



INTRODUCTION

Thank you for selecting the Reaction 54 kit from BTE! The R54 is an entry-level R/C turbine model utilizing traditional wood construction. A lot of effort has gone into the engineering of this kit to make it an enjoyable and satisfying project from the first drop of glue to the first landing. It has always been a goal of BTE to produce kits that are just as pleasurable to build as they are to fly.

Welcome

If you are new to turbines, welcome to the pinnacle of recreational R/C modeling. You have no doubt worked your way up from trainers to sport models to aerobatic ships. Perhaps you've gained some quality stick time with racers or ducted fan models as well. Those are all cool in their own way, but in my opinion at least, there is nothing like the thrill



The Moment of Truth! Bruce's sister, Susan, poses with the prototype Reaction 54 moments before its maiden flight at the Siskiyou County Airport in northern California. Look close and you can see the faint outline of Mount Shasta in the background.

of piloting a model propelled by the raw power of a miniature gas turbine. There is something very pure about a turbine model in flight. The lack of torque and general aerodynamic cleanliness combine to produce a smooth, almost silky, performance. And oh, that sound! When you taxi onto the runway and move the throttle stick forward, you know something special is about to happen. We're talking serious goosebumps.

If you are an experienced jet pilot, you will find the R54 is a refreshing and relaxing alternative to the high-buck, high-maintenance, high-stress turbine models that you may be used to. It will probably be your slowest turbine model, but if the R54 fills the roll of your "everyday" jet, then I will consider that a success. Sometimes it's not about the speed, it's about the spirit.

My Background

I came to the world of turbines in a different fashion than most. My previous jet experience came from designing, building, and flying sport R/C models powered by pulsejet engines. My father introduced me to the famous Dyna-Jet Redhead many years ago, and they have always held a certain fascination with me. Anyone who has heard the incredible roar of a Dyna-Jet never forgets it! As you may know, pulsejets are incredibly loud, run very hot, have no throttle, and can be temperamental. Oh, did I mention they are **incredibly loud**? Every landing with a pulsejet model is deadstick, so most of my designs featured big wings so they would glide well. Speed was never a priority. In fact, efforts were made to keep the speed down because I prefer close-in flying. This design philosophy, to a certain extent, was translated to my first turbine model, the R54.



The inspiration for the general configuration of the Reaction 54 goes back to this Dyna-Jet powered model, the Old Flame.

About the Reaction 54 Design

My father and I built a number of pulsejet models dating back to the 1990's. One of those models, our Old Flame, was perhaps the best pure flyer of the bunch. The overall configuration of the R54 borrows heavily from the Old Flame in that it features a low wing with the engine mounted under the rear part of the fuselage. On the next page is a list of the other major design considerations for the R54...

All Wood - I'm comfortable with traditional wood design, and I figure so are a lot of potential modelers looking to get into jets. Besides, being all-wood helps it stand out in the jet market that is dominated by composite designs.

Big and Light - Big models are easy to see, and light models are delightful to fly. Bigness helps keep the top speed down, and lightness helps keep the landing speed down. A big fuselage gives you plenty of room for all that "stuff" that turbine models need to haul around. A big, thick wing is inherently strong and gives you plenty of room for retracts. Light weight gives you vertical performance and reduces landing gear loads.

Retracts - In my opinion, there has been a tendency to make entry-level turbine models too simple. Aspiring turbine pilots have above-average skills and don't need to step back to a basic trainer. The R54 is still a fairly simple design, but I want it to serve modelers well as a stepping stone to faster, more-complex turbine models. Retracts are part of the jet scene, and the R54 just wouldn't look right without them.

Exposed Engine - I saved my pennies for several years to buy my first turbine engine, and didn't want to bury it inside an airframe. Besides, an exposed engine is easy to work on and saves the weight, cost, and complexity of an exhaust tube, inlets, and bypass. The R54 features an elegant streamlined area just ahead of the engine to help maintain smooth airflow to the turbine inlet. For lack of a better term, I call this the "boat tail".

Low Cost - By definition, a turbine model will be expensive compared to most R/C models. Besides the engine itself, the typical turbine model is expected to have custom-made composite fuel tanks, spring-loaded landing gear struts, and special machined "jet" wheels. A major goal of the R54 was to keep the total cost low compared to other turbine designs by using low-cost, off-the-shelf hardware items like the Du-Bro fuel tank, wire struts, and regular wheels. The R54 blurs the line between your everyday sport model and what has become the norm in the turbine community.

Safety - The greatest safety feature of the R54 is that it's fairly slow by turbine standards and easy to fly. Care was taken in the design to separate the fuel tank area from the turbine with a robust structure in the boat tail. A neoprene pad is provided to cushion the front of the tank in an impact. The BTE prototype model has been thoroughly flight tested and has proven itself to be a robust, well-behaved design that does what it is supposed to do, and does it well.

Things You Don't Normally See on Turbine Models

There are some design and equipment aspects of the R54 that you don't normally see on the typical turbine model. To put your mind at ease, here is the reasoning behind some of my choices made during the development of the R54.

Push/Pull Cable Linkage for Rudder and Elevator - This might be the most unusual aspect of the design, but it has proven itself in flight testing and on several of my earlier pulsejet designs. When installed as shown on the plans, you will find the system makes for a very rigid, slop-free connection to the control surfaces. The servos are mounted up front to keep the weight forward and are easy to access under the large hatch.

Easy Hinges - I love these hinges! They are economical and easy to install. Some might question their strength, but that is addressed by using lots of them spaced fairly close together. If you go with plastic film, you don't even have to worry about hinging until the model is completely covered.

Wire Landing Gear Struts - These aren't included in the kit, but they are supplied with the recommended retract package. The struts on the R54 are short, so 3/16" wire is plenty stiff to handle the loads, even on grass. The R54 lands slow, so it doesn't need the cushioning of more expensive oleo-style spring struts.

Sport Wheels - A low-speed model like this doesn't need special, high-priced "jet" wheels. The 3" diameter Sullivan and Hangar 9 sport wheels that I use handle rough terrain with no problem and the tires have never rolled off the rim even after some bad landings with high side loads. And they are cheap to replace if necessary.

Electric Nose Wheel Brake - AMA requires brakes on turbine models. Again, considering the low-speed nature of the R54, brakes aren't really necessary. The Kavan electromagnetic brake meets the AMA requirement, is relatively inexpensive, is easy to install, and adds a little weight to the nose which you need anyway.

Bolt-On Wing - Modelers who have built my designs in the past know that I like to keep things simple. That's why the R54 has a simple one-piece wing that bolts on like a normal sport model. This provides a solid center wing joint without the extra complexity, weight, and cost of wing joiners. Besides, the finished wing is shorter than the fuselage, so transporting is not a big issue.

Open Rib Bays - To drive home the sport model feel of this design, I went with some open rib bays near the tips. I've seen film used on open structures on birds much faster than the R54. You can sheet the whole wing if you wish (plenty of wood is provided in the kit), but in my opinion it's just extra weight.

Plastic Film Covering - Okay, this isn't totally uncommon on sport jets. Still, the R54 was designed with plastic film covering in mind from the outset. Use a high-quality film like Monokote or Ultracoat, and be mindful of the orientation of the seams in relation to the airflow.

Glues

General construction of most of the model can be done using Cyanoacrylate Adhesive (referred to as CA in the book). BTE offers a package of high-quality Handibond CA tailored specifically to the R54. The instructions will, from time to time, make suggestions as to the type of glue to use in certain steps. There are times when a good aliphatic resin like Elmer's Wood Glue or Tite-Bond (referred to as "yellow glue" in the book) will be the best choice. Slow-dry epoxy (30-minute or longer) is recommended for high-stress areas like the wing joint.

A Note About Craftsmanship

I keep referring to the sport nature of this model and my effort to keep it simple. Do not, however, lose sight of the fact that this IS a turbine-powered model that can achieve high speeds and high in-flight air loads. I encourage you to take your time with the construction, build it straight, and build it strong. Every effort has been made at BTE to produce wood parts that fit well, but ultimately, the quality of the finished product is up to you. Approach the building process with an attitude of "do it right" rather than "do it fast", and you will be rewarded with a unique R/C model that you can truly be proud of.

Enough Already, Let's Build!

Okay, okay, but like all instruction book writers, I am obliged to insist that you read through the booklet completely before you start, and study the plan sheets. Think ahead. Grab the glue. Turn the page... **◀R54▶**

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Instruction Book Note for 2014

This book was originally written about ten years ago, and there have been some major advancements in the hobby and turbine engines since that time. We now have 2.4GHz radios, kero-start turbines, electric retracts, and numerous other advances in equipment. But balsa is still balsa and the science of aerodynamics remains unchanged. So build your R54 as shown - there have been no significant changes to the airframe since it was introduced. In later chapters, you will see references to dated equipment, but the examples presented there and your own experience should be enough to guide you through. As mentioned at the left, think ahead!