

INSTRUCTION MANUAL

# T-BOLT



GIANT LEAP ROCKETRY, LLC

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2831 SE Cornelius Pass Road

Hillsboro, Oregon 97123

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## T-BOLT 38mm

*Thank-you and congratulations on purchasing this beautiful high powered rocket from Giant Leap Rocketry.*

*-The GLR Team-*



**THE T-BOLT IS THE PERFECT LEVEL 1 or LEVEL 2 ROCKET!!!**

**PLEASE BE AWARE THAT THE T-BOLT CAN (DEPENDING ON THE MOTER CHOSEN) GO OVER 6000 FEET; THEREFORE A TRACKING SYSTEM IS RECOMMENDED FOR A SUCCESSFUL RECOVERY.**

We at Giant Leap Rocketry, LLC hope you enjoy this rocket. The T-BOLT is carefully engineered to make this rocket high performance on the one hand, yet efficient to build on the other. We recommend that you take your time, learn and enjoy. The T-BOLT series is another in a long line of high quality kits from Giant Leap Rocketry, LLC.

# T-BOLT...The Perfect Level 1 or Level 2

We provide more details to help with your rocketry education



T-BOLT shown with the optional high performance FinCan and optional Nozzle-Shaped Motor Retainer

The T-BOLT is a perfect rocket for a level 1 launch. The T-BOLT is a 38mm minimum diameter rocket. This means that the airframe is the motor mount tube as well. It is adaptable down to 29mm motor using the optional 29-38mm Slimline adapter (ordered separately from GLR). The T-BOLT can be flown on a variety of motors to extremely high altitudes. Be certain your center of gravity (CG) is at least 1.5 body diameters or more forward of the

center of pressure (CP) when the rocket is fully loaded and ready for flight!

**This is critically important or the rocket will not be stable in flight.**

For example, if your rocket is 1.5" in diameter, then the CG should be at least 3" forward of the center of pressure. We provide you with the CP distance from the tip of the GLR Pinnacle No-

secone. As long the design remains the same as provided by GLR, the CP won't change; but, if you modify the **length** of the rocket you will need to determine the CP again for yourself. The CG depends on the weight distribution, which can change depending on your motor choice or other items that change the **weight** of the rocket. You can find the distance of the CG by balancing the rocket on your finger. If the CG is too far back, add nose weight. All measurements must be done with a "launch ready" rocket. This means your rocket is loaded with a motor, recovery components and any electronics or other accessories you plan to use during flight. Remember, during launch, the recovery hardware may shift aft, thus shifting the CG to an unstable condition. Be sure to allow for this before flying by loading your recovery components aft in order to properly check CG.

Note: Heavier motors shift the CG aft, requiring you to add nose weight. Be sure to check the CG location prior to launch!!

## ***Specifications:***

This rocket comes in both Fiberglass and Magnaframe Fiberglass Specs are listed first and Magnaframe listed second.

### **Fiberglass**

Dry Wt. Mass (no motor load) 38.15 oz.  
Length: 42 ½" (with Nozzle retainer the length is 43 ⅛")

Outside Diameter O.D. 1.65"  
Inside Diameter I.D. 1.36"  
CP=36.7" aft from GLR Pinnacle Nosecone tip  
CG should be less than 33" aft of GLR Pinnacle Nosecone tip  
Motor Mount: 38mm (29mm with adapter)  
Parachute: 30"

### **Magnaframe**

Dry Wt. Mass (no motor load) 32.2 oz.  
Length: 45 ½" (with Nozzle retainer the length is 46 ½")  
Outside Diameter O.D. 1.65"  
Inside Diameter I.D. 1.36"  
CP=39" aft from GLR Pinnacle Nosecone tip  
CG should be less than 36" aft of GLR Pinnacle Nosecone tip  
Motor Mount: 38mm (29mm with adapter)  
Parachute: 30"

Recommended motors (motors in italics require 38 to 29mm adapter):

*Aerotech 29mm motors: H128, H165, H180, H210*

Aerotech 38mm Motors: I161, I357, I300, I211, I284, I366, I435, J420, J350

## **WARNING!!**

Flying rockets is potentially dangerous, and you or others can be injured and/or killed by the usage of this product. Property damage can also occur by the usage of this product. In using this product, you agree to comply strictly with all safety codes of the Tripoli Rocketry As-

sociation and the National Association of Rocketry, as well as all local, State and Federal laws. By using the product, you agree that Giant Leap Rocketry, LLC, (also in this document noted as GLR) it's owners or employees will not be held legally or financially responsible for the correct or incorrect usage of this product. If you do not agree with these statements, return the kit in resalable condition to Giant Leap Rocketry for a refund. By using this kit, you agree that you have read, understand and accept these conditions.

**PLEASE READ THE SAFETY CODE AND LIABILITY STATEMENTS AT THE END OF THESE INSTRUCTIONS.**

**NOTE: THIS ROCKET IS NOT A TOY**

**BECAUSE OF THE ROCKETS SIZE AND WEIGHT IT IS A SERIOUS VIOLATION OF FEDERAL LAW TO FLY THIS ROCKET ANYWHERE EXCEPT AT LAUNCHES SANCTIONED BY THE TRIPOLI ROCKETRY ASSOCIATION OR THE NATIONAL ASSOCIATION OF ROCKETRY WHOSE ORGANIZERS HAVE SECURED AN APPROPRIATE WAIVER FROM THE FEDERAL AVIATION ADMINISTRATION. FAILURE TO DO SO CAN RESULT IN SUBSTANTIAL FINES AND/OR IMPRISONMENT. DO NOT EVEN THINK OF FLYING THIS ROCKET ANY-**

**WHERE EXCEPT AT CERTIFIED LAUNCHES.**

**IF YOU HAVE ANY QUESTIONS OR ARE UNCLEAR REGARDING THE ASSEMBLY OR USE OF THIS PRODUCT, PLEASE CALL GIANT LEAP ROCKETRY, LLC. YOU ARE TOTALLY RESPONSIBLE FOR THE SAFE USAGE OF THIS ROCKET. FOLLOW ALL PERTINENT SAFETY CODES AND DIRECTIONS AT THE LAUNCH SITE. ALWAYS WEAR EYE PROTECTION WHENEVER LOADING EJECTION CHARGES OF ANY TYPE AND KEEP SPECTATORS AWAY. MAKE A CHECK LIST TO HELP YOU PREPARE YOUR ROCKET PROPERLY SO AS NOT TO OVERLOOK AN IMPORTANT STEP DURING THE EXCITEMENT AND STRESS OF PRE-FLIGHT PREPARATION. IF YOU DO NOT FEEL READY TO FLY THIS OR ANY OTHER ROCKET *DON'T*. Take your time and do it safely and correctly. REMEMBER, THE FUTURE OF THIS HOBBY ALONG WITH THE SAFETY OF THOSE AROUND YOU IS IN YOUR HANDS.**

## **PARTS LIST:**

One-1.5" x 33" Filament-Wound Fiberglass **OR**

One- 1.5" x 36" Magnaframe

One-1.5" GLR Pinnacle Nosecone

One- Eye Bolt For the GLR Pinnacle Nosecone

One- 38mm Slimline Retainer Set

One- KEVLAR® Parachute Heat Protector Pad

One- 30" Parachute

One- Hard Point shock cord attachment

One- Glue stick dowel rod 18" long

One- Assembly Instruction

One- Swivel

### STYLE OPTIONS:

A Slimline Nozzle retainer (Pictured on Cover) and GLR Rail Guide Stand offs are available as an option.

## Disposable Supplies Needed by the Builder to Assemble This Kit:

*5, 15 or 30 Minute Epoxy or Aeropoxy  
(Can Be Ordered Separately From GLR)*

*Mixing Cups and Mixing Sticks  
(Can Be Ordered Separately From GLR)*

*J.B. Weld  
(Can Be Ordered Separately From GLR)*

*Masking Tape*

*Tape Measure*

*Sharp Pencil*

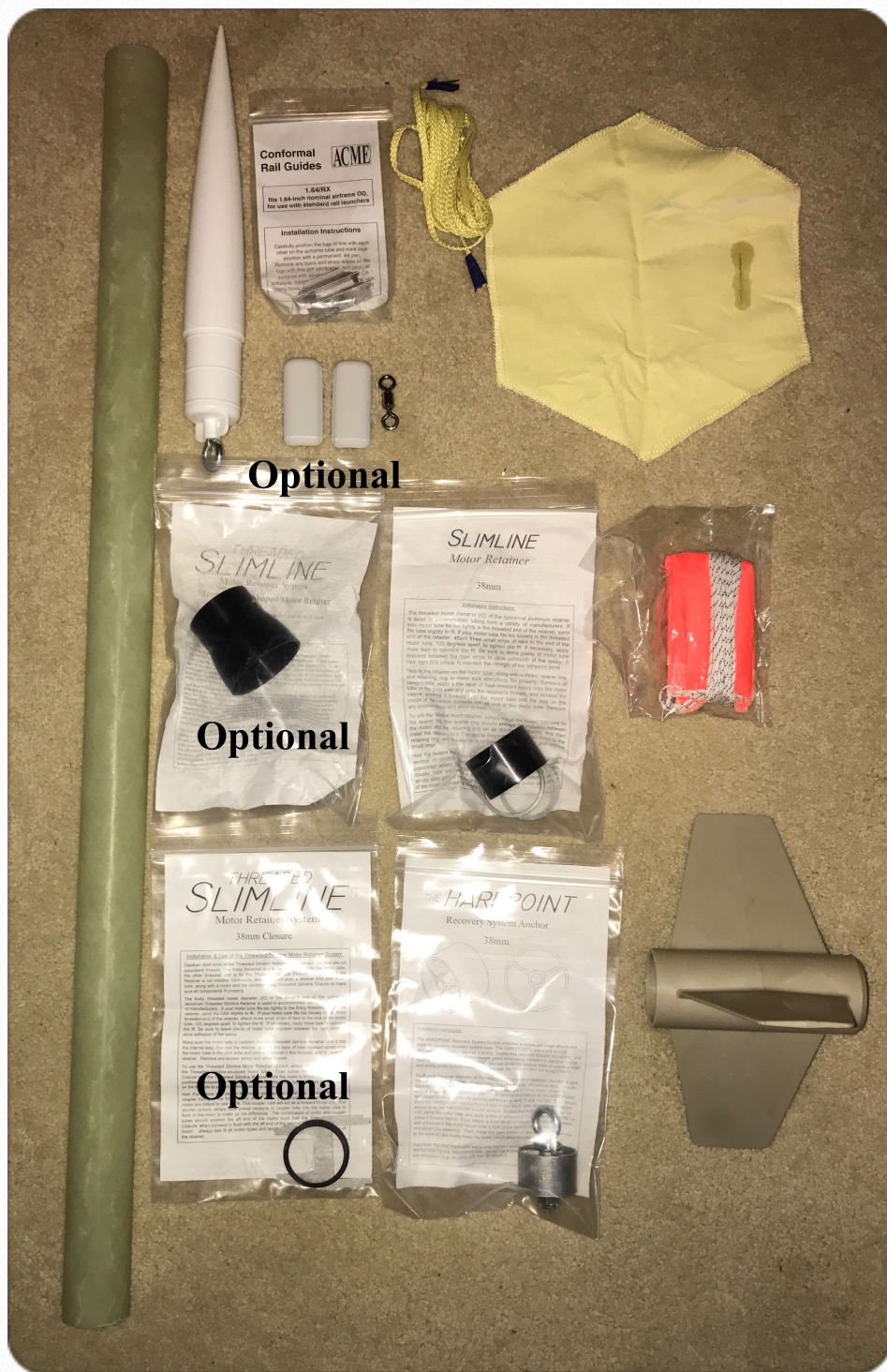
*#250 Sandpaper*

*Paper Towels*

*Latex Gloves*

*(Can Be Ordered Separately From GLR)*

*Rubbing Alcohol or Lacure Thinner*



One- 38mm Acme FinCan

One- Pack of 2 38mm Acme Rail Guides

One- Twelve foot 1/4" Kevlar® Shock Cord

NOTE: you **MUST** use high-quality epoxy **and** JB Weld with this kit. Other types of adhesives are not suitable and will make the rocket unsafe for flight. You may prefer a slower setting epoxy (30 min.) if you are a novice builder, as this will allow more time to assemble the rocket.

## ASSEMBLY

1. On the 33" long fiberglass or the 36' long magnaframe 38mm airframe, with a pencil mark one end "Forward" and the other end "Aft" and sand the outside of the airframe up six inches from the Aft end using 250 grit sandpaper.

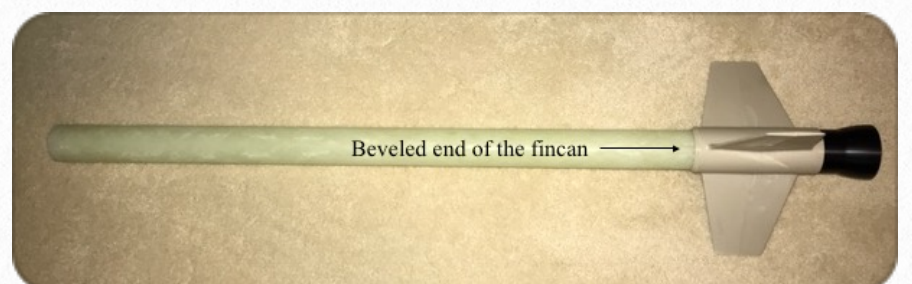


2. Using J.B. Weld, attach the GLR Slimline Motor Retainer to the AFT end of the motor tube. You **MUST** use J.B. Weld because it is rated for high temperature use, whereas regular epoxy is not. You could lose the motor if you do not use J.B. Weld. **Allow to fully cure be-**

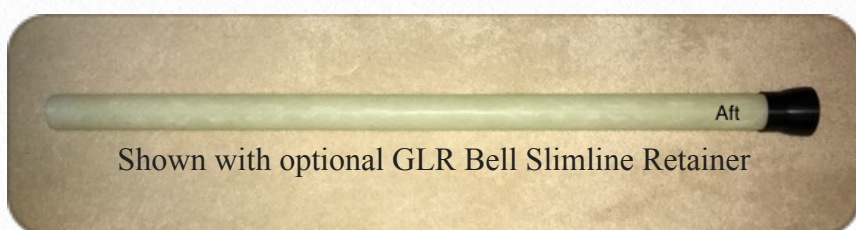


**fore moving to the next step.** If during your trial fitting of the GLR Slimline Motor Retainer, the GLR Slimline Motor Retainer seems a bit too loose, simply place a **SMALL** amount of tape on the aft end of the airframe at distances of about 120 degrees from each other overlapping the end of the tube. This will snug up the fit and allow a proper adhesion. Once the GLR Slimline Motor Retainer is in place remove any tape that is exposed on the internal area of the airframe and discard.

3. With a pencil, mark the tapered end of the GLR FinCan "FORWARD" and the other end "AFT". FinCan is short for "fin canister". You will love the GLR FinCan, it is incredibly strong and durable and you don't need to worry



about inter-fin alignment! That is easy, that is built tough, that is GLR.



Slide the GLR FinCan onto the FORWARD end of the airframe, making sure that the AFT end of the GLR FinCan goes on first. The words "FORWARD" and "AFT" on the airframe and GLR FinCan should match direction when the GLR FinCan is in place on the airframe.

4. Do not slide the GLR FinCan all the way on. Instead, leave the GLR FinCan forward on the airframe so that the AFT end of the GLR FinCan is about 6" above the GLR Slimline Motor retainer.

5. Apply Aeropoxy to the area that will be covered by the GLR FinCan. (This area of the airframe should have been lightly sanded in step 1.)

6. Before the epoxy cures, slide the GLR FinCan the rest of the way onto the airframe until the AFT end of the GLR FinCan butts up against the GLR Slimline Motor Retainer.



Once in position, clean up any epoxy that oozed out the AFT end with alcohol and paper towels. Set upright on your work surface (resting on the retainer) and allow to fully cure.

7. Next, identify the GLR Hard-point Recovery System Anchor. Place the eyebolt through the center of the device, and tighten the nut. There should be a washer on both sides of the Hard-point. Secure one end of the GLR Kevlar® Shock Cord to the eye bolt by tying a fisherman's clinch knot. A secure attachment is critical at this stage because this mount will no longer be accessible once it is inserted into the airframe. Dap a small drop of epoxy on the knot to prevent it from unraveling. Because Giant Leap Rocketry, LLC provides heat-resistant Kevlar® Shock Cord in this kit, rather than nylon, there is no need to wrap the GLR Kevlar® Shock Cord with masking tape to protect the GLR Kevlar® Shock Cord from heat.

**INSERTING THE GLR HARD-POINT RECOVERY SYSTEM ANCHOR INTO THE AIRFRAME IS TRICKY. READ THESE NEXT STEPS THOROUGHLY TO UNDER-**



**STAND THE PROCEDURE BEFORE ATTEMPTING TO COMPLETE IT.**

8. Once the GLR Hard-point Recovery System Anchor is prepared, you must insert the GLR Hard-point Recovery System Anchor into the airframe as follows: You are provided a glue stick dowel. Do not snap it or otherwise alter the length because it will serve as a measuring guide. Mix some J.B. Weld (do not use epoxy). Measure the dowel and make a mark on the dowel at 15" and 16". Measure and mark the airframe also at 15" and 16" from the forward opening of the airframe. (Because Giant Leap Rocketry uses the finest resins when fabricating our fiberglass airframes, in good light you will be able to see through the airframe as you insert the GLR Hard-point Recovery System Anchor.) With one hand, hold the airframe horizontally (i.e., flat, not upright). With the other hand, dip the glue stick into the mixed J.B. Weld and insert the glue stick UNTIL THE 16" LINE ON THE END YOU ARE HOLDING IS FLUSH WITH THE FORWARD END OF THE AIRFRAME (the end opposite to the fin can). Use care not to touch the inside



of the airframe with the J.B. Weld. Apply the J.B. Weld in a ring to the interior of the airframe. The ring of epoxy should coat the internal circumference of the airframe from the 16" to the 15" mark from the forward end of the airframe.

It is important to avoid getting the J.B. Weld on other areas inside the airframe, so do the best you can. You will be able to clean up some later. Repeat the procedure as necessary until you have a full-solid ring of J.B. Weld inside the airframe. Remove glue stick and clean the J.B. Weld from your glue stick.

Before the J.B. Weld cures within the airframe, insert the GLR Hard-point Recovery System Anchor through the FORWARD end of the airframe. Hold the GLR Kevlar® Shock Cord and insert the GLR Hard-point Recovery System Anchor NUT SIDE IN FIRST, making sure that the free end of the GLR Kevlar® Shock Cord points FORWARD, or away from the GLR Fin-Can. Using the CLEAN glue stick, push the GLR Hard-point Recovery System Anchor all the way down **until the mark you made on the glue stick is even with the FORWARD end of the airframe.** Once in place, immediately take a moistened paper towel with alcohol or thinner on the end of the glue stick and swab out the inside of the airframe removing J.B. Weld where it should not be. This is important because you do not want your recovery system hanging up on clumps of J.B. Weld. **AVOID**

## MOVING THE JUST PLACED GLR HARD-POINT RECOVERY SYSTEM ANCHOR.



**IMPORTANT:** Once the GLR Hard-point Recovery System Anchor is in place, hold the airframe upside down with the FORWARD end pointing to the ground and the GLR FinCan (AFT end) up. This prevents J.B. Weld

from dripping down the motor tube section of the airframe (which would prevent the insertion of a motor casing). It is also a good idea to check that the J.B. Weld is not running down the FORWARD end of the airframe as well. This could interfere with your recovery components insertion. If J.B. Weld does drip forward you can clean it as explained above. **If the GLR Hard-point Recovery System Anchor slides forward and is not stable in the airframe, place the airframe in a more horizontal position.** Allow the J.B. Weld to fully cure.

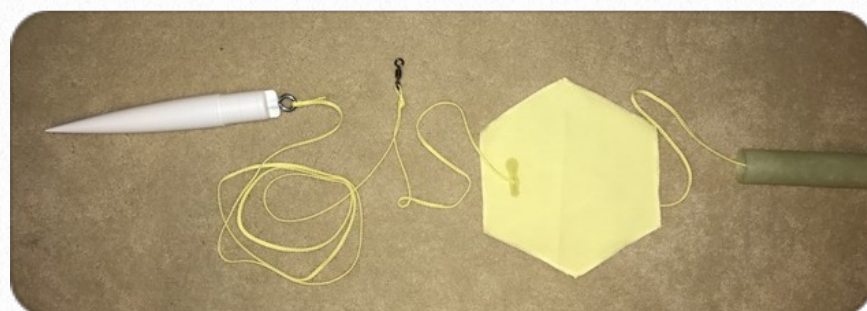
9. GLR provides a high quality Kevlar® Parachute Heat Shield to protect your parachute from the heat generated that occurs as a result of the ejection charge deploying your recovery



system when your rocket reaches apogee. Slide the GLR Kevlar® Parachute Heat Shield onto the free end of the GLR Kevlar® Shock Cord. Do not secure GLR Kevlar®

Parachute Heat Shield to the GLR Kevlar® Shock Cord; just let the GLR Kevlar® Parachute Heat Shield slide freely.

10. Slide the swivel on to the free end of the GLR Kevlar® Shock Cord - it will be used in step 13.
11. Screw the eyebolt into the base of the GLR Pinnacle Nosecone.
12. Tie the free, unused end of the GLR Kevlar® Shock Cord to that eyebolt.
13. A dab of epoxy will prevent the knot from unraveling.



14. Grab the swivel and tie a small loop into



the GLR Kevlar® Shock Cord about 36" from the GLR Pinnacle Nosecone. This loop with the swivel will be the parachute attachment point. BE SURE THAT THE GLR KEVLAR® PARACHUTE HEAT SHIELD IS BELOW OR AFT OF THE LOOP (ON THE OTHER SIDE OF THE GLR Pinnacle Nosecone). The sequence is as follows: GLR Pinnacle Nosecone, eyebolt, GLR Kevlar® Parachute Heat Shield, loop with swivel, shock cord, chute protector, shock cord and airframe.

15. Carefully remove the parachute from that poly bag and hold the parachute by the shroud lines. Center or "even" the lines at the apex

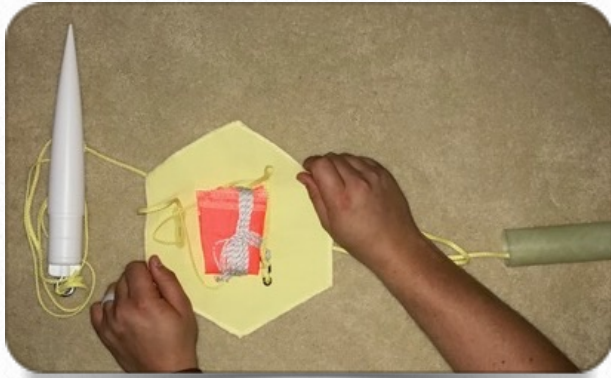


held with your finger. Slide the shroud lines together through the free end of the swivel and open the shroud lines enough to allow the parachute to slide through and knot down onto the swivel.

The attachment point of the swivel is critical. When the rocket descends you don't want the airframe and GLR Pinnacle Nosecone banging into each other so there needs to be adequate and appropriate spacing of the parts. The final photo in this manual will show how the rocket will look during the deployment so you can see how all of the parts are interacting.

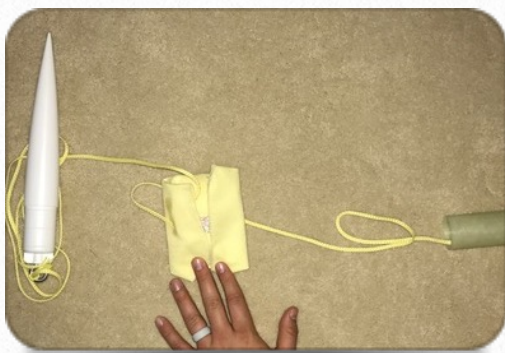
## RECOVERY SYSTEM PREPARATION

1. To prepare the rocket for flight, insert most of the GLR Kevlar® Shock Cord into the airframe first. Do this by creating accordion lengths of cord about 3-4" long, then insert into the tube. Leave about 3-4 feet of cord out.



2. Roll up the parachute. Then slide up the protector towards the chute. Do

NOT slide the protector all the way to the chute, but instead stop about 1 foot away. Then



lay some GLR Kevlar® Shock Cord into the protector, then lay the chute in the pad too.

3. Fold the protector around the chute like a burrito and insert into airframe.

You must position the heat pad so that it protects the chute from scorching. Fold is as tight as possible. Should you find the “burrito” to



tight for the airframe, shake some corn starch on the “bur-

rito” and it should slide much easier.

4. Slide the GLR Pinnacle Nosecone onto airframe. The GLR Pinnacle Nosecone should be snug but not tight onto the airframe. If the GLR Pinnacle Nosecone is too loose, use a

piece of masking tape on the shoulder of the GLR Pinnacle Nosecone to snug the fit. If too tight sand gently with 240 grit sandpaper. Remember, the chute is deployed when HOT gases from ejection charge expand in the airframe, popping the GLR Pinnacle Nosecone off, so you want a snug fit - not too tight, not to



loose.

### Attaching the Rail Guides & Spacers

1. Begin by marking a line along the length of the airframe section. Angle aluminum (1" by 1") is particularly helpful because when laid on a tube, it allows one to mark a straight line on a curved surface. You may want to make it a permanent part of your rocket toolbox. Make sure





that the line is between two of the fins, otherwise the fins will interfere with the rail.

2. Measuring from base of the rocket to base of rail guide, place one rail guide about 8" up from the aft end of the rocket and the other about 24". Then trace each rail guide on the airframe. Remove rail guides.

3. Mark, with the angle aluminum, the center of the rail guide spacers.

4. Below are the instructions to attach the rail guides and spacers if you bought the optional GLR Slimline Nozzle Retainer and the required GLR Rail Guide Spacers. The instructions are exactly the same for both set ups except you will not use the GLR Rail Guide Spacers if you did not upgrade your rocket. Lightly sand the attachment points on the airframe as well as the



GLR Rail Guide and the GLR Rail Guide Spacers for good adhesion. Mix J.B. Weld and attach first the GLR Rail Guide to the GLR Rail Guide Spacer and then attach the GLR Rail Guide Spacer and GLR Rail Guide to the points on the airframe. While curing, sight down the tube to check for good alignment. It is also a good idea to place some masking tape on the rail guides lightly securing them to the spacers and securing the spacers to the airframe. The masking tape will prevent a "drooping" of the guide system as the J.B. Weld sets. It is advisable to rest your rocket on a counter so that the GLR FinCan is hanging off the edge; this will allow the GLR Rail Guide and the GLR Rail Guide Spacers upright.

### **Vent Holes in Airframe - - IMPORTANT!**

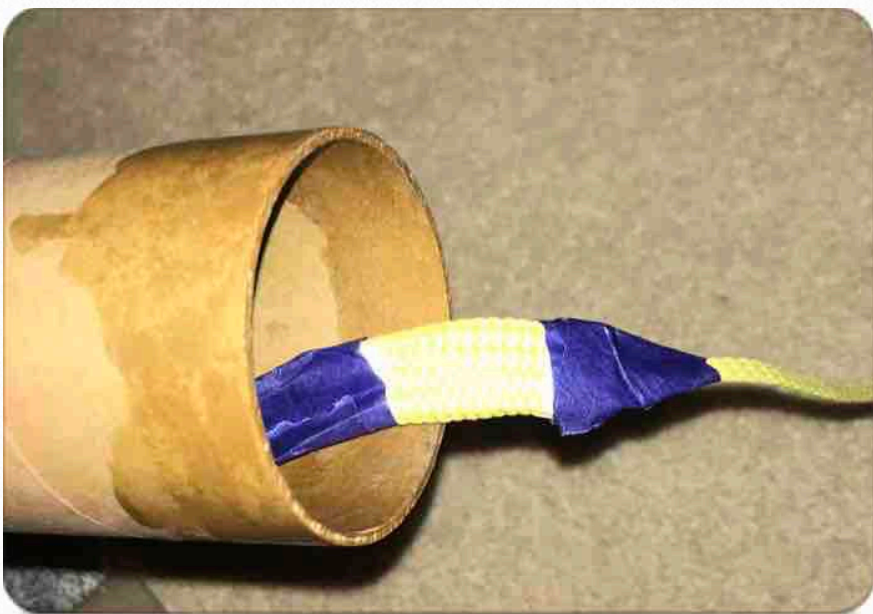
**REMOVE YOUR RECOVERY SYSTEM BEFORE COMPLETING THIS SECTION!!!**

Because the air pressure is reduced at high altitudes, you will need to relieve the internal pressure in the recovery compartment; otherwise the GLR Pinnacle Nosecone will pop off the airframe during ascent. To avoid this, drill, opposite the rail guides, one  $3/32$ " hole about 13" back from the tip of the GLR Pinnacle Nosecone, another at 21" from the tip of the GLR Pinnacle Nosecone. These holes are absolutely necessary for a safe flight. Do not make the holes any larger or you will risk reducing the effectiveness of the ejection charge.

## Recommendations

With fiberglass, lightly sand the rocket with 240-400 grit paper, prime and sand.

Paint with a good quality paint like Krylon or an auto engine paint that will withstand the heat created by the friction during flight.



## Finishing with Magnaframe

Protect the Rocket from Zippering.

Zippering is when the ejection charge is too great and the impact of the airframe and the shock cord is so violent that the shock cord literally rips or zips the airframe. To strengthen the Magnaframe airframe and reduce the potential for zippering you can place a small amount of cyanoacrylate (super glue) on the Forward 1/2" to 1" of the airframe. Spread the glue on the outside, inside and edge of the airframe end and let it set completely. Obtain from your local



hardware store some DAP Plastic Wood. It doesn't matter the color. Prime the phenolic airframe with extra thick filler spray primer. With a gloved finger, extrude a small amount of the DAP Plastic Wood and trace the fine grooves of the Phenolic Airframe and deposit the DAP Plastic Wood into the grooves. Be conservative because all that is not in the groove must be sanded away. That said, the material does shrink a bit as it dries, so it must be left a little high. When the DAP Plastic Wood is completely set up, sand the airframe to a smooth finish.

Paint with a good quality paint like Krylon or an auto engine paint that will withstand the heat created by the friction during flight.



## Safety Code and Waiver

Giant Leap Rocketry, LLC (herein referred to as GLR) has exercised reasonable care in the design and construction of our products and carefully inspects every product prior to shipment. However, since GLR cannot control the use of our products or information provided once sold, we cannot and do not warrant the products or information included herewith or the performance or results obtained by using our products or information. Our products and information are provided "AS IS". GLR makes no warranties of any kind, either expressed or implied, including but not limited to, non-infringement of third party rights, merchantability, or fitness for a particular purpose with respect to the product and any related published materials. To the extent you use or implement our products or information in your own setting, you do so at your own risk. In no event will GLR be liable to you for any damages arising from your use or, your inability to use our products or information, including any lost or damaged property, or other incidental or consequential damages, even if GLR has been advised of the possibility of such damages, or for any claim by another party. Lack of care can be dangerous. By purchasing our materials you agree to the above conditions and to use our products at your own risk. You must abide by the following safety guidelines: (for more info, see [www.tripoli.org](http://www.tripoli.org)) The following is a con-

densed version of the NAR/TRA HIGH POWER SAFETY CODE. The complete code can be found in the handbooks of the organizations.

1. Only a person who is a certified flyer shall operate or fly a high power rocket.
2. Must comply with United States Code 1348, "Airspace Control and Facilities", Federal Aviation Act of 1958 and other applicable federal, state, and local laws, rules, regulations, statutes, and ordinances.
3. A person shall fly a high power rocket only if it has been inspected and approved for flight by a Safety Monitor for compliance with the applicable provisions of this code.
4. Motors.
  - 4.1 Use only certified commercially made rocket motors.
  - 4.2 Do not dismantle, reload, or alter a disposable or expendable high power rocket motor, not alter the components of a reloadable high power rocket motor or use the contents of a reloadable rocket motor reloading kit for a purpose other than that specified by the manufacture in the rocket motor or reloading kit instructions.
5. A high power rocket shall be constructed to withstand the operating stresses and retain structural integrity under conditions expected or known to be encountered in flight.
6. A high power rocket vehicle intended to be propelled by one or more high power solid propellant rocket motor(s) shall be constructed using lightweight materials such as paper, wood, plastic, fiberglass, or, when necessary, ductile metal so that the rocket conforms to the other requirements of this code.
7. A person intending to operate a high power

rocket shall determine its stability before flight, providing documentation of the location of the center of pressure and center of gravity of the high power rocket to the Safety Monitor, if requested.

8. Weight and Power Limits. 8.1 Ensure that the rocket weighs less than the rocket motor manufacturer's recommended maximum liftoff weight for the rocket motor(s) used for the flight. During pre-flight inspection, The Safety Monitor may request documentary proof of compliance. 8.2 Do not install a rocket motor or combination of rocket motors that will produce more than 40,960 newton-seconds of total impulse (4.448 newtons equals 1.0 pound).

9. Recovery. 9.1 Fly a high power rocket only if it contains a recovery system that will return all parts of it safely to the ground so that it may be flown again. 9.2 Install only flame resistant recovery wadding if wadding is required by the design of the rocket. 9.3 Do not attempt to catch a high power rocket as it approaches the ground. 9.4 Do not attempt to retrieve a high power rocket from a place that is hazardous to people.

10. Payloads. 10.1 Do not install or incorporate in a high power rocket a payload that is intended to be flammable, explosive, or cause harm. 10.2 Do not fly a vertebrate animal in a high power rocket.

11. Launching Devices 11.1 Launch from a stable device that provides rigid guidance until the rocket has reached a speed adequate to ensure a safe flight path. 11.2 Incorporate a jet deflector device if necessary to prevent the rocket motor

exhaust from impinging directly on flammable materials. 11.3 A launching device shall not be capable of launching a rocket at an angle more than 20 degrees front vertical. 11.4 Place the end of the launch rod or rail above eye level or cap it to prevent accidental eye injury. Store the launch rod or rail so it is capped, cased, or left in a condition where it cannot cause injury.

12. Ignition Systems. 12.1 Use an ignition system that is remotely controlled, electrically operated, and contains a launching switch that will return to "off when released.

12.2 The ignition system shall contain a removable safety interlock device in series with the launch switch. 12.3 The launch system and igniter combination shall be designed, installed, and operated so the liftoff of the rocket shall occur within three (3) seconds of actuation of the launch system. If the rocket is propelled by a cluster of rocket motors designed to be ignited simultaneously, install an ignition scheme that has either been previously tested or has a demonstrated capability of igniting all rocket motors intended for launch ignition within one second following ignition system activation. 12.4 Install an ignition device in a high power rocket motor only at the launch site and at the last practical moment before the rocket is placed on the launcher.

13. Launch Site. 13.1 Launch a high power rocket only in an outdoor area where tall trees, power lines, and buildings will not present a hazard to the safe flight operation of a



high power rocket in the opinion of the Safety Monitor. 13.2 Do not locate a launcher closer to the edge of the flying field (launch site) than one-half the radius of the minimum launch site dimension stated in Table 1. 13.3 The flying field (launch site) shall be at least as large for a given impulse as stated Table 1 of the Tripoli safety code. See [www.tripoli.org](http://www.tripoli.org) <<http://www.tripoli.org>> . 14. Launcher Location 14.1 Locate the launcher more than 1,500 feet front any occupied building. 14.2 Ensure that the ground for a radius of 10 feet around the launcher is clear of brown grass, dry weeds, or other easy-to-burn materials that could be ignited during launch by the exhaust of the rocket motor. 15. Safe Distances. 15.1 No person shall be closer to the launch of a high power rocket than the person actually launching the rocket and those authorized by the Safety Monitor. 15.2 All spectators shall remain within an area determined by the Safety Monitor and behind the Safety Monitor and the person launching the rocket. 15.3 A person shall not be closer to the launch of a high power rocket than the applicable minimum safe distance set forth in Table 2 of the Tripoli Safety code. See [www.tripoli.org](http://www.tripoli.org) <<http://www.tripoli.org>> . 16. Launch Operations. 16.1 Do not ignite and launch a high power rocket horizontally, at a target, or so the rocket's flight path goes into clouds or beyond the boundaries of the flying field (launch site). 16.2 Do not launch a high power rocket if the surface wind at the launcher

is more than twenty (20) miles per hour. 16.3 Do not operate a high power rocket in a manner that is hazardous to aircraft. 17. Launch Control. 17.1 Launch a high power rocket only with the immediate knowledge, permission, and attention of the Safety Monitor. 17.2 All persons in the launching, spectator, and parking areas during a countdown and launch shall be standing and facing the launcher if requested to do so by the Safety Monitor. 17.3 Precede the launch with a five (5) second countdown audible throughout the launching, spectator, and parking areas. This countdown is given by the person launching the rocket, the Safety Monitor, or other flying site operating personnel. 17.4 Do not approach a high power rocket that has misfired until the safety inter-lock has been removed or the battery has been disconnected from the ignition system, one minute has passed, and the Safety Monitor has given permission for only a single person to approach the misfired rocket to inspect it. I understand and will at all times conduct myself with the understanding that the above stated risks and safety procedures; (a) are not necessarily all of the risks, (b) that even by observing the above procedures there remain RISKS OF INJURY OR DEATH from HIGH POWER ROCKETRY, (c) that the utmost in attention and prudence must be exercised at all times. By purchasing this product(s) from GLR, you agree to: (1) Assume all of the risks, damages, injury, or even death. (2) Assume the obligation to exercise the utmost

care in pursuit of my activities at this event. (3)  
that you must be over 18 years old (for motor  
purchase and use). GLR cannot be held respon-  
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tions.