it seems that REFLEX needs the aerodynamic incidences for both wing and stabilizer, not the geometric incidences. At least the model's behavior is quite reasonable if these incidences are set. Moreover, the much discussed effects of the stabilizer's cambered airfoil are all factored in. Both geometric and aerodynamic decalage are quite big (3 or 4 degrees) but typical for models like Telemaster. That indicates that they are flown at rather low speed, requiring big lift coefficients and angles-of-attack and thus the highly cambered airfoils. That is a flight regime where even the stabilizer may contribute lift to help unburden the wing, and the cambered airfoil is just most effective in that case. It helps minimize the total induced drag of wing and stabilizer, but only if the C/G is set unusually far back.

Control deflections were set in a pragmatic manner. Rudder deflection is limited to 30 degrees by the cutout of the elevator. I simply set also elevator deflection to this value. Another nice round number, 10 degrees, was tried for the ailerons, together with even 50% differential. No exponential rate was set. All these settings turned out to be adequate, though there is still considerable adverse yaw.

In the first place, the REFLEX model was made with three different drives, and each version with a variant. This was replacing the strip ailerons going from 20% to 95% wing span by shorter ones and separate flaps. The strip ailerons were set to act also as flaperons with 20 degrees deflection. The shorter ailerons going from 50% to 95% need 20 degrees deflection for the

same effect. The (8% to 50%) flap deflection was set to 45 degrees for a good air brake effect. Only the low-powered model versions are limited to 35 degrees flap deflection because they lack the power to climb with flaps deployed 45 degrees. The variants with flaps are to demonstrate real STOL behavior.

The overall weight was set to 160 oz / 10 lbs / 4.5 kg according to Hobby-Lobby's Web page. The moments-of-inertia were estimated correspondingly. Blaine Beron-Rawdon's method of relative-radius-of-inertia was applied with the values measured from my Brummi parkflyer because this is the most similar configuration I have values for. These values are the same for all versions and variants of the REFLEX model of the Senior Telemaster.

The parasitic drag of fuselage and landing gear is estimated quite reliably choosing rather big coefficients due to the engine and muffler and the boxy fuselage shape. The electric version has a lower drag, correspondingly, because the motor is hidden in the fuselage. The "Lift gradient of fuselage" value, influencing not only knife-edge flight but also sideslip, is only a wild guess - unfortunately.

An O.S. MAX 60F-SR with O.S. muffler was assumed as Senior Telemaster's engine. The drive settings in REFLEX are based on power and torque measurements published in an older German book. Static thrust with a 12x6" propeller was estimated using ThrustHP Calculator. It was assumed that the engine might rev up to 18000 rpm what determines the decrease of thrust with speed in REFLEX. Fuel consumption would be 42 oz / 1.2 l per hour at full power setting, what was used to estimate the flight time.

In the "payload" variant of the .60 version, not only the thrust/weight ratio was reduced corresponding to the 81 oz / 5 lbs / 2.3 kg payload. The model was "beefed up" to withstand the higher loads by increasing the maximum g-load to 12. Landing gear stiffness was increased as well. The 45 degrees maximum flap deflection was left unchanged for demonstration.

For the .45 version, I simply applied the 0.75 displacement ratio to all drive parameters in REFLEX. Only the longer flight time is estimated using real fuel consumption values of a .45 engine. For comparison, the two-stroke .45 was replaced by the RCV 58-CD four-stroke with a 12x6" propeller. The parameters were estimated, as well as those of the .20 version, which was made because Frank Schwartz in the post on RC Universe mentioned a .19 version. In all cases, weight was reduced somewhat to reflect the lighter engine and flight time was extended according to the lower fuel consumption.

For the electric version, the drive parameters for REFLEX were calculated using Drive Calculator. An AXI 4120/18 outrunner motor, an APC 14x10 Electric propeller, and a 5000 mAh 5s1p LiPo battery would weigh about as much as the glow engine drive (35 oz / 990 g). The 0.6 thrust/weight ratio is quite good for this model. Flight time was estimated from the 5.6 minutes

full-power runtime assuming that full power is rarely needed and much less power is required for cruise flight. By the way, a 2500 mAh 6s2p A123 LiFePo battery would have 1.3 V more voltage, the same capacity (5000 mAh) and quite a bit more weight (11 oz / 300 g) than the LiPo battery.

A 6000 mAh 4s battery would reduce the thrust/weight ratio to 0.44, what is still quite sufficient for most practical purposes, but nearly double flight time. But the maximum flap deflection is reduced to 35 degrees in this "duration" variant so go-around and climb are possible with full flaps. The drive parameters are adapted to the lower battery voltage.

The .60 RCM 1975 version is the same as the .60 glow version except that all-up weight is only 104 oz / 6.5 lbs / 2.95 kg and the moments of inertia have been reduced accordingly. The .20 RCM 1975 version has the same drive as the .20 version mentioned above and as little as 92 oz / 5.75 lbs / 2.6 kg weight. Even if RCM did not build the model with two aileron servos, the simulator model has flaperons so you may try them but don't have to.

The original Engel versions with barn-door ailerons are there to show the differences to the RCM/Hobby-Lobby versions. They got big flaps to demonstrate their effect compared to the smaller flaps demonstrated here on the Hobby-Lobby versions. And they have the 104 oz / 6.5 lbs / 2.95 kg weight of the RCM version even though RCM built the Engel version even lighter.

The .61 Engel version with payload weighs 5 kg because that's what it was meant for (the weight limit in Germany). The .35 Engel version shows what actually would be enough power for this lightweight model and the .19 version shows that it still flies well with even scarce power. The versions with a 2820/14 electric motor show that the model is well powered and has even quite a flight duration with a slightly bigger battery.

The *original* (6 ft) Telemaster is compared here with two different assumed weights: 88 oz / 5.5 lbs / 2.5 kg and 70 oz / 4.4 lbs / 2.0 kg. The former is a usual weight for a trainer of this size while the latter seems to be what the designer intended with the eminently lightweight structure of this model.

The heavier variant got a powerful (for the time) .35 engine with a 12x4" propeller. Engine rotational speeds were not as high as later in the 1970s. Big diameter but small pitch made for a lot of thrust at quite low speeds. This engine/prop combination is actually too powerful even for the heavier version, though. The typical and adequate .30 engine with a 10x4" propeller is good for well enough thrust at the same speed. 4" pitch was common for trainer models back then because it was enough to achieve the required slow flight speed and in turn made even for a braking effect when throttling down to idle (2200-2400) rpm. In the first place, this allowed the beginner to land the model without stopping the engine!

Flight Characteristics

Senior Telemaster is a remarkably smooth and steady flying utility airplane, but it’s a model for the connoisseur. Many model pilots may be bored or even annoyed.

Some are bothered by the fact that substantial rudder is needed with ailerons. That might start off learning to fly coordinated turns (there is no harm in trying). After all, such behavior is unavoidable with the highly cambered airfoils used for the wing. The adverse yaw is even quite small compared to that of other models, even though Senior Telemaster has slender ailerons, because it's set up with only 10 degrees maximum deflection but even 50% differential.

Just for that the next complaint will be that the ailerons are not effective. But they are just as effective as rudder and elevator, and as needed. It’s an unfair complaint because the model will of course somewhat refuse to turn if adverse yaw is not canceled out by rudder. So at least arm the combi mixer (or whatever it is named) on your transmitter to give the same amount (in %) of rudder deflection as aileron throw and you’ll be surprised.

Rudder against adverse yaw will be even badly needed if the ailerons are deployed as flaperons. Because aileron throw is superposed to flap deflection, severe adverse yaw is unavoidable and aileron effect is really poor. This nasty behavior isn’t made up for by the small improvement in landing behavior. Flaperons might be better than nothing if the model was built with the strip ailerons, but it’s easy to replace them by smaller ones and separate flaps even later.

The strip aileron chord length is retained for both ailerons and flaps without much loss of effectiveness. The shorter ailerons need twice the deflection, but without noticeable additional adverse yaw, and they stay effective when flaps are deployed. No tip stall will occur even with full aileron.

The effect of flaps (as well as flaperons) is to slow down the model and to make for a nose-high attitude when some engine power is set. Increased lift is not important because the big wing and the highly cambered airfoil are good for more than enough lift and because the lift increase is quite small, anyway. More important is much drag increase because that enables you to choose an arbitrarily steep glide path. That’s why maximum flap deflection was set to 45 degrees for the flap variants.

But beware of inexperienced pilots on the sticks! In the weaker .45 glow engine version, maximum flap deflection is only 35 degrees to make that life-saving go-around maneuver possible. Reducing deflection from 45 to 35 degrees reduces drag but not lift, and this modification has been done to the full-scale single-engine aircraft because there are many inexperienced pilots. The strong glow and electric Senior Telemaster versions are so well powered

that they even climb with flaps 45 degrees down, and even with some payload.

But with flaps down, it's not possible to land the model smoothly without substantial power. Even if you have to land in a confined area and need to steeply approach the model with idling engine, you will have to apply a short but decent push of throttle to round-out the approach and bring the model from the extreme nose-down attitude to the nose-up attitude for touch-down. It needs some practice to do that in the right amount and in a coordinated manner.

The normal and less spectacular landing procedure with full flaps is to adjust a reasonably flat approach path so the change in attitude for touch-down is small. Telemaster is trimmed so that only throttle is needed for that and elevator only to correct for gusts etc. Bear in mind that changes in attitude and especially touch-down require moving the elevator and throttle stick coordinated in the same direction, maybe the elevator slightly leading the throttle. It will need substantial power to fight the high drag and flatten the approach, but it will still need substantial elevator to flare. If you have the airplane in three-point attitude and ready for touch-down, chopping power will let it really plop down and the roll distance will be very short.

With flaps (and even flaperons), Telemaster is a real STOL airplane (STOL = Short Take-Off and Landing), but STOL airplanes are for experts only. For dropping candies or R/C skydivers or for glider towing, you can make good use of high engine power and big flaps drag for a fast up and down. If you are an expert making such use of the model, build it with a powerful engine and with flaps. If the model is used as a trainer, both are really not needed and may be even detrimental.

You will as well appreciate a powerful engine and the flaps if you're using the model to just carry much load, for instance video or measuring equipment. It will fly noticeably faster and will need noticeably more space for landing. The ".60 glow flaps payload" variant will show that. Take-off and climb are still really good, and even landing isn't hard at all (actually it's easier). But with the heavy 5 lb payload (50% of net weight) a go-around maneuver will require the flaps be reduced to 35 degrees or the model will barely float but won't climb. As an expert, you would still appreciate the 45 degrees deflection for steep approaches and short landings and just carefully reduce flaps in case of a go-around.

The .45 glow engine version has just as much power as is needed for vivid normal flying without payload. That is the version I would recommend for a beginner. Still I would prefer the flaps version, which is limited to 35 degrees deflection to enable a go-around to be done without touching the flaps lever. A rank beginner just shouldn't touch it at all and learn to land the model without flaps. Later he can find out the effects of flaps including the easier take-off with 10 or 15 degrees deflection.

Anyway I can imagine the Senior Telemaster in the hands of a beginner only with an instructor on the buddy box. The model is likely to be owned by the instructor and used because of its "slow motion" behavior and good overall characteristics. That way some things are demonstrated to the beginner he otherwise wouldn't recognize as soon and easily.

Following the review of the 6 Foot Telemaster Electro ARF is a very interesting discussion of the model's trainer abilities, worth reading the three first pages of posts. Not many people there write about a beginner alone with the model. That is in contrast to the supposable designer's intention, though. Just the "original" 6-foot Telemaster seems to be meant as a beginner model for those learning without an instructor. (See my consideration in the History chapter, Sketch section, on page 46.) That's how wrong one can be.

Telemaster is built like a free-flight model, but it isn't exactly set up like one. The simple structure makes for low weight but reasonable strength. The big wing and horizontal tail, both with cambered high-lift airfoils, and the low wing loading make for slow flight. Unlike a free-flight model, Telemaster has controls, but small ones as customary in the early R/C era when proportional control was not yet in common use and servos were weak and unprecise. Still it is a "full-house ship" with all the controls a full-size airplane has. And even though it is a shoulder-winger with substantial dihedral (3.9 degrees) it doesn't fly on its own.

Like a beginner model of the 1960s, it may be even flown with rudder and throttle only, but it has to be flown and it's hard. Due to the moderate dihedral and decalage, there's only moderate influence on the model and it won't return to straight and level flight without help. On the contrary, it will remain in the current attitude and state, what is intended behavior for a utility airplane. You may set it on a straight or a circle course and will have to make only few small corrections, but you won't leave it alone. A rank beginner needs a model that flies on its own and returns to straight and level flight after he has upset it, so he may just leave it alone until it has calmed down. As a modeler at RC Groups put it: "The Telemaster is a great trainer, just not an easy trainer!" You might compare my essay on the VEBF, a real 1960s beginner model.

Just to see how it works, the Senior was equipped with an old 1970s O.S. MAX .20 with a 9x4.75 propeller, similar to the VEBF. Of course, this is not a rocket version with it's 155 oz / 9.7 lb / 4.4 kg weight, but it flies off paved runways and, with 10 degrees flaps or some down elevator to lift the tail, even from short grass. Once in the air, the model has all the power it needs for normal flying and lets the other versions seem overpowered. A *modern* .20 or even .15 would have the right amount of power to give a very "scale-like" flying, like a full-size vintage airplane. It's not for airwork or for beginners, but might be a duration flyer (at least 45 minutes at full power).

As well to show the difference in flight performance, the model was made with the 104 oz / 6.5 lb / 2.95 kg all-up weight (and the paint scheme) specified (and shown) in the 10/1975 issue of RCM magazine. Of course the .60 engine with a 12x6” prop lets it leap off the ground but with a .20 and a 9x4.75 it's still as powerful as you may want it to be at only 92 oz / 5.75 lb / 2.6 kg all-up weight. It doesn't even need down elevator to lift the tail for take-off though a short blip helps. The best version for beginners?

All the flight characteristics mentioned above can be seen in REFLEX. That means the parameters found by just measuring and calculation or taken from the plans are well suited. REFLEX faithfully renders the model's flight behavior, even though there have to be a few simplifications as in any simulator. In this case, only one issue comes into mind.

Oddly, you have to apply left rudder during the ground roll. Once the model is in the air it flies straight on it’s own. Obviously, REFLEX renders some of the effects of propeller torque but not all of them. At least one effect is not part of the flight physics model. I think it’s not the obscure P-factor or the gyro effect. The former is effective at high angle-of-attack (AOA) and at some speed, but here the left twist exists also when the model is level and slow. The latter is effective only at the moment when AOA changes.

In reality, there’s a strong propeller slipstream. Often people explain that it spins around the fuselage and hits the vertical tail from only one side, pushing it to the other and so yawing the airplane. Because engines turn right-handed so does the slipstream and hits the tail from the left pushing it to the right. Even though this effect undoubtedly exists but is not rendered in REFLEX, I prefer another way to explain the observed behavior.

The spinning slipstream is itself a gyro. It has to pass the wing, which produces the lift to carry the airplane. The lifting wing deflects the slipstream down what makes it bend clockwise (seen from above), and that *action* gives - as a *re-action* - the left-yawing tendency that is not rendered in REFLEX (as any gyro effect). The effect would be greatest when the propeller is working with maximum torque and the wing with maximum lift coefficient, so during ground roll for take-off. In REFLEX it isn’t there. We see a right-tendency caused by the engine right thrust, which is gone when the model is in the air because then the right thrust compensates the torque effects.

Finally, the original Engel Senior Telemaster and Engel Telemaster have been added, several variants each. They all show that so-called barn-door ailerons have more roll effect with less adverse yaw than the so-called strip ailerons of the newer RCM or Hobby Lobby versions. That is perhaps because they make for little airfoil camber without kink what results in less drag per additional lift. Anyway, the Engel Senior Telemaster variants got additional big flaps (as wide as the ailerons) to show how big their effects are compared to the “strip flaps” demonstrated on the Hobby Lobby variants.

History

Facts and Doubts

Very little of the Telemaster history is actually known, at least to me, but here it is for those who care about it:

The only fact never doubted is that all started with Alexander Engel in Germany producing the Telemasters in his own factory. That Karl-Heinz Denzin was the designer is challenged by Frank Schwartz, who worked for Hobby Lobby and reports in his Telemaster Story:

» Engel never told me who the original designer of the plane was. He did not design it and there apparently was some controversy over the true designer as he related to me that a number of people in Germany claimed to have been the designer. Notwithstanding, Engel had the exclusive rights and continued to produce them well into the seventies. «

But Jim Martin in the Mini Telemaster review clearly states:

» Alex did not design them: Karl-Heinz Denzin did as an employee of Engel's. But Alex owned the name and the design. «

And a Denzin biography, written by a member of the German vintage model society (who interviewed Denzin) and published in a German Web magazine in 2007 (in the Web Archive, scroll about 70% down), tells that K.-H. Denzin worked for A. Engel in 1967 and 1968 and the "Telemaster (Junior and Senior)" was the result.

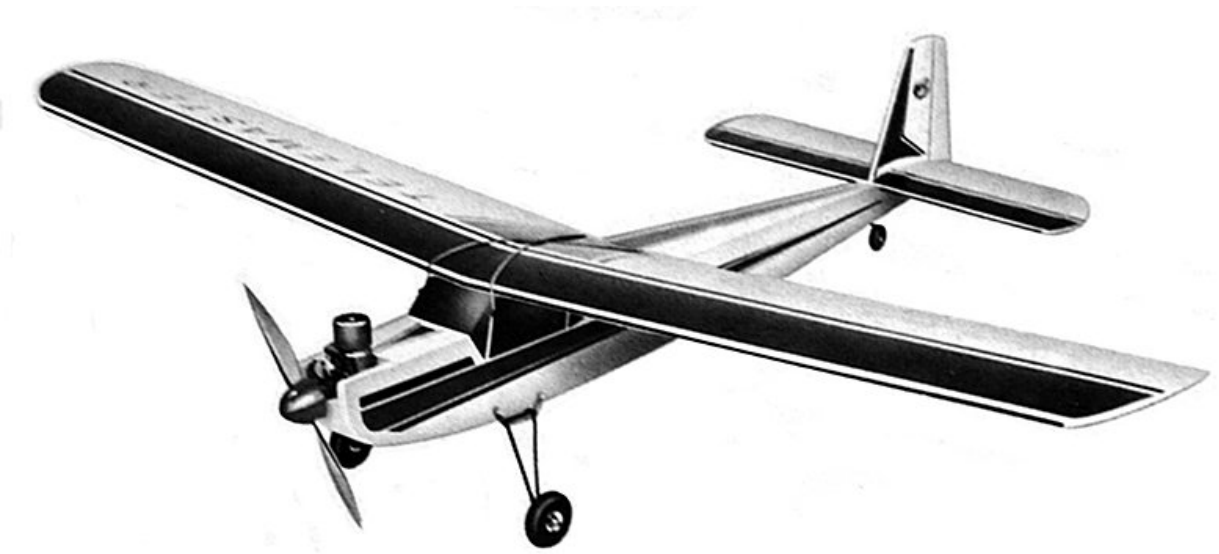
That also sheds some light on the time of creation. While Jim Martin just guesses it was in the early 1960s, the biography explicitly specifies 1967/68. That is supported by the fact that the 1967 and 1968 Engel catalogs offer some older, big utility models (see chapter Trivia) but don't show any Telemaster. Then again, the 1973 Engel catalog has a whole page for the three Telemaster variants (see following page).

Strange enough, it lists the Junior (4 ft), “standard” (6 ft), and Senior (8 ft) Telemaster in that order, but mentions K.-H. Denzin as the designer only in the middle, for the “standard” Telemaster. That is consistent, though, since he is mentioned only on the plan and in the instructions of the “standard” Telemaster. So this one seems to be the original and Senior and Junior are mere scaled variants.

It may be interesting to look at the description of the models, written by the original manufacturer (my translation of the 1973 catalog page):

The 3 Telemasters

well-engineered designs by experts for ambitious R/C pilots and as well for those who still wish to be, and moreover not only in Germany but also in the USA and many more countries, the far and away best-selling models in our product line. Guess why?



JUNIOR-TELEMASTER, R/E R/C trainer, 49 in wing span, for .15 to .20 engines. Who has never flown an R/C model before should start with the Junior. He doesn't mind much and is a perfect training partner.

TELEMASTER, powered multi R/C model by K.-H. Denzin, 71 in wing span, 47 in length, more than 70 oz payload, for .30 to .61 engines. Suited for a variety of tasks, including model glider tow.

SENIOR-TELEMASTER, giant model with 94 in wing span, for .35 to .61 engines. Quick-assembly kit including about 27 sqft Nylon covering fabric.

Telemaster and Telemaster-Senior were developed for the fans of big model airplanes, and due to their high inherent stability and docile flight characteristics they facilitate proceeding directly from free-flight sport models to multi R/C flying. Provision is made in the plans for all controls and throttle. If for some reason the ailerons are not used, the dihedral should be increased from 2 to 4 inches to provide sufficient lateral stability.

Due to their high-lift airfoils, Telemaster and Telemaster-Senior are very well suited for special tasks like banner tow, leaflet or parachute dropping, aerial photography, etc., but they are suited only for rather simple aerobatics.

The JUNIOR-TELEMASTER was derived from the giant model TELEMASTER. It is designed especially for the fans of docile rudder/elevator models. Ailerons were intentionally omitted. It is well possible to install them later offhand and as one sees fit. All 3 Telemasters may be safely controlled even with inexpensive small R/C gear – like our Bellstar 2/1 or 2/2.

(The original and the translated catalog page in the original layout are here.)

Remark: There seem to be flaws in the TELEMASTER model description. That "more than 70 oz payload" actually belongs to the Senior's description and .30 to .49 engines should be used according to the instructions. The sentence "Suited for a variety of tasks…" belongs to the Senior's description, too. This 6ft version should have been explicitly named a trainer model because it first and foremost is one.

Seems there's nothing to object. No mere advertizing, all in all a remarkably factual and correct description, proven by 40 years of customer satisfaction. The model just really hit the mark. So what happened next?

Senior Puzzle

1973 was the year when the Senior Telemaster was brought to public attention in the USA by the April 1973 RCM original Senior Telemaster article (at the Outerzone vintage plans website, it's the second supplement) initiated by Jim Martin, owner of Hobby Lobby. Obviously, they imported the kits produced by Engel in Germany, but not for long, as Frank Schwartz reports:

» Engel finally quit producing them but the demand was still there. He gave the rights to Jim Martin of Hobby Lobby (I was sales and advertising manager there at that time) and Jim had Joe Bridi make the kit for him...plus the plans for the US version also appeared in RC Modeler magazine. «

That was in October 1975, only two and a half years later. No reason is mentioned anywhere why Engel ceased production. The defunct Engel company history web page once even told that in 1977 Engel established a new model airplane production in England, named *Balsacraft*. But there's no other mention of "the far and away best-selling models in our product line". Strange enough in this context is another remark by Frank Schwartz:

» Later, Hobby Lobby gave the rights to produce the planes to a company in England and they produced some variations of the plane. «

Anyway, all sources agree that the Telemaster quickly became famous. One indication of that is a story told over and over again, even though nobody knows where it came from and if it is actually true. The story as told by Frank Schwartz, quoted in 2007:

» The Telemaster became famous in Europe as one of the original planes was used to carry a line across a chasm for building a bridge. First a small line was carried across and once done, larger and larger lines were pulled across. This is the claim to fame for the Sr. Telemaster. Probably the first industrial use for a model airplane. «

But the story existed much earlier as it is told already in the April 1973 RCM original Senior Telemaster article:

» This aircraft design has been around for a number of years in Germany, and has been used to string telephone lines across deep ravines, which task would otherwise require the use of a full-size helicopter. «

Funnily – or maybe strangely – enough, the Denzin biography in the defunct German Web magazine has the same story "the other way around". Without mentioning a source, (as well in 2007) the article tells about the Telemaster:

» This model is - as far as is known - the first workhorse of the air and was rigged for banner and glider tow, photography, as well as candy or skydiver dropping. In the USA, the model even became famous because it helped running a power line across a chasm and saved hefty helicopter expenses. «

If that were a true story, I think A. Engel / K.-H. Denzin as well as Jim Martin / Joe Bridi would have properly used it for advertizing. But they just didn't mention it, as far as I know, so I think it's only a rumor. I don't think they put out that rumor, either, even though Jim Martin probably passed it down to RCM.

In fact, there has been that first industrial use for a model airplane – just not for the Telemaster. No less a figure than Hanno Prettner and his father Hans built a special-purpose model named Boomerang in 1971. It weighed 7 lb, had a 69 in wing with a thick airfoil, a Webra 61 RC Blackhead engine with needle-valve servo, and a tow-release – not quite a Telemaster. On request of their local power company in Austria, the Prettners used their model to carry 0.7 mm Nylon filament across inaccessible mountain areas over distances of up to 800 meters. Then stronger and stronger lines were pulled back and forth until the power line was in place. That saved the company hefty helicopter expenses. (Described in detail in the May 1972 issue of the German FMT magazine, available on their Chronicle of Model Aviation DVD.)

So there seems to be some truth in the story, but for me it's still a typical *urban legend* or *folklore*, or, since its origin and originator are unknown, a *FOAF (friend of a friend) tale*. Even if it probably does not pertain to the Telemaster it yet could do, and that certainly speaks for the Telemaster and its qualities.

Yet there was some grumbling about Joe Bridi's redesign, especially the wing, which was weak compared to the very sturdy original wing and had less effective strip ailerons instead of the original barn doors. Again, Frank Schwartz put it into clear words:

» There is a puzzle here as Bridi “redesigned” the plane somewhat. The outlines and plan form remained the same, but he used aluminum sheet gear in some of the kits and also had a steerable tail wheel. The main deviation was the wing. Whether Bridi didn’t want to use as much 3/32 by 4 by 48 inch balsa sheet or he thought his idea was better, will never be known. Nonetheless, Bridi’s version of the Senior Telemaster (as it remains today), featured strip ailerons and stringers on the top and bottom of the wings rather than the sturdy sheeting. The first batch of Sr. Telemaster kits by Bridi for Hobby Lobby were falling out of the sky right and left due to weak light ply dihedral braces and the very construction of the wing itself. The remedy was to add more braces which was done and this seemed to solve the problem. «

» The barn door ailerons on the original were much more effective than the strip ailerons but Hobby Lobby and Bridi persisted in using strip ailerons, even to this day. «

» I have the plans for the original wing and if one is building the Senior Telemaster, he should build the fuselage and tail group according to the "new" plans, use wire landing gear and get a copy of my original German wing plans and he will have a better flying and responding plane...my humble opinion, of course. «

Indeed it is rather puzzling to compare the two RCM articles. The April 1973 RCM original Senior Telemaster article sounds quite candidly enthusiastic:

» The kit, itself, consisted of some of the finest quality balsa wood that we have seen to date. The structure is utter simplicity, and virtually any modeler could follow the construction sequence even without English instructions. The fuselage is of the lightest weight design we have seen, using excellent engineering techniques to achieve maximum strength and durability at a minimum of weight «

Two and a half years later, in October 1975, they had to boost the new version. How should they explain the redesign to the fans of the original (German) Senior Telemaster? So they presumed to sell it as an improvement all along the line:

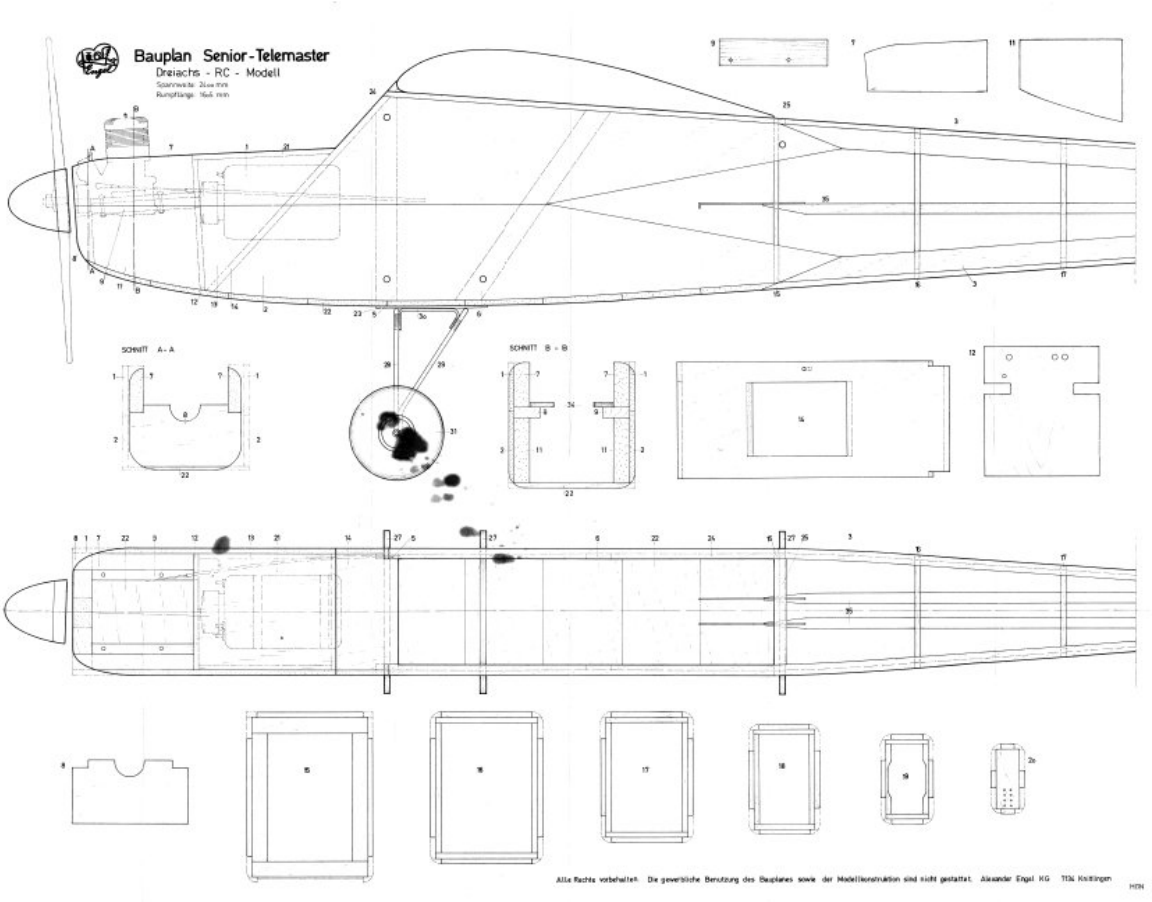
» A few minor modifications have been made to improve the structural integrity of the model, although little could be done to improve the outstanding flying characteristics of this magnificent aircraft. «

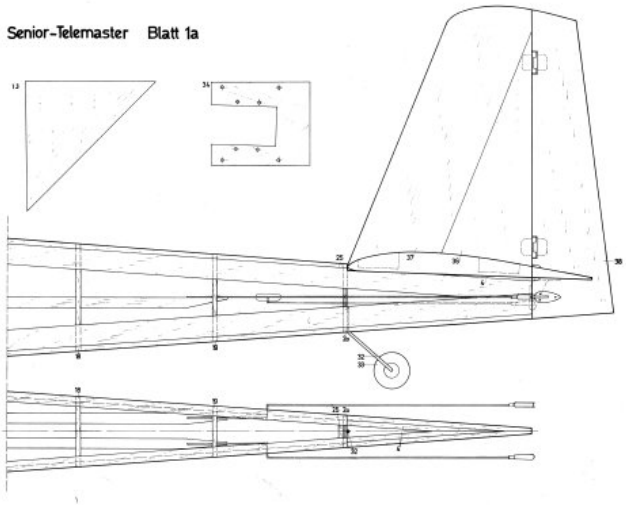
» While the new version of the Sr. Telemaster looks like the original machine once kitted in Germany, the new one boasts some design changes. The changes were made both to simplify the construction and to offer a stronger airframe. The barn door ailerons have been changed to strip ailerons. They're easier to build and set up and they offer a stronger wing trailing edge. Heavy spars, full length 1/2" x 3/16" strips running along the front of the wing, a 1/4" ply spar dihedral brace coupled with a 1/8" ply leading and trailing edge dihedral braces add up to a wing that's almost strong enough to make a diving board for the local swimming hole! A dorsal fin has been added to the vertical fin for strength. The stabilizer has been re-designed to make it more twist resistant and the fuselage construction has been changed to make the building easier and the airframe stronger. «

Some remarkable discrepancies between the two articles, don't you think? I suggest you take for granted what Frank Schwartz reported and compare the stabilizers yourself. Let me add that the new version was even 9 oz heavier than the original one, both as built and specified by RCM. To me it seems the first article was true and what the second article purports is just the opposite of what really resulted from the redesign. Oh well, at least it were different authors. And we know how to read model airplane reviews after all, don't we? I may sound like being annoyed, but see yourself.

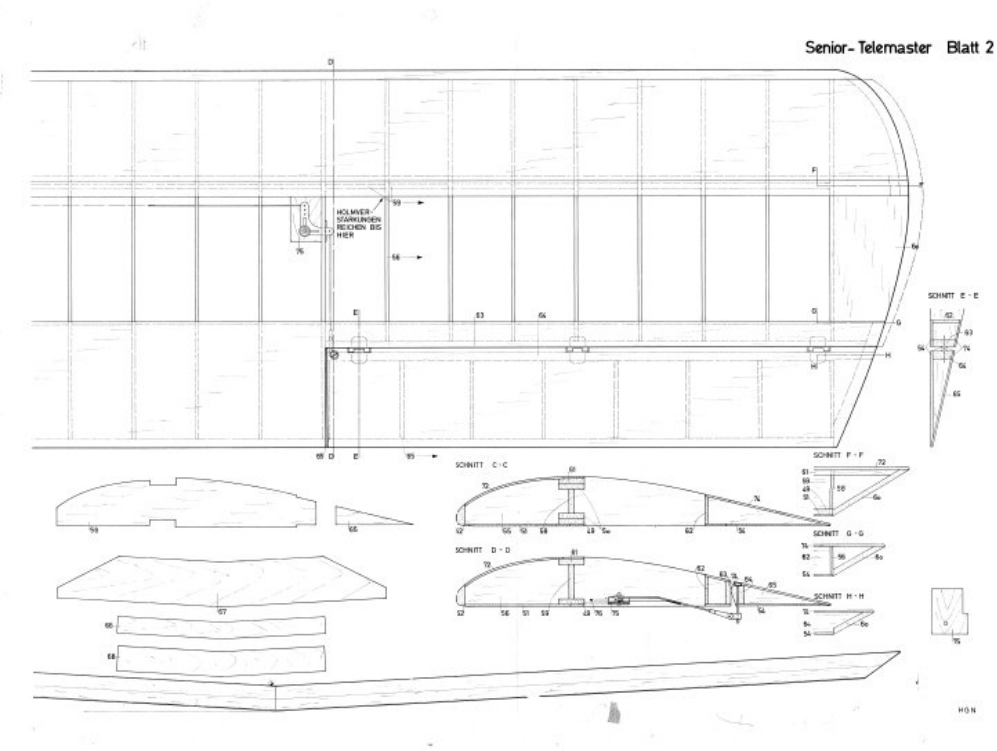
Original Senior

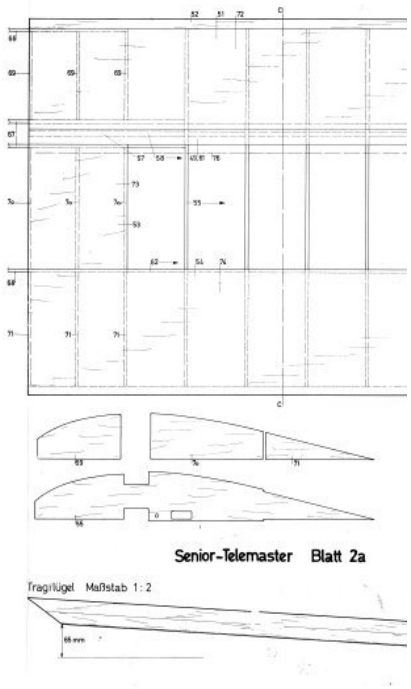
First, look at the original (German) plans as kindly provided by Brad Nichols. Notice some sophisticated fuselage details typical for K.-H. Denzin, and the simple and lightweight structure:



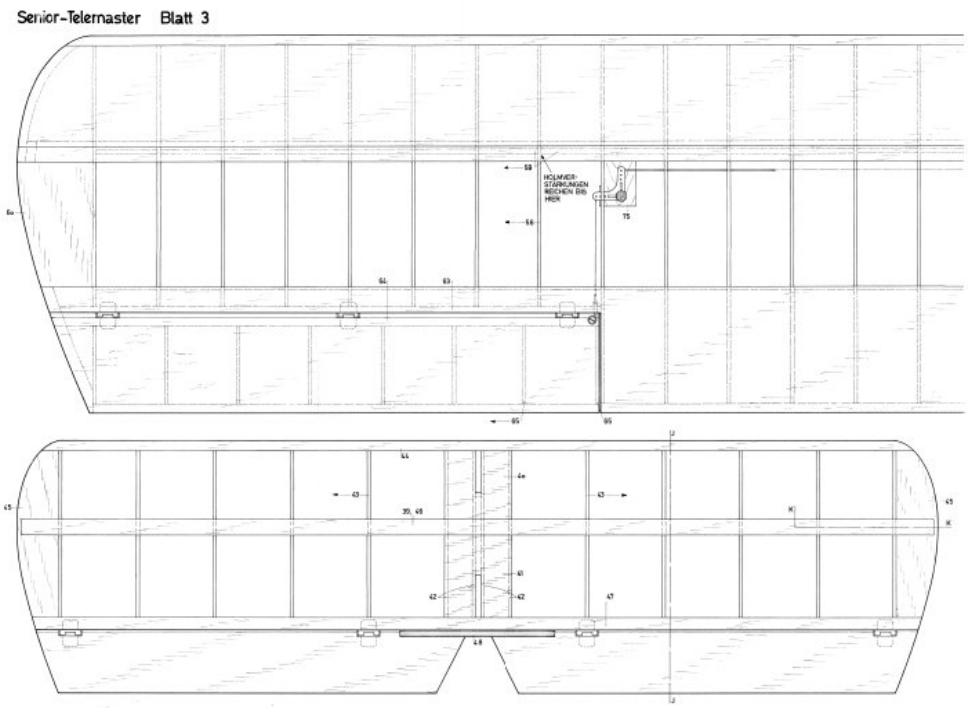


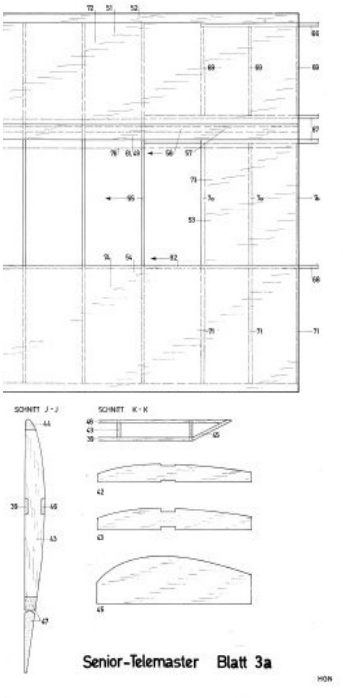
That's the incriminated wing structure. Notice the D-tube (front) and triangular-tube (rear) sheeting for ultimate torsional rigidity. For ultimate strength, there's an I-beam main spar with doubled bars out to the ailerons, shear web, and solid dihedral braces. This is a common heavy-duty design used for slender glider wings, for aerobats, or just for load-carrying models.





The left wing is shown here for completeness and doesn't add anything new. Just notice the small rib spacing and the absence of cap strips. The barn-door ailerons have three (pin) hinges and require a bellcrank linkage. Nothing special on the stabilizer.





Good, Bad, and Ugly

At first glance, there seems to be nothing wrong with this design. On the contrary, for me it is a shining example of a simple and most efficient concept, carefully designed with much attention to detail – just very well-engineered without compromises. I needed Brad Nichols' help to see the downside, the expenses in building material and time:

» You will find out very quickly why Joe Bridi made the modifications he did. The original plane would have required balsa sheeting for the leading edge that was far wider than would have been available at the time. Plus the design resembles an older style of building from the late free flight days or very early R/C days. It features rib spacing about 50mm apart, about 1/3rd more ribs than necessary. It also featured landing gear that was rubber banded on. The Bridi rendition of the plane is far simpler to build and uses fewer materials, is probably lighter, and for the most part is true to outline of the original design. «

Agreed, K.-H. Denzin had his experiences and his own style, even if I don't think he was biased by the free-flight designs. He just chose the best solution in each case, that is one he knew of, and accepted a bit more cost, still keeping them low. To me it seems he just didn't compromise the main design goal to have a perfect load-carrying airplane. His other designs had substantially wider rib spacing, so this one should have been chosen for a reason, maybe to prevent the thin (2 mm), flat bottom sheeting from buckling. And Bridi made each wing have 16 ribs instead of 20, that's just 20% saving.

» There is a happy medium that can be reached with a re-design to bring the structure up to a more modern and simpler build. The Telemaster 40 is just that, only a little smaller. On the Telemaster 40 the wing is sheeted top and bottom to the thickest part of the chord of the wing covering only half the distance of the spar. The trailing edge is also sheeted but only about 30mm or so. Cap strips 10mm wide attach to the aft half portion of the spar and make for a clean surface from sheeting to sheeting. This allows you to space the ribs closer to 80mm apart without the covering sagging between them. «

That is indeed a very acceptable compromise because it reduces costs without spoiling the function. Undoubtedly there are solutions other than those chosen by K.-H. Denzin. Still I think you would compromise function, and the original design isn't that expensive, either.

Remark: Only later we found out that Denzin designed the 6ft Telemaster only and someone else scaled it up to 8ft giving the Senior Telemaster. The original 6ft Telemaster has conventional rib spacing, even two ribs less per wing side than Bridi's Senior Telemaster, and the trailing edge bar is *replaced* by triangular-tube sheeting up to the ailerons, which are something like a continuation of this tube.

» Putting the stringers across the top leading edge of the wing on the Senior Telemaster was a terrific way to keep the covering from sagging in between the ribs without having to come up with extra wide sheeting material. It does less damage to the shape than sagging material would, and it simplified construction. «

Yes, if you aim at avoiding the many ribs and the sheeting material. I think that might have been no problem for Engel, though. He had his own factory

and made not only models but also cut balsa sheets and bars. I remember 1.0 x 0.1 m sheets of various thickness being standard, but there were also special 1.2 x 0.1 m sheets available, even if a bit more expensive. To me the 2.4 m wing span even seems to be especially chosen with respect to this sheet size. And I guess Joe Bridi had not the same balsa supply as Engel.

I might even perceive that "heavy spars" in the 1975 article as heavy balsa quality. He just found a smart solution for his problem, but neglecting the original main design goal.

» Back in those days it was probably a good idea to make the plane so that it would come apart instead of breaking on impact. Most people put in a plywood plate and bolt the gear to that now. It's a good simple reliable design. «

Again yes, K.-H. Denzin was used to the rubber-band and dowel mount for wing and landing gear, but on closer inspection he utilized it to get a rather filigree and lightweight fuselage, not only to prevent damage on impact. I know his rudder-only designs, they are very sturdy to withstand the impact just unavoidable there. Telemaster, on the other hand, was designed as a full-house ship in the first place, filigree for low empty weight but still sturdy to carry huge loads.

Please note that I don't want to argue with Brad Nichols. I really appreciate his help in understanding Joe Bridi's intentions and design decisions. It's just that I'm playing not devil's, but the original designer's advocate, probably because I'm feeling nearer to him. I'm not able to give Brad's explanations, so his contributions are essential to shed light on all aspects of the topic.

Joe Bridi's redesign looks like an early, quite successful example of value engineering. He achieved the intended savings without rendering the model useless. Obviously, his solution worked quite well, at least after adding more dihedral braces to prevent wing fracture. His version is even a bit heavier (comparing the weights specified in the two RCM articles, 95 oz / 2.7 kg in 1973 and 104 oz / 2.95 kg in 1975) but still safe to fly as long as it doesn't carry heavy payload, in which case the owner could, and should beef it up as he sees fit. That's why there are those forum threads like The Birth of a Heavy Duty Senior Telemaster, in which Frank Schwartz was quoted.

My main concern with this design is indeed the wing, which seems not strong enough to be up to the model's "aerodynamic" load-carrying ability. So using the model is limited to an extent not predictable for the owner. With the original design, he could just rely on the model being sturdy enough to bear all possible loads. All he can rely upon with the new design is it being strong enough to bear its own weight. Add any load and it's all up to you.

The main spar may be strong enough, but for me it doesn't look so. There are only a few shear webs and they are ridiculously weak. The original shear webs are not much heavier but much more effective. The original shear webs and sheetings gave even two closed "tubes" for enough torsional rigidity to

withstand the big airfoil moment. Fortunately, this torque makes for down-pitch so the non-rigid new wing just develops some washout under load. It's indicative that the full-size RCM plan (below) and the ad picture (page 1) show "geodetic angle braces" in the rib bays to enhance torsional rigidity, and I wonder why they are not shown in the small RCM article plan (page 6).

The original design just was a heavy-duty Senior Telemaster, no need to create one. But while I'm still bothered by the wing structure, I can even accept the strip ailerons.

What I can hardly stand, though, is the humorous tone in the introduction of the 1975 article, because - knowing what I know now - to me it sounds like spoofing. So I dare to intersperse some scathing annotations, reminiscent of Jef Raskin's great squib about How To Read a Model Plane Review:

» A few minor modifications have been made ["Minor" means only the structure has been changed, but "a few" means nothing is as it was before.] to improve the structural integrity of the model [The improvement was that it now can disintegrate automatically.], although little could be done to improve the outstanding flying characteristics of this magnificent aircraft. [That's why they found a way to at least impair them instead by using strip ailerons.] «

» While the new version of the Sr. Telemaster looks like the original machine once kitted in Germany [That's about all they have in common.], the new one boasts some design changes. [So it badly needs to.] The changes were made both to simplify the construction [Because the original was known to be complicated, wasn't it?] and to offer a stronger airframe [Because the whole world knows it was fragile, wasn't it?]. The barn door ailerons have been changed to strip ailerons [unfortunately]. They're easier to build and set up [not only, but mainly for the manufacturer] and they offer a stronger wing trailing edge. [Because their balsa is so hard.] Heavy spars [because lightweight balsa is too expensive], full length 1/2" x 3/16" strips running along the front of the wing [equally heavy for the same reason and because sheeting is too expensive, anyway], a 1/4" ply spar dihedral brace coupled with 1/8" ply leading and trailing edge dihedral braces [at least they didn't leave out any required braces] add up to a wing that's almost strong enough to make a diving board for the local swimming hole! ["Almost" means far from being strong enough, but flexible enough to be a diving board.] A dorsal fin has been added to the vertical fin for strength. [You never liked the floppy removable tail feathers, anyway, didn't you?] The stabilizer has been re-designed to make it more twist resistant [That's a red herring, there was no problem before and no redesign, either, they just hold back the good but expensive Nylon covering.] and the fuselage construction has been changed to make the building easier and the airframe stronger [even though you never thought it needed to be]. «

Not to put the article's author down, but wouldn't it have sufficed to just describe the qualities of the new kit design? Why implicitly belittle the original design while many modelers were eagerly awaiting a new Senior Telemaster kit, anyway? But expecting that could be a tall order regarding Ben Strasser was in close cooperation with Joe Bridi and Dick Kidd.

Anyway, now that my steam has been vented, just a few words about the specified weights: They might be all enhanced but that doesn't matter.

Engel specified 6.5 lbs on the kit box of his version (see chapter Kit), and RCM 6.0 lbs in the 1973 article. Two and a half years later in 1975, RCM specified 6.5 lbs and Hobby Lobby 7.0 lbs in an ad (see page 36). That might mean that Engel and Hobby Lobby were a bit conservative to avoid being liable for promising a weight too low to achieve for the average modeler. Then again, RCM could have demonstrated the lowest achievable weight in both cases.

All these weights are a bit ambitious, yet I don't think they cheated. Of course it's *conceivable* that RCM got kits with especially selected balsa wood, but they *didn't* even *need* that. I remember Engel's balsa wood as good quality and deem the 1973 article candid. And as to weight even the 1975 article should be candid because the Bridi version used heavier balsa but less of it and was still half a pound heavier. RCM must have been just very strict in avoiding all unnecessary weight while Engel and Hobby Lobby both added half a pound as a safety margin.

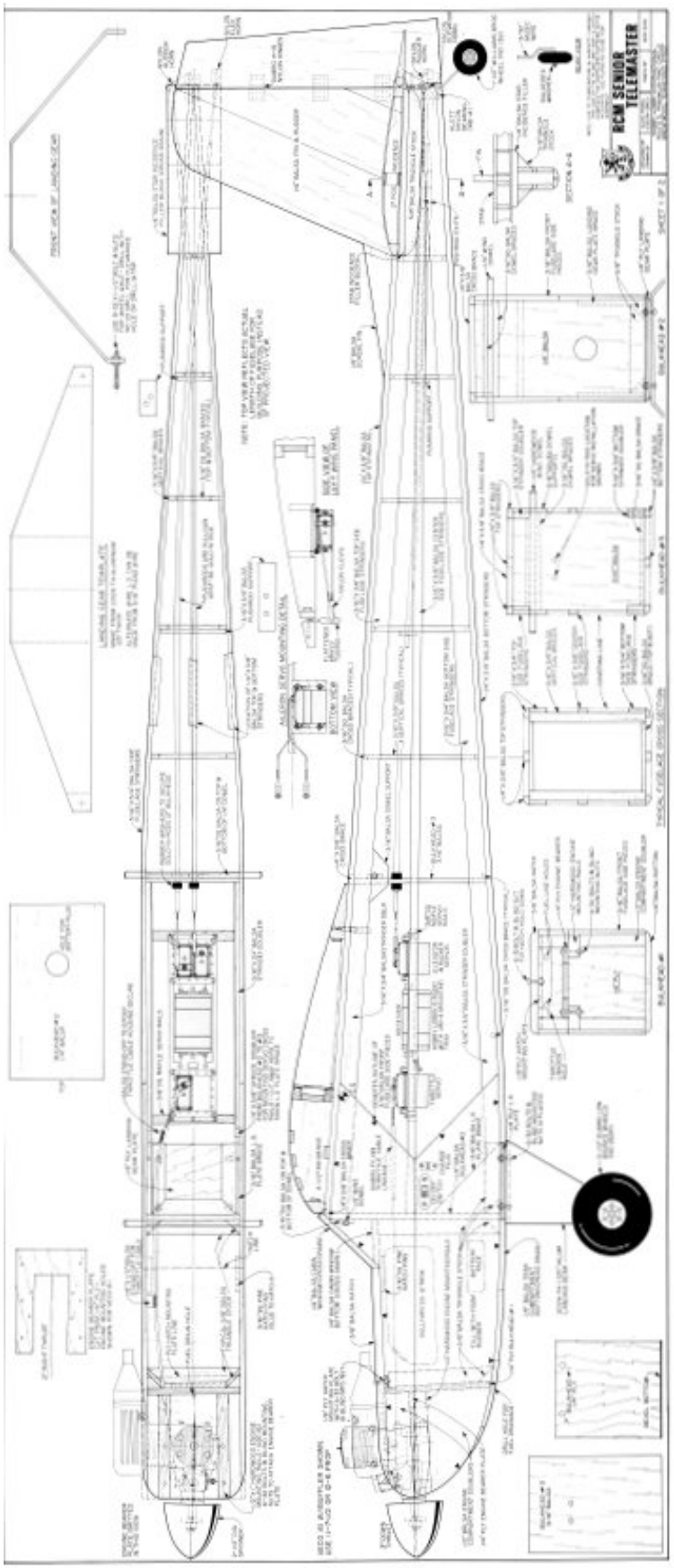
Over the years, Hobby Lobby got even more cautious and specified 8 lbs on their product Web page, then 9 lbs, finally even 10 lbs. With a new owner in 2009 and renamed to Hobby Express in 2013, they had the Telemasters re-designed and specified only 9 lbs for the Senior Telemaster *Plus* ARF (see chapter The Senior Plus). That would be a weight reduction by redesign, but I have this model and didn't manage to achieve 9 lbs. Instead, 10 lbs still seems to be a more realistic supposition (see my review web page).

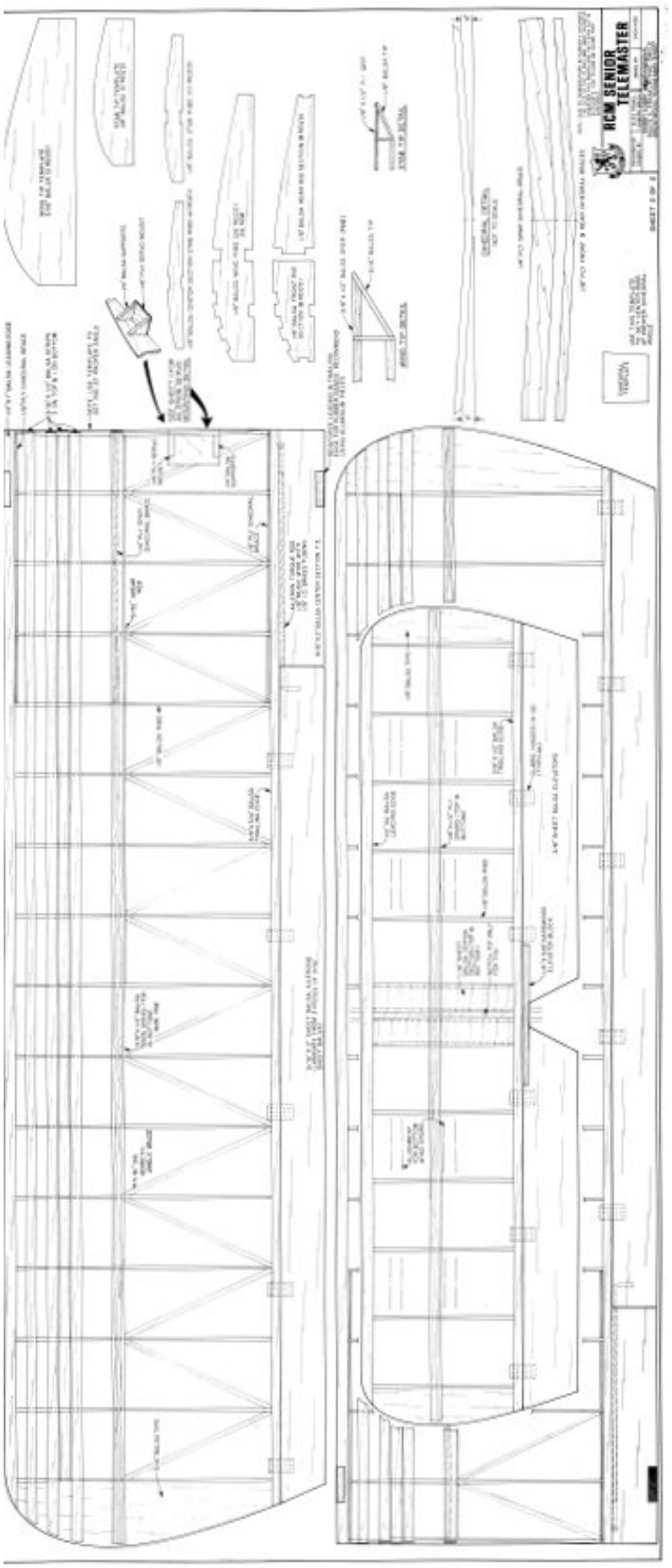
I have no idea why and how the Senior Telemasters end up with that much weight today. Nobody, not even an ARF manufacturer, seems to be as strict in weight-saving as erstwhile RCM. They just did reference builds to promote the model, what is completely OK. But I think the 17.3 oz/sqft wing loading of a 10 lbs Senior Telemaster is still very good, even if not spectacular.

We just had the general 5 kg / 11 lbs weight limit in Germany in the 1970s, so Engel was *forced* to make the Senior as lightweight as possible. In the US, and today on chartered airfields in Germany, 10 lbs tare weight and say 7 lbs payload are not a problem, provided the model is built sturdy enough. So the weights specified by RCM back then might be something like megapixels specified for digital cameras today: they just don't matter in the field.

Re-engineered Senior

Finally, I suggest looking at the RCM plans below, again kindly provided by Brad Nichols, to appreciate the clever design. And have a look at the ad by Hobby Lobby from the same year that I mentioned above.


RCM SENIOR
TELEMASTER


RCM SENIOR
TELEMASTER

In a new thread at RC Universe, the old stories are rehashed again but also a new story is added: A balsa shortage due to the building of several LNG tanker ships in the 1970s prompted Alexander Engel to replace the balsa sheeting by brittle hard foam (Duracell), which is actually unsuitable.

In the said thread at RC Universe, someone posted an old advertizing for the Senior Telemaster kit from the December 1975 issue of RCM, two months after the article about the Bridi Senior Telemaster. This is the two-page ad:

The text of this ad (see next page for a legible reproduction) proves true Jim Martin's recollection that there was a balsa shortage and subsequently the model was redesigned and made in the US. But even though this story now seems to be true, that does just not detract from the above reasoning.

Also important, in this ad Hobby Lobby specifies a low weight (7 lbs, 3.2 kg) of the model and its low wing loading (9.25 oz/sqft). In the US, the payload may be even 10 lbs, characterizing the model's load-carrying ability. Overall weight (17 lbs = 7.7 kg) is more than what was allowed by German law back then (11 lbs = 5 kg). One may doubt that this weight was borne by the wing, but the model as such could bear it easily.

7 lbs overall weight is even more than the 6.5 lbs (2.95 kg) weight specified for the RCM build of the Bridi Telemaster. The later Hobby Lobby Web page about the Senior Telemaster specified even 8 lbs (3.6 kg) weight. So there's a difference of 1.5 lbs (0.7 kg) which still doesn't make any noticeable difference in wing loading and flight behavior, though.

In all my years as an RCer the high points in flying enjoyment have been my cumulative flying experiences with this unbelievable SENIOR TELEMASTER.

Here's a physical description of this huge, high lift airplane:
95" wing span (almost 8 feet!)
14" wing chord (width)
1330 square inches of wing area (9¼ square FEET!)
320 square inches stabilizer area (lifting stab)
1653 square inch TOTAL LIFTING AREA.
About 7 pounds total build-up weight with RC gear.

Those above rather "dry" numbers don't really describe how this SENIOR TELEMASTER flies, but they hint at it. The significant numbers—the TOTAL LIFTING AREA of 1653 square inches, and the TOTAL WEIGHT of 7 pounds reveal that the WING LOADING of this plane is only about 9¼ ounces per square foot! Because of this gliderlike wing loading the SENIOR TELEMASTER can:

1. LAND at less than 7 miles per hour,
2. TAKE OFF (with a .60 for power) in TWO FEET,
3. LAND BACKWARDS in a 10 mph wind!

It can carry about 10 pounds of additional cargo (cameras, who knows what else!) In Germany, where this plane was originally designed, it's widely used for stringing cables over valleys, and the US Government has several of them that are carrying TV cameras for the Remote Piloted Vehicle development programs.

But, RC flying is the name of the game, and SENIOR TELEMASTER flies like no other RC plane. Because of its lifting stabilizer it accelerates from 10 mph to 70 mph without any elevator trim change. It will perform EVERY pattern contest maneuver (not like a low wing pattern ship admittedly, but, it'll DO'em!) I can fly mine inverted all day long, or perform giant size loops, and even do OUTSIDE loops. In addition, it can do lots of things the pattern ships can't do—like TAIL SLIDES of 50 feet, cross-controlled SIDE SLIP LANDINGS, and easily-controlled one-wheel touch and goes.

The SENIOR TELEMASTER is so easy to fly that we don't hesitate to recommend it to a complete beginner.

We used to import these from Alexander Engel Kit Mfrs., in Germany. Alex had to quit making them because of the unavailability of the 5½" wide by 47" long balsa wing sheeting. He gave us the rights to kit the SENIOR TELEMASTER in the U.S. and the plane is now kitted exclusively for us by a West Coast Kit manufacturer who turns out the most widely admired quality line of kits in this country.

The design has been improved considerably and construction has been simplified (it was already very easy to build—now it's even simpler). It now uses strip ailerons which have proven more effective, and the wing sheeting problem has been solved by using stringers. A steerable tail wheel device is now included and the machining and fit of the balsa parts is now nearly perfect.

You may consider this to be the most beautifully crafted kit you have ever seen.

SENIOR TELEMASTER has been the subject of TWO articles in Radio Control Modeler Magazine. I can't recall any other RC plane in history to have been so honored.

For an experience in RC flying that simply cannot be adequately described in words, I recommend this SENIOR TELEMASTER kit to you.

Hobby Lobby / RCM Senior Telemaster Kit $89.95

ORDER BY PHONE TOLL FREE ! **800/251-8186**

This is the text part of the ad shown on the previous page, enlarged so you can read it.

While it should not be true that the Senior Telemaster was used for stringing cables, it should be true that it has been used by US governmental organizations or their contractors for various purposes. After all an example is given in the October 1975 RCM article.

Two months later, this ad again boasts about simplification of the construction. You already know what to think about that, as well as about the supposedly more effective strip ailerons.

And it's a little cheating that they specify "WING LOADING" as 9¼ oz/sqft even though this value is in relation to the "TOTAL LIFTING AREA". That "lifting stab" is just a myth and the real *wing* loading would be 12.1 oz/sqft. I would believe the specified 7 lbs weight, though, and I wonder why they needed that cheating because 12 oz/sqft is still spectacularly low.

As an interesting aside, you may note that Hobby Lobby calls the model "RC Modeler Magazine's SENIOR TELEMASTER", and two month's earlier RCM magazine called it "RCM SENIOR TELEMASTER". So there was a cooperation in which Hobby Lobby benefited from RCM's popularity and reputation.

Back to Origin

Much later (2011), the German Alexander Engel KG (since 1993 owned by the founder's son) still offered the Precedent T240 as an explicit Senior Telemaster successor, even called Telemaster T240 (discontinued soon after). Over many years they had the old Telemaster models in their product line. Obviously, these still have been produced by Balsacraft in England, as later was the line of Precedent Txxx models. At least the T240 looks like a modernized, enhanced, and embellished version of the Senior Telemaster, derived from the original German design. And the ad text reads like trying to connect with the old times:

» Like its predecessor, the legendary Senior Telemaster, also the T240 gives an impressive display in all areas - as a tug and a load carrier or just as an easy "Sunday flyer". The big payload and the roomy fuselage open up nearly endless opportunities, like installation of a still or video camera or skydiver dropping and much more. «

From the Engel website:

Nothing is known about who owns Balsacraft and why they don't sell in the USA (or do they?). The Precedent models are marginally known in the UK and in Germany, while the USA and the rest of the world are still dominated by Hobby Lobby and their "own" (Bridi-design or Hunt-design) Telemasters. And even the T240 is no longer available (2011). Seems it was an extremely successful acquisition in 1975.

So let us again look back to the beginnings. Brad Nichols acquired original Engel (German) Senior Telemaster and Telemaster kits and provided not only the plans of both but also the building instructions. They shed some light on which was the actual Telemaster and who designed it.

There is some evidence that Karl-Heinz Denzin designed the 6 ft Telemaster when he was an employee of Alexander Engel in 1967/68, so it is the "original" Telemaster. Someone else (but I don't think Alexander Engel personally) scaled it up giving the 8 ft Senior Telemaster. There is a strong resemblance between them. The 4 ft Junior Telemaster is a scaled-down version but with less resemblance, so it might have been designed by yet another person.

Anyway, have a look at the plans, building instructions, and bill of material of the (6 ft) original Telemaster as well as the (8 ft) Senior Telemaster in two separate documents. You might notice that the original document is actually better written and formatted. Obviously, the Senior document has been adapted and rephrased by another person with more emphasis on marketing diction. Maybe then it has been typed by a typist while the original document could have been phrased and typed by Karl-Heinz Denzin himself. But that is all speculation...

Trivia

Even more speculation is about the origin of the design as well as its name "Telemaster". Frank Schwartz reported that there was a number of people who claimed to be the designer of the Telemaster. Knowing the building instructions and plans, it seems clear that K.-H. Denzin designed the original 6 ft Telemaster. But the name could have been coined in advance since it was used from the very beginning.

Alexander Engel kitted several models designed by reputable people. One of them was Heinz Siegle, presumably a quite capable technician and company owner of his own. As early as in the late 1950s he designed quite big and well-flying models. Due to their size and aerodynamic layout, they could be controlled even by the primitive and heavy single-channel electronic-tube R/C of that time and still carry a lot of load.

Early Engel catalogs (1967 and 1968) don't show any Telemaster. Instead there is a model named PILOT (picture above) as well as a smaller JUNIOR PILOT and a bigger TELE-PILOT (see 1967 catalog page). Originally these were mere free-flight sport models and only later the medium-size model had been equipped with rudder for single-channel R/C. But the scaled-up version seems to be meant as a rudder-only model for the ancient heavy tube R/C in the first place. That is suggested by the name TELE-PILOT, the "TELE" coming from Greek for remote, probably meaning remote control.

In 1967 transistorized, quite lightweight multi-channel reed R/C was already commonplace. At that time, Engel offered such R/C sets made by small, specialized manufacturers. Accordingly, the catalog offers new versions of PILOT and TELE-PILOT for multi R/C, what is emphasized in the lower left corner of the page. Still there are only "instructions for installation of

ailerons", probably because the model was designed as free-flight with big dihedral so ailerons are actually not needed and not effective either.

There is an even bigger model named RADAR MASTER (picture below) and a giant (scaled up by 1/3) SENIOR RADAR MASTER (see 1967 catalog page).

The latter model has a 9.6 ft wingspan and is considerably bigger than even the Senior Telemaster. The catalog picture shows not only the German colors on the rudder but also a signet on the fin, signifying a factory with a chimney stack. That "SMB TECHNIK" in this signet stands for "Siegle Modellbau Technik", a company name, and they might even have produced the kits and have them distributed by Engel.

Anyway, Heinz Siegle was obviously a proficient designer of big load-carrying models and might have claimed to be the originator of the scaled-up Senior Telemaster or even of the general Telemaster concept.

Who knows, and who knows who came up with the names. With his fondness of the English language, it could have been Alexander Engel. Anyhow, it was a small step to replace the "RADAR" by "TELE" and keep the "MASTER". After all RADAR MASTER had been designed for R/C in the first place, even if rudder-only, and was now meant for "full-house" R/C and even additional functions possible with a 12 channel R/C set. And the prefixes "JUNIOR" and "SENIOR" for the scaled-down and scaled-up versions had been used before for PILOT and RADAR MASTER, respectively. In fact, I believe that it was Alexander Engel who needed striking names for the models and just invented them for good marketing effect also in the US. Why not that simple?

There is one single 1968 catalog page for both PILOT and RADAR MASTER. Presumably Engel wanted to keep the catalog as thin as before while offering more models and accessories in it. Maybe he was also about to replace both models by the new Telemasters but had the kits not ready yet. Besides, he started to specify prices only in a separate price list.

It's interesting to see the prices which seem very low today but were not back then. There's even a noticeable increase from one year to the next. The German prices are converted using the fixed rate of exchange valid till 1969: 4 DM to 1 $. That leads to yet another speculation: In addition to common inflation, since then a permanent currency revaluation made German goods ever more expensive in the US. The rate of exchange dropped from 3.40 to 2.50 DM for 1 $ (by about 25%) just in 1973 when the Telemaster came out in the US. Later that might have been a reason to produce it in the US, in addition to the balsa supply issue, which was a cost issue as well and required the redesign to get by with less and lower-quality balsa cut in the US.

The model descriptions are quite modified compared to the 1967 catalog and Heinz Siegle is explicitly mentioned as designer of both models. The free-flight JUNIOR PILOT is omitted and the "new version for multi R/C operation" (1967 for PILOT and TELE-PILOT) is debunked as a paper promise: "Both models are controlled by rudder and may be easily equipped with functional elevators." The same new candor as to the other model: "Originally, RADAR MASTER has been designed for control with rudder only; installation of functional elevators and ailerons is outlined in the plan." Duh!

The model descriptions are shorter and less enthusiastic, but more to the point. Even more important, there are several statements (roominess, load-carrying ability, possible uses, flight characteristics) which are later literally reused in the Telemaster catalog page. To me that means Engel "softly" sold out the old models in 1968, knowing he would replace them the next year by the modern Telemasters which were really designed for and up to the task.

In the next Engel catalog I had access to, the 1973 issue that is, there are no longer any "PILOT" or "RADAR MASTER" but only "The 3 Telemasters" (filling a whole catalog page, see page 23 above), by now even "the far and away best-selling models in our product line"...

Kit

Actually this is about more trivia. The following pictures are borrowed from an eBay offer years ago. Even though they are a bit blurry they show some interesting things on an original German Senior Telemaster kit.

The colorful box cover has German model name (with a hyphen) and specifications printed on, as well as a picture of the model.

Wingspan (Spannweite) and length (Länge) give an idea of the model's size (next picture).

Most important and emphasized by an exclamation mark is the payload bigger than 4.4 lbs (Zuladung über 2 kg!), meaning less than 6.6 lbs (3 kg) tare weight and characterizing the model as a terrific load carrier.

The MADE IN WEST GERMANY is not printed but stamped on, maybe required for export.

The picture shows a simple but attractive color scheme for the Senior, different from the stripes shown in the monochrome catalog picture (page 23 above), which shows the 6 ft Telemaster.

It should make for better visibility of a real model and is easier to do for a simulator model. And I like it better...

The open box contains a big pile of lumber. Obviously, balsa is so bulky that even the small weight of the Senior Telemaster airframe fills such a box up to the brim.

The black things are the two pre-bent landing gear wires.

The top cover on the right side contains the four plan sheets (see above), the building instructions with bill of material (all together here), and a plastic bag.

This close-up view again shows the landing gear pieces on top of all the balsa wood.

In the top cover, on the left side, is a plastic bag with the Nylon covering fabric included in the kit, together with the respective instructions.

This picture proves that it was true and not a paper promise that the 8 ft Senior Telemaster kit included the Nylon covering fabric (as opposed to the standard 6 ft Telemaster kit, compare the bill of material of former or latter). Maybe they left it off the kit later because it was expensive and replaced by simpler and better film covering, anyway. But at least in 1973, and at least in Germany, it was obviously specified and delivered as part of the kit.

They made quite a fuss about it, and it seems it was even worth it. Pages 73 and 74 of the 1968 catalog praise both Nylon fabric and special dope. The fabric is really called perfect, being lightweight and strong, applied dryly and sealed after only one coat of special dope, and even cheap considering its benefits. Not having film covering yet, this might even have been true. The special dope needed had been attuned to this application with regard to viscosity, tightening, and opacity and thus required only half as many coats as before, saving both time and money while giving a perfect covering.

That's a bold claim. They try to back it up by referring to Karl-Heinz Denzin: "New developments with involvement of our associate K.-H. Denzin for all modelers who, like him, are long ago looking for something better." (See left margin of page 74.) I can well believe that K.-H. Denzin aimed to improve model building in every way and found exceptional solutions in his pragmatic way. But above all this remark proves that Denzin did more than design the Telemaster when he worked for Engel, that he had a better reputation than even Engel (maybe because he was not interested in the commercial side of the hobby), and that he was seen as a better employee ("associate") in Engel's company, the company trying to benefit from his reputation.

Now we know that Telemaster was perfectly designed in all respects, even the covering. We don't know, though, why K.-H. Denzin left Engel after only two years and went to Krick in the same town were he went on to design wonderful scale models raved about until today. In this case I have to defer my speculation to the section after the next.

Equipment

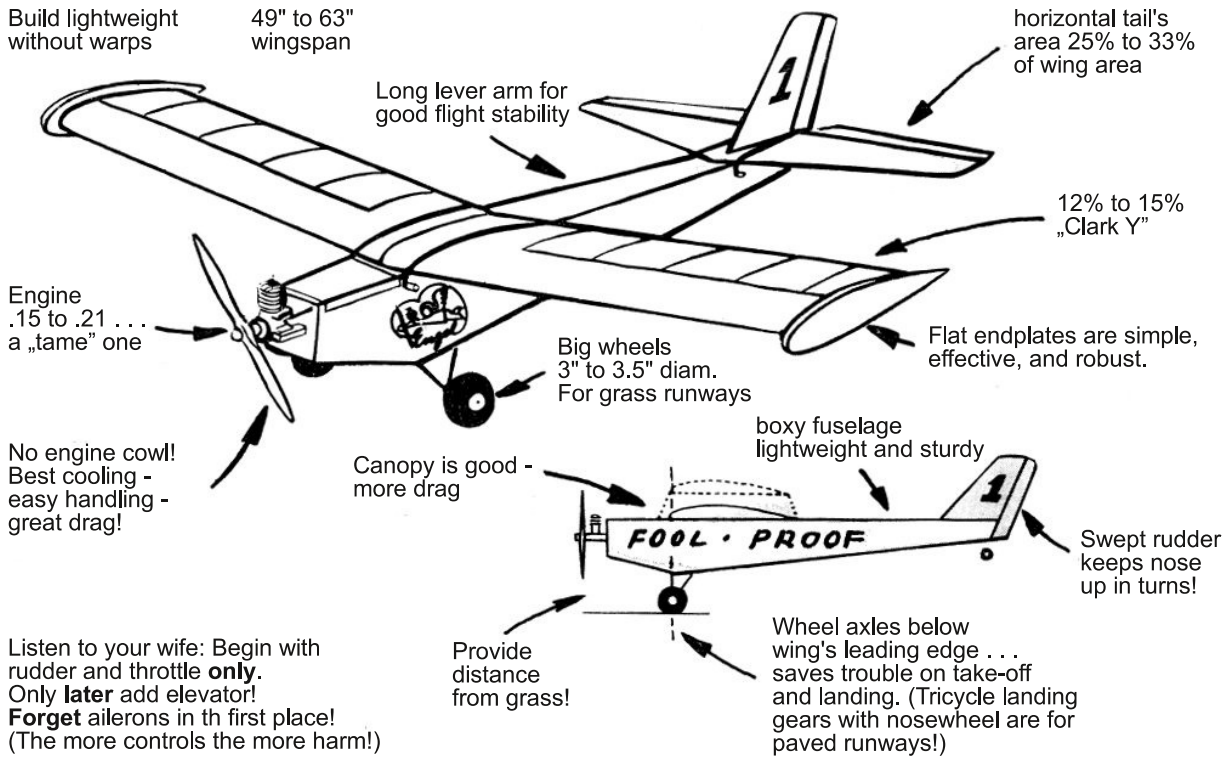
Instead let's have a look at several pages of the 1968 Engel catalog listing the engines and accessories (tanks, propellers, spinners, wheels, hinges, clevises, bellcranks, nuts and bolts) intended for the Telemaster models and specified in the Telemaster and Senior Telemaster bills of material. Specified there as well is the glue needed to build the models and here you may find the glue catalog page as well as the page about x-acto knives, just as an interesting aside. Engel not only exported models like Telemaster to the US but was also an avid importer of American modeling stuff of all kinds.

A mystery on the Telemaster catalog page itself (page 23 above) can be unraveled now: What was the recommended R/C set "Bellstar 2/1 or 2/2"? In the 1960s, Engel sold simple reeds radios made by Multiplex, a manufacturer located close-by and later an innovative powerhouse of the industry. All important radio brands were merchandized by other companies, and in the 1970s Multiplex became a full-range manufacturer merchandising their own products. There was nothing left for Engel than a makeshift: He offered the Kyosho Bellstar 220, which was actually the first R/C car radio (Kyosho history page, scroll down), as his Bellstar 2/1 or 2/2, what meant nothing else than 2 channels and 1 or 2 servos included in the set. Of course it was much cheaper than a full-blown airplane radio.

The transmitter had a wheel instead of a stick – fair enough for a rudder-and-throttle-model. But only two channels for the Telemaster which was explicitly specified as a full-house ship – that's an oxymoron. Obviously that offer was useless and only a stopgap for the catalog so we can shrug it off as a mere oddity. However, it's true that any Telemaster model needs only moderately strong servos and not exactly the most expensive R/C gear available.

Sketch

Finally, you may have a look at page 11 of the 1967 Engel catalog. As far as I know this was the only issue with this really remarkable page. K.-H. Denzin is quoted to help define what a perfect beginners model might be and which problem has to be solved. There's even a sketch outlining important features of a fool-proof first model for someone *on his own* (without an instructor):



Maybe this was the starting point for Denzin and Engel when they intended to design an up-to-date model for training and airwork that could replace the older ones, but they didn't reuse the sketch in later catalogs and even went beyond the concept shown there.

Notwithstanding the correctness of their insights and recommendations, these seem a bit quixotic, and both of them must have realized this. In the past, one had to learn *building* a model in the first place. So better the first model was simple and cheap, as well as the R/C set which was mere "reeds" ("bang-bang") R/C with only one, two, or three functions. Next task for the beginner was *setting up* and *trimming* the model before he could begin learning to *fly* it, with only two functions as a start. All that on his own…

Unfortunately, people wouldn't buy such simple models suited for learning but nicer, more complex ones they couldn't handle both in building and flying. That was the whole point of catalog page 11. So one year later in 1968, when they came up with the 6 ft Telemaster, they made it look better than the sketch so people would buy it in the first place.

Obviously, a completely new idea was making it a *big* and *full-house* (all controls) ship, exploiting more purchasing power and the availability of affordable proportional R/C sets at least in the near future. Both features made the model attractive and future-proof but had not been feasible in the past.

In the instructions and in the 1973 catalog (page 23 above) they said about the model that » due to it's high inherent stability and docile flight characteristics it facilitates proceeding directly from free-flight sport models to multi R/C flying «. Seems this bold claim never really met any public awareness, but for me it's the whole point of the new model. It meant a new and innovative division of tasks between the first and second model of a beginner.

He (or she) should first buy a *free-flight sport model* simply to learn *building*, *setting up*, and *trimming* a model in the first place. There where several attractive free-flights in the catalog so there seemed to be a fair chance of inducing a beginner to buy one of them. Once he had mastered it, he could now buy an attractive second model – the Telemaster – as his *first R/C model* and had a fair chance to learn *flying* because it really was the most forgiving and easy-to-fly model imaginable.

Its size and configuration made not only for that but also for a remarkable ability to carry big payloads. That was actually not attractive for the beginner but rather for the proficient flier. Now several older, outdated models could be replaced by the modern one, at least if there were scaled versions.

Maybe that was a necessary commercial concern of Engel while Denzin was interested in the ideal trainer model only. Maybe that's why they ceased cooperation and Denzin left Engel for another company where he could design his excellent scale models. Even though this is all speculation it could at least explain why Denzin didn't design the Senior and Junior Telemasters.

The Senior replaced both RADAR MASTERs. A bigger model wasn't needed, anyway, due to the 5 kg (11 lbs) gross-weight limit for all models in Germany, which was lifted only later (and only at chartered fields). Senior Telemaster maxed out this limit with a remarkably low 2.7 kg (6 lbs) tare weight.

The Junior was just a concession to the conventional concept of learning to fly R/C as described in the catalog page 11. It replaced all PILOT variants and perhaps even more old beginner models.

So Engel had someone scale-up and -down the original Telemaster to get all he needed for a modern product range. He didn't dilute the idealistic concept but was simply prepared for all possible cases: real airwork (Senior), modern training as well as airwork (original), and old-school training (Junior).

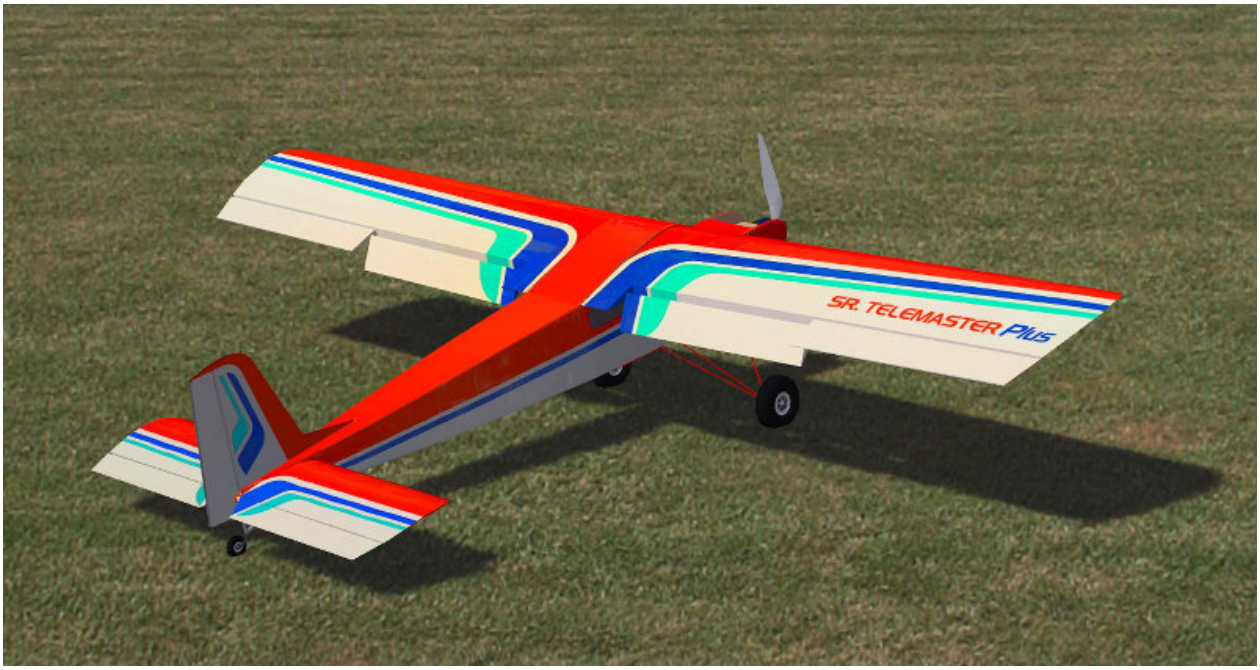
Engel and Denzin were not really visionary but the right persons with the right visions at the right time. The concept just worked, even for decades. To me it seems that Denzin managed to design a perfect trainer and utility model rolled into one and that's why we are talking about, building, and flying Telemaster models even today – five decades later.

The Senior *Plus*

There are new Versions! In 2003, Jim Martin retired, and again in 2009 Hobby Lobby got a new owner who in 2013 renamed it Hobby Express. At least that is what I know. Anyway, since 2011 all Telemaster models were redesigned for modern construction, easier build and even better, that is "modern" flight characteristics. The first in the line of these V2 (version 2) Telemasters was a completely new Senior variant, the Senior Telemaster *Plus* ARF, which has been discontinued in 2017, though.

The airframe structure is all new and covered with film. The landing gear is made from wire and has a bungee. The fuselage is wider to have more room for payloads like cameras, and there is an optional drop box to drop candies. The wing has "barn door" style ailerons and big flaps. All controls have their own servo, a total of six. There's a modern electric drive with a big propeller.

New for Telemasters is that it's an ARF. For detailed information you may have a look at my Web review where also more sources of information are referred to. Another point is the different aerodynamic setup compared to the "old" Telemasters. A thread at RC Groups (post #2) hints at this fact which is not mentioned in any other source. I had to find out what exactly it means by measuring the incidence angles on the real model, which I bought in 2012 and which is rendered in REFLEX XTR².



Setup

The post in the forum thread mentioned above says that the new setup was found by experimenting. The new model is said to fly more like contemporary trainers, what may mean the old Telemaster's behavior is antiquated.

The angles measured on the Senior Telemaster *Plus* indeed show a more "neutral", less stable setup than the well-documented 1975 version:

(All values are degrees.)	2011 Senior TM *Plus*			1975 Senior TM		
	wing	stab	decalage	wing	stab	decal.
flat-bottom incidence	3	2		4.5	2	
+ chord-to-flat-bottom	1	0.5		1.5	1	
= geometric incidence	4	2.5	1.5	6	3	3
- zero-lift angle-of-attack	-2.5	-1.5		-2.5	-1.5	
= aerodynamic incidence	6.5	4	2.5	8.5	4.5	4
(thrust offset down/right)	4	2.5		3	2	
(dihedral)	2.0			3.9		

The wing incidence is reduced by 1.5 degrees, as are both geometric and aerodynamic decalage. On the other hand, both right and down thrust are a bit increased. Dihedral is only about half as big as before. So pitch and speed stability as well as lateral stability are indeed those of a modern trainer and not nearly those of an old self-righting trainer or even free-flight model.

The recommended balance (at 5.5" to 6.5" behind leading edge) matches the smaller decalage in that it's more aft (39% to 46% of chord) than on the old model version (5.1", 36%). The REFLEX model is balanced exactly like my real model (6.4", 45%).

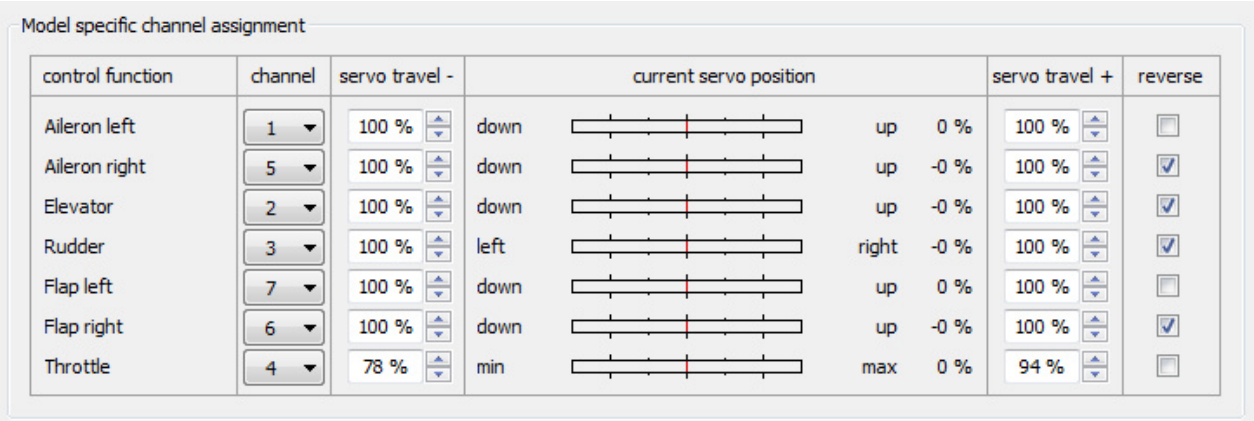
The control throws are set as recommended, the flap deflection as I saw fit:
rudder 30° both left and right
elevator 25° both up and down (recommended is 20°)
ailerons 18° up and 15° down, meaning 20% differential
flaps 20° take-off and 45° landing
These throws as well as -30% exponential seem just about right.

Unfortunately, the new model version turns out to be just as heavy as the old one (10 lbs) what is much more than specified by RCM in 1975 (6.5 lbs). Worse, the measured inertia around all three axis is bigger than estimated. Of course, this is relative, and compared to other models, Senior Telemaster *Plus* is still a nice flying model.

The drive setup renders that of my real model. The model version named "Senior Plus 360kv 17x12E 4sLiPo" is the 500W drive I have in the first place for reasons described in my Web review. It may seem a weak drive to many modelers but actually it's well sufficient and quite efficient. The version "Senior Plus 360kv 17x12E 5sLiFePo" is the same except the battery which makes for 650W power. The version "Senior Plus 360kv 17x10E 5sLiPo" is virtually what Hobby Express recommends and is a 650W drive as well, just with a slightly different character.

Finally, the model version named "Senior Plus 360kv 17x12E 4sLiPo 8 lbs" experimentally assumes 8 lbs gross weight of the model, stemming from a lighter airframe structure. That's why lower moments of inertia are set accordingly, to try if and how that makes for livelier flight behavior.

To test the effects of flaperons, the model-specific channel assignment (of REFLEX version 5.05.0 or newer) has been used. The model version named "Senior Plus 360kv 17x10E 5sLiPo tx" is set up for the Multiplex channel assignment of my ROYALpro transmitter:


Model specific channel assignment

control function	channel	servo travel -	current servo position			servo travel +	reverse
Aileron left	1	100 %	down	up	0 %	100 %	☐
Aileron right	5	100 %	down	up	-0 %	100 %	☑
Elevator	2	100 %	down	up	-0 %	100 %	☑
Rudder	3	100 %	left	right	-0 %	100 %	☑
Flap left	7	100 %	down	up	0 %	100 %	☐
Flap right	6	100 %	down	up	-0 %	100 %	☑
Throttle	4	78 %	min	max	0 %	94 %	☐

To try this model version with flaperons you have to find an equivalent assignment for your transmitter. There, you have to set up a model memory with a mixer which droops the ailerons with flaps. I chose no droop up to 20° flaps and up to 15° droop with full (45°) flaps, but you may do otherwise.

Keep in mind that REFLEX as well as my transmitter consider flaps as camber flaps which can also go up. Even though I can set up the transmitter (in the mixer setup) to use the whole slider way for 0° to 45° flaps down, it's not possible to instill that into REFLEX. That's why a separate model memory is needed in the transmitter especially for the SrTM+ in REFLEX. There, flaps retracted may be servo as well as slider center position.

Flying

As one would expect, the model behaves quite neutral. Due to both the small decalage and big down thrust, it doesn't react to different power settings as promptly as the old version. It's well trimmed for climb at full power and cruise at half power, but when leveling off you should not only reduce power but also set the new (horizontal) pitch attitude with elevator.

On the other hand, you may use flaps (for instance 20°) to set a decent decalage. Now the model reacts to power setting even more than the old model version. Full power gives a steep climb, 45% power a slow cruise. Only varying the power setting suffices to get the correct pitch attitude, no elevator needed.

Still down elevator is advisable during the take-off run to lift the tail and get the wing out of a stalled condition. As with any taildragger, even with STOL airplanes, this is good practice to shorten the take-off. The real model does it automatically early in the takeoff run while the simulator model will do it noticeably later (because no cambered stab is possible in REFLEX).

Regardless of flap setting (0°, 20°, 45°), landing needs much elevator. A three-point landing requires decent power to have some blast on the full-up elevator. The aircraft should be approached slowly in a slightly nose-up attitude, held by some up elevator, the glide slope controlled with power only.

In a flare, the airplane is brought into three-point attitude with nearly full up elevator and then throttle is cut for an immediate touch-down. For a wheel landing, only a bit more up elevator than on approach is needed to let the main wheels settle gently, and throttle is cut slowly but virtually simultaneously. In both cases it's important to approach slowly, slightly nose-up, to avoid ballooning.

Take-off and landing are not as short as one may wish due to the more than 10 lbs weight, what is not exactly low for a Senior Telemaster. Still the Plus is not really heavy and fast, either, and slower than most models of this size. The experimental 8 lbs version is even slower and livelier, but again the real 10 lbs version is not too bad, either.

The model will not only hold a pitch angle but also a bank angle, meaning it does not return to straight and level flight on its own. That's comfortable for the proficient flyer though it may be not for a beginner. But even a beginner should be able to control the model which is very calm and docile. Not even any exponential setting is needed.

Straight flight is achieved by the decent right thrust. But like all Telemaster REFLEX models, this one as well needs left rudder to counteract the right thrust while on the ground, this one even more than the other ones.

Despite the 20% differential, substantial rudder is needed with any aileron deflection. It's surely good to practice coordinated turns “by hand”, but for convenience you may set an aileron-to-rudder mixer in the transmitter.
I have even three different values set for the flight modes cruise (50%), take-off (75%), and landing (100%).

In these flight modes, the flaps are set to 0°, 20°, and 45°, respectively. I experimented with a mixer to have some automatic up elevator with flaps, but that wasn't really useful (and not realistic either, as it turned out).

Drooping the ailerons with flaps as flaperons turned out to be not really useful as well. The mixer droops the ailerons by 15° at full (45°) flaps. Since the ailerons can't get much lower by setup and since more droop would make for even more drag, this is avoided by the mixer. In it's default setting, there's virtually 100% aileron differential, meaning the ailerons don't go down further and go up only to level position. Therefore aileron effect, meaning roll control, is poor. Moreover, once in a turn the airplane needs much top aileron or it will enter a spiral dive. It just feels unstable. If differential is reduced to 67%, roll control is better but still not really good.

So you may try such settings with the prepared “... tx” simulator model and a suitable transmitter setup, but I think you will then skip the flaperon option as I did. It's not needed anyway since the lift effect is small. By the way, you have to include any aileron differential as well as exponential in your transmitter setup when using the model-specific channel assignment.

There's a demo flight (hit F9 in REFLEX, select “Senior Telemaster Plus”) that hopefully shows the model's flight characteristics, first without and then with flaps, including those with drooped ailerons and 100% differential in the last single flight near the end. The different flap deflections, aileron differentials, and aileron-to-rudder (combi) mixes are demonstrated on the ground before each single flight in the whole demo flight. (It will install and work only in REFLEX version 5.05.4 or newer.) You may view the demo flight at YouTube.

Three of the four landings in the demo flight show how they should not be done. Of course that was not my intention, but the porpoising shown there is kind of a trait of the model. That simply means that landings have to be done properly to be gentle. Meanwhile I increased up elevator throw to 25° and practiced landings, so now I'm able to do a gentle landing every time.

The Giant

Nothing flies like Senior Telemaster? The Giant Telemaster does it after all. This is the biggest of all Telemasters, offered by Hobby-Lobby (now Hobby Express) as an ARF (discontinued) or kit (discontinued), which had been manufactured by Aero Craft Ltd (Web Archive) and later by a local kit cutter in Tennessee. There is still an even newer version available as kit.

Presumably, this is Craig Wagner of Aero Craft Ltd posing next to the model to show its size. Wingspan is 12 ft / 3.6 m and wing area 3050 sqin / 197 sqdm. Length is 90 in / 2.3 m. The over-all flying weight may be as low as 23 lb / 10.5 kg.

At least this is Craig Wagner next to the un-covered airframe. The designer Tom Hunt calls the model "The Balsa Overcast". Here you see why. But you see as well that the Giant is built at least as lightweight as the Senior. There's an informative thread on RC Universe where you may see it as well (and another one).

The flight characteristics of the Giant are more than similar to those of the Senior, at least more than you may think. The geometry is simply scaled up and the structure is even more filigree. Now both models have exactly the same 17 oz/sqft / 52 g/dm wing loading. That means the Giant flies as slow and lands as short as the Senior, but – considering the size – this looks even slower and shorter. Now all is really slow motion.

The model was rendered in REFLEX by scaling the parameters. The visual model got the same paint scheme as the Senior but in green color. This was the only basic color left and actually I didn't like it as much as the others, but for the huge model it's surprisingly good.

The most obvious differences to the Senior were incorporated into the visual model. The wing dihedral is reduced and lift struts are added. The aluminum plate landing gear was replaced by a wire landing gear, which is lightweight but still able to carry the airframe's weight. Ailerons and flaps are enlarged to 25% of the wing's chord length (instead of 15% on the Senior). There is no flaperon version.

The two recommended drives are rendered in REFLEX models. Primary recommendation is an electric drive, consisting of an AXI 5330/24 brushless outrunner motor, an APC 20x11" Electric Flight propeller, a Jeti Advance plus 90 ESC, and a 10s1p 4000 mAh LiPo battery. The drive parameters for REFLEX were calculated using Drive Calculator. Secondary recommendation is a Zenoah ZG-26 gas engine. Toni Clark in Germany offers the enhanced ZG 26SC and shows a performance diagram. Static thrust with an 18x6" MenzS propeller was estimated using ThrustHP Calculator.

Both drives pull the model with authority. The electric drive is quiet, clean, has no vibrations (if balanced), and is easy to operate. Full-power run time would be only 4.5 minutes, but in cruise flight the current draw is so low that there will be up to 15 to 20 minutes flight time. It's possible to add a second battery (1.04 kg / 2.3 lb) and double flight time. That's good for just flying around and for aerial photography/video.

If the model is used as a glider tug, though, a gas engine may be preferred. The Giant Telemaster is very well suited for towing big *slow* gliders with a wing loading and airfoil similar to those of the TM. If there are only one or two flights in an hour or two, the electric drive will suffice. The gas engine, on the other hand, needs only 34 oz / 1 liter fuel for one hour of towing, good for hauling several gliders in succession.

The ZG 26 is recommended as smallest engine, but I would avoid bigger engines or at least strengthen the airframe to cope with the vibrations. The

ZG 26 with a low-pitch propeller gives much thrust, enough for both a glider and the Telemaster itself, which is lightweight like a glider. A higher-pitch propeller would only waste power because the model isn't able to fly fast, anyway.

Even with the low-pitch propeller the model should be somewhat strengthened for towing. The tow-release is usually located on the upper side of the fuselage just behind the wing. I would build special longerons from the front bulkhead to this point so the tow forces don't affect the fuselage structure. This would not be difficult because the Giant has a modified fuselage and wing center section, which is not rendered visually in the REFLEX model, though.

Also the gas engine is not rendered in the visual model. It would be much work to build such an engine for REFLEX. I simply put a glow engine up front so just don't look at it. The AXI electric motor is rendered quite correctly, but the sound is only the generic REFLEX electric sound. The gas engine has the Zenoah G20ei sound, though, which was extracted from a video Rich Noon presented in his review on RC Groups.

Scaling up the Senior Telemaster produced the parameters for the flight characteristics. The Hobby-Lobby Web page says the horizontal tail has 672 sqin area while scaling up the Senior gave 724 sqin. This difference is not explainable and was ignored. The wing dihedral was reduced to 1 degree, which is estimated from several pictures in the Web. The huge model flies even smoother than the Senior. There seems to be much dynamic stability.

The effects of the longer-chord flaps were derived from the Senior TM values, which are only rough estimates. The pitching moment is even bigger what makes flare for a three-point landing quite hard, but it's still possible using the trick mentioned above. The drag is a bit higher, too, but both drives let the model climb even with flaps deflected 45 degrees. Though the flap parameter values are my best guesses they might be completely wrong. All I can say is that the model's flight behavior is plausible and generally realistic.

There may be some flaws in the REFLEX models of the Giant Telemaster that just can't be avoided due to lack of material and information. The flight behavior in the simulator should be pretty close to the real one, though. That means the model is capable of doing some spectacular maneuvers, even if not aerobatic ones but steep approaches and short landings.

This shall be demonstrated in the demo flight "Giant Telemaster 26ccm". If the Telemaster installer didn't it for you, you'll have to download and install Horst Lenkeit's "MFG Uetze" scenery from RC-Sim (now defunct) to view this demo flight. Alternatively, you may view a video of this demo flight, for instance if you don't own a copy of REFLEX. It is here on YouTube, and here in HD but without comments.

Some fellows complain such a nice model shouldn't sound like a chainsaw, what is quite true because the Zenoah engines are primarily used for chainsaws. Nevertheless they are cheap, robust, reliable, and powerful engines making model flying easy and enjoyable. But some four-stroke glow engines are not too bad, either. Especially the Saito FA 125A is such an alternative and was assumed for another setup of the Giant. The REFLEX model's sound was extracted from a video Rich Noon presented in his review on RC Groups. Now it sounds just like a single-cylinder motorcycle.

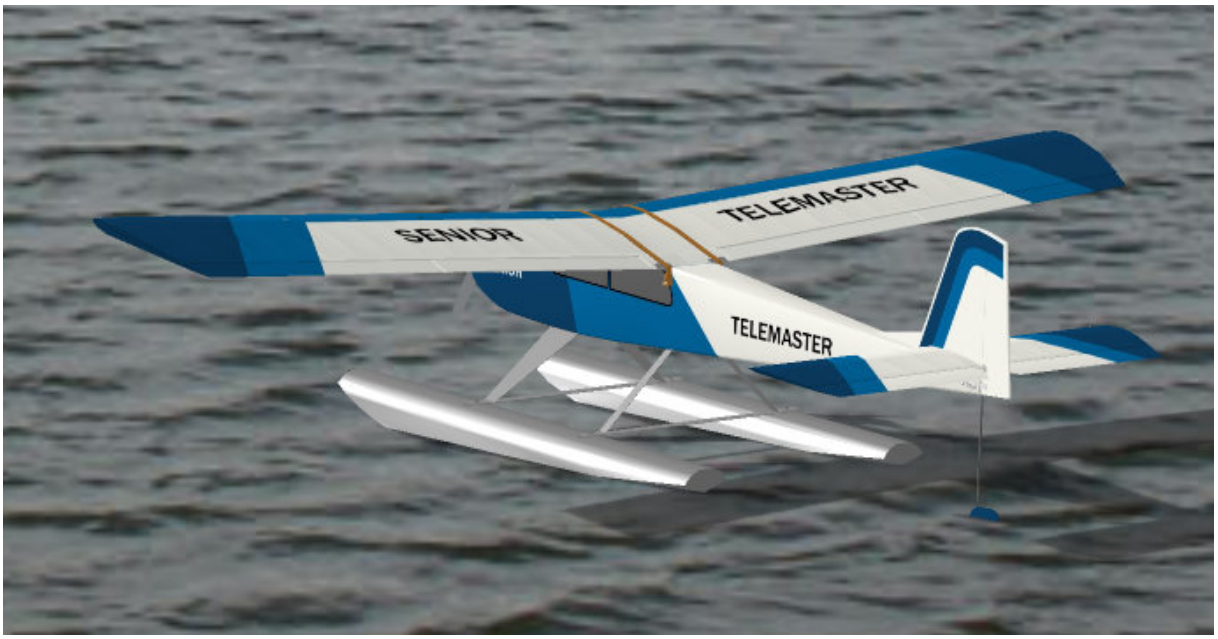
The drive parameters of both the gas and the glow version are guesswork, but they should be not too far off from reality. Anyway, the Saito is just as powerful as the Zenoah at even lower rpm and half the weight. The Giant now weighs only 21.5 lb / 9.7 kg. Again, a low-pitch propeller (16x6") was assumed so the model will take-off after a few feet and climb steeply. High speed is not Giant's business so a different propeller would only waste power (and energy).

The Saito engine seems to be an interesting alternative even in reality. It's only slightly more expensive than the Zenoah and is said to be just as reliable and easy to handle. Now that gas fuel has become more expensive, even fuel cost might be comparable. If your club manages to get Methanol in bigger quantities (synthetic oil and a bit nitro should be no problem) it might cost just as much as automotive fuel. And a four-stroke should be a thrifty engine.

But the question has eventually been settled by the advent of gas conversions. The FG-21 (1.26) is an even better replacement for the Zenoah with even better economy. Sounds like the glow version (FA 125A)...

Floats

The Senior Telemaster is known to be a good floatplane. After the successful creation of a water look-alike in REFLEX sceneries, the Senior's water flying abilities may be demonstrated also in the simulator, at least approximately.



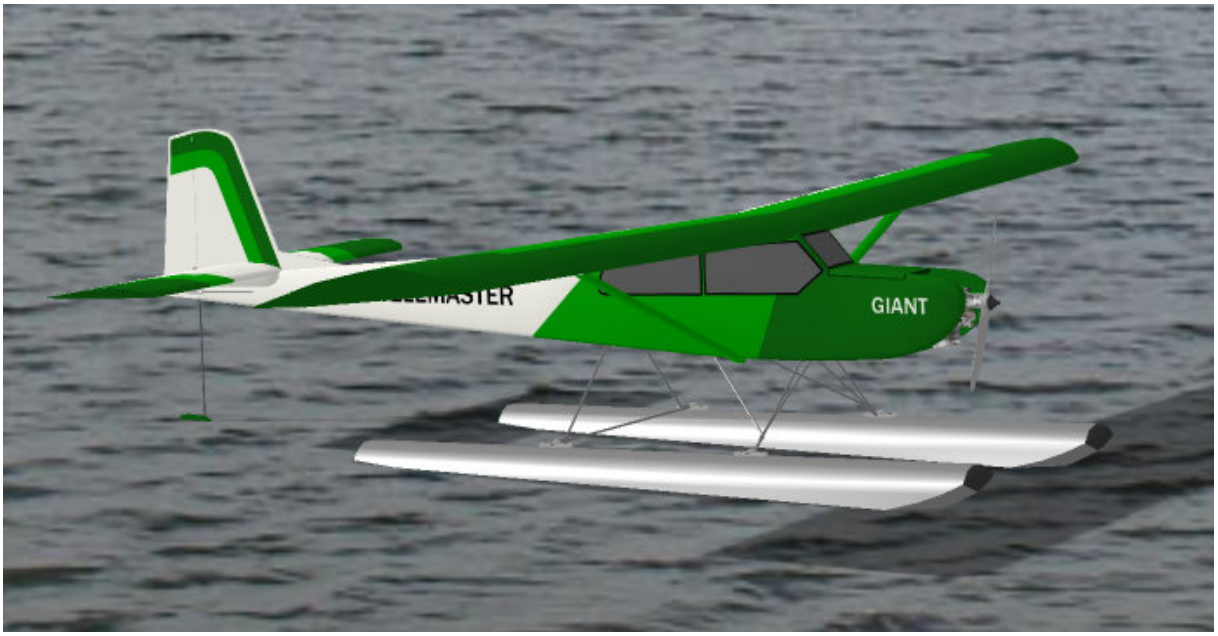
The floats are supposed to be semi-scale round-top Sea Commander floats (obviously, both website and company vanished). Chuck Cunningham's article has an excellent overview over float design for models. Bruce Stenulson's article gives a step-by-step description of float sizing and set-up. More advanced was Ed Westwood's (now defunct) article on float design.

Following the rules given in these articles, the floats are 45" long what is 75% of the distance between the propeller and the rudder hinge line. (Only later I noticed that Frank Schwartz in the post on RC Universe mentioned the Hobby-Lobby floats were 36" long.) Sea Commander floats of this size weigh 25 oz / 0.71 kg what is supposed to be the weight of both floats. Senior Telemaster's weight was increased by this amount, assuming the additional float struts weigh as much as the dropped wheels. The center-of-gravity was lowered and the moments-of-inertia were increased accordingly.

The floats were positioned so the normal landing gear struts reach down to them and the propeller's clearance is retained. Because the wing's incidence angle is quite big, the floats' top is parallel to the model's centerline. The step of the floats is on a line inclined 8 degrees back from the vertical, going down from the balance point below the wing's main spar or slightly behind it.

As recommended by Chuck Cunningham, there are no water rudders on the float transoms but a single water rudder on an extension of the rudder hinge

pins, just instead of the tail landing gear. Sort of an aluminum landing gear with horizontal struts requires no diagonal struts or wires for the floats. This is far simpler than reproducing every detail of real floats. After all Telemaster is a utility model and not a scale model.



The Giant Telemaster turns out to be an even better floatplane due to its sheer size and due to the effective barn-door ailerons and flaps. The floats are now just 68” long and weigh 60 oz / 1.7 kg. Because there was already a wire landing gear, the float gear was made following Chuck Cunningham’s recommendation.

Because a wooden propeller on a floatplane is not a good idea, both Senior and Giant got a plastic propeller. The Senior now has a Super Nylon and the Giant an APC Sport.

Both the Senior with the .60 glow engine and the Giant with the 26 ccm gas engine have more than enough power. Water take-offs are short even without flaps, and despite the big float drag, steep climbs are possible even with full flaps. Of course, steep descents and short landings are possible with and without flaps.

Yes, I know that water flying in REFLEX is not quite realistic, but it is still quite good. If you handle the seaplanes as you would in reality, it will look similar to real water flying. At least you may enjoy the look and feel of seaplanes in the simulator.

This should be demonstrated in a demo flight named “Giant Telemaster 26ccm on floats”. If the Telemaster installer didn’t it for you, download and install Harald Bendschneider’s “Baggersee” (Gravel Pit Lake) scenery from his very interesting Web site www.Szenerien.de to view this demo flight.

The Giant's spectacular flight characteristics even with floats are demonstrated in another demo flight named "Giant Telemaster 26ccm on floats 2" (at YouTube). If the Telemaster installer didn't it already, download and install Paul Dürr's "Rheinbrücke Hartheim" (River Rhine Bridge Near Hartheim) scenery from his spectacular Web site sceneries.paulduerr.info for the demo flight.

Conclusion

While the REFLEX model cannot be *completely* realistic at all, it yet shows the essence of the real model's flight behavior, which might be described as "smooth" and "steady". So just enjoy the look and feel of this classic model!

But if you're one of those expert Telemaster pilots I'd surely like to hear any corrections or suggestions from you.

Enjoy!

Burkhard Erdlenbruch

mailto:Burkhard@Erdlenbruch.de?subject=Telemaster

My Web page about the REFLEX model flight simulator:
http://time.hs-augsburg.de/~erd/Modellflug/textReflex.html

More REFLEX models and the latest versions are on my page
http://time.hs-augsburg.de/~erd/Modellflug/textDownloads.shtml

My Web review of the 2011 Senior Telemaster *Plus* ARF:
http://time.hs-augsburg.de/~erd/Modellflug/textTelemaster.html

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