



BALLISTIC RECOVERY SYSTEMS, INC.

**OWNER'S MANUAL AND GENERAL INSTALLATION GUIDE
FOR
BRS-6™ EMERGENCY PARACHUTE RECOVERY SYSTEMS**

(Models: 600, 800, 1050, 1350, 1350HS, 1600, & 1800)

IMPORTANT NOTICE: Owners **MUST** completely read this manual. As an owner of a BRS system, it is *absolutely mandatory* that you completely read this manual before installing or using your new unit. Failure to properly install, maintain, and/or use the BRS system could result in personal injury or even death to you or your passengers, and damage to your aircraft.

BRS Part № 020002-01, Revision A

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This manual complies with applicable sections of ASTM F 2316,
"Standard Specification for Airframe Emergency Parachutes
for Light Sport Aircraft"

This manual supersedes and replaces all previous
BRS 6 Owner's Manuals

WARNING

Use of the BRS (ballistic recovery system) unit is for emergency situations only. Such use may subject you to mishap, injury, and even death. Since BRS cannot govern use of the unit, BRS Inc. hereby disclaims all liability.

Unauthorized modification of any component part of the BRS unit, or failure to strictly follow the procedures and directions set forth in this manual or supplemental material provided by BRS, can result in deployment failure and personal injury or death to the pilot and any passengers aboard the aircraft.

Proprietary Notice

The information contained in or disclosed by this document is considered proprietary to Ballistic Recovery Systems, Inc. This document and the items and information contained or disclosed within shall not be used, copied, or reproduced in whole or in part, nor shall the contents be revealed in any manner to any person unless written permission is obtained from Ballistic Recovery Systems, Inc.

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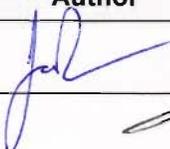
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Information for Emergency Personnel
BRS™-6 System Parameters

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INTRODUCTION

Congratulations on the purchase of your new BRS-6™ Emergency Parachute System, what we believe to be the highest quality, most innovative product of its kind. With worldwide sales exceeding 31,000 units and over 260 saved lives to its credit, BRS has the most successful and popular systems available.

BRS Emergency Parachute Systems utilize a manually activated, solid propellant rocket motor to extract a round, non-steerable parachute and recover the aircraft in life-threatening emergency situations. With adequate altitude, it is designed to then lower the airplane to the ground at a survivable rate of descent. Current products are the result of nearly 30 years of BRS experience in designing, testing, manufacturing, and servicing ballistically deployed parachutes for aircraft. Functional and structural reliability have been essential to their successful development.

BRS has sold units for over 350 different types of ultra-light, LSA, experimental aircraft, and military unmanned aerospace vehicles (UAVs). In addition, there are FAA-certified systems currently installed on every Cirrus Design SR-20 and SR-22 aircraft, and select Cessna models (C150, C172, and C182) as an aftermarket STC product. The use of proven parachute and rocket motor technology has been a key factor in this endeavor. The materials, components, design methods, and production methods used in the BRS solid propellant rocket motors, parachutes, and related components have been adapted from military applications that have evolved through hundreds of projects over the past several decades. BRS Inc. maintains that our units have been tested under more conditions, in a greater selection of aircraft, and through a broader variety of potential use modes than any other emergency backup parachute system intended to recover aircraft and occupants together.

While the BRS Emergency Parachute System will not make your flying absolutely safe, it will provide you with additional safety, if used according to this manual and with common sense.

BRS Incorporated is a publicly held company based in South St. Paul, Minnesota. A full-time staff is available to assist you with any needs you may have relative to your new purchase of a BRS unit. If you have questions of any type, feel free to contact the company using the following information:

BRS, Incorporated
380 Airport Road
South St. Paul, MN 55075-3541 • USA

Telephone: (651) 457-7491
(763) 226-6110 (Emergency Only)
FAX: (651) 457-8651

Email: info@BRSparachutes.com
Website: www.BRSaerospace.com

Hours: M-F, 8:00 AM to 5:00 PM, CST

This document was written with owners and potential owners in mind, giving a general overview of the BRS product line, safety information, operation, and maintenance. In addition, this document provides a general overview of the most critical aspects of a parachute installation to be considered when planning the integration with your aircraft. We have also added a section at the end expressly for emergency personnel. This section will be beneficial to emergency workers who may not have heard of our products, yet desire to know more about them in the event of an accident. Please keep in mind that this document is not tailored to any particular aircraft and was kept generic enough to cover most applications.

In most cases, BRS will provide additional installation instructions and guides for your particular aircraft to supplement this document. *However, for custom orders, it is very likely that you may not receive any supplemental instructions, since it is cost-prohibitive to develop a complete set of instructions for an order of one. Instead, we will most likely send previously made drawings of different but similar installation intent.*

IMPORTANT NOTICE: Owners MUST completely read this manual. As an owner of a BRS system, it is *absolutely mandatory* that you completely read this manual before installing or using your new unit. Failure to properly install, maintain, and/or use the BRS system could result in personal injury or even death to you or your passengers, and damage to your aircraft.

Before purchasing a BRS product for non-certified aircraft, each customer shall understand and accept in writing the following disclaimer:

- BRS products are not designed for a specific aircraft
- BRS's representations and warranties regarding this product, including, without limitation, the performance specifications of this product shall only apply to the extent the product is used within the scope of its formal Product Specification. BRS Product Specifications may be obtained by contacting BRS.
- Any reference by BRS to an aircraft model, including, without limitation, illustrations and installation guidance, is based on the informal accumulation of customer experiences that have been shared with BRS and are now being passed on to subsequent customers without any formal testing by BRS, without any agreement with the manufacturer of such aircraft model, and without ongoing scrutiny or formal consideration by BRS.
- The customer shall be responsible for the appropriate installation and maintenance of this product. BRS will not, in any event, be responsible for any installation or maintenance even if the customer has discussed the specific installation with BRS and received what the customer believes to be specific instructions.
- The installation of a BRS product will affect the weight and balance of the aircraft and may affect its handling.

If you have any questions or are unsure of any portion of this manual, please call or write *before proceeding in error*. BRS wishes for you to fully understand the proper use of the BRS system for your safety and that of your passengers.



Failure to read and understand this manual could cost you your life!

BRS uses the standard ANSI attention symbols and words throughout this manual. **Users or readers are highly advised to observe text accompanied by all such symbols and words and treat them as important safety instructions.**

▲ DANGER – This symbol appears where the information describes an *imminently* hazardous situation which, if not avoided, **WILL** result in death or serious injury. This symbol is used only for the most extreme situations.

▲ WARNING – This symbol appears where the information describes a *potentially* hazardous situation which, if not avoided, **COULD** result in death or serious injury.

▲ CAUTION – This appears where the information describes a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or where an alert against unsafe practices is useful.

In addition, other important information will be highlighted with:



TERMS AND CONDITIONS

*These terms and conditions shall apply to all offers, sales, agreements, contracts or other arrangements between Buyer and Ballistic Recovery Systems, Inc. ("BRS") regarding the sale by BRS of parachute systems and other goods to Buyer ("BRS Unit"). These terms and conditions shall be read in conjunction with any additional terms and conditions in any purchase order or other agreements between Buyer and BRS to the extent possible, but shall control over such agreements to the extent they conflict. **Terms and conditions are subject to change without notice.***

Buyer is required to pay for order in its entirety at time of order placed.

The purchase price set forth above does not include any taxes or fees, including but not limited to sales use tax, excise tax or customs fees, if applicable. All such taxes and fees are in addition to the purchase price and are the sole and exclusive responsibility of, and shall be paid by, Buyer. The purchase price set forth above shall be subject to increase without notice by the amount of any sales, use or excise tax levied or charged either by the federal, state, and county, city or other government agency.

Risk of loss of the BRS Unit(s) shall pass to Buyer at the time of delivery of such Unit(s) to a common carrier or Buyer's delivery agent at the FOB (or ex-works) shipping point, which shall be BRS' facility. Buyer shall be solely responsible for any fire, theft, accident or other insurance Buyer desires for delivery of any BRS Unit(s).

BRS shall not assume any risk or liability for delay or non-fulfillment under this Agreement due to fire, explosion, flood, storm, acts of God, war, strikes, breakdown, fires, governmental orders, inability to obtain necessary materials or components or other causes beyond BRS' control. Manufacture, shipment and delivery are subject to any prohibition, restriction, priority, allocation, regulation or condition imposed by or on behalf of the United States of America, which may prevent or interfere with fulfillment of this order.

Except as otherwise set forth herein, all sales are final. Claims for errors, deficiencies or imperfections shall not be considered unless made within thirty (30) days after receipt of BRS Unit by Buyer. BRS shall, at BRS' sole and exclusive discretion, either replace such non-conforming BRS Unit or credit Buyer for the price of such non-conforming BRS Unit within a reasonable time of BRS' receipt of such non-conforming BRS Unit.

All claims for defective BRS Units must be presented to BRS, in writing, within one (1) year after date of delivery of such BRS Units. Failure of Buyer to give such notice shall constitute a waiver by Buyer of all claims with respect to such defective BRS Units. BRS shall be given an opportunity to verify the existence of any alleged defect. Returns must be authorized by acquiring an RMA number (return material authorization) from BRS Inc. prior to shipment back to BRS Inc facilities.

In the event a defective or non-conforming BRS Unit shall be replaced by BRS or in the event BRS shall refund the sales price received from Buyer for such defective BRS Units, Buyer shall return the non-conforming BRS Units to BRS in strict accordance with BRS' written instructions concerning shipping, handling, insurance and other matters as to which BRS may issue instructions.

BRS shall not be liable for any claims for labor or consequential damages and BRS Unit(s) may not be returned except by permission of BRS. BRS accepts no responsibility for breakage, damage or losses occurring after delivery by BRS to a common carrier or Buyer's delivery agent, to whom all such claims must be referred directly.

BRS warrants to Buyer that BRS Unit(s) subject to this Agreement shall be free from defects in workmanship or material. BRS' liability for breach of warranty for defective BRS Units delivered to Buyer under this Agreement shall be limited, at BRS' option, to: replacing or repairing such defective BRS Units; or refunding the sales price received by BRS for such defective BRS Units.

THE EXPRESSED WARRANTIES CONTAINED HEREIN ARE IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION THE WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

BUYER'S SOLE REMEDY IN THE EVENT OF BREACH BY BRS OF ANY OF THE WARRANTIES CONTAINED HEREIN SHALL BE THEIR REPAIR OR REPLACEMENT, AT BRS' OPTION, OF THE NON-CONFORMING BRS UNIT(S). BRS SHALL NOT BE LIABLE FOR DAMAGES, INCLUDING WITHOUT LIMITATION SPECIAL, INCIDENTAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, ARISING OUT OF OR IN CONNECTION WITH THE PERFORMANCE OF THE BRS UNIT OR ITS USE BY BUYER. BRS' MAXIMUM AGGREGATE LIABILITY FOR LOSS OR DAMAGE ARISING UNDER, RESULTING FROM OR IN CONNECTION WITH THE SUPPLY OR USE OF THE BRS UNIT, OR FROM THE PERFORMANCE OR BREACH OF ANY OBLIGATIONS IMPOSED HEREUNDER OR OTHERWISE, WHETHER SUCH LIABILITY ARISES FROM ANY ONE OR MORE CLAIMS OR ACTIONS FOR BREACH OF CONTRACT, TORT (INCLUDING NEGLIGENCE), DELAYED COMPLETION, WARRANTY, INDEMNITY, STRICT LIABILITY OR OTHERWISE, SHALL BE LIMITED TO THE AMOUNT ACTUALLY RECEIVED BY BRS FROM BUYER FOR THE PURCHASE OF SUCH UNIT(S).

BRS and Buyer consent to jurisdiction over any actions or legal proceedings arising out of or relating to the sale and purchase of any BRS Unit(s) under these terms and conditions of the courts of the State of Minnesota and/or the Federal District Courts, Fourth Division, State of Minnesota. The parties expressly agree that Minnesota shall be the exclusive forum for any such actions or legal proceedings.

In the event BRS is required to institute any action or legal proceeding to enforce any of the terms and conditions herein, BRS shall be entitled to recover all of its court costs and reasonable attorneys' fees and other related costs, expenses and disbursements arising out of such legal proceedings in which BRS prevails.

If any term or condition herein shall be found by a court of reasonable jurisdiction to be invalid, void or unenforceable, in whole or in part, such decision shall not affect the validity of any remaining term or condition. The remaining terms and conditions shall stand in full force and effect, and shall in no way be affected, impaired or invalidated.

WARNING

Use of the BRS (ballistic recovery system) unit is for emergency situations only. Such use may subject you to mishap, injury, and even death. Since BRS cannot govern use of the unit, BRS hereby disclaims all liability.

Modification of any component part of the BRS unit, or failure to strictly follow the procedures and directions set forth in this manual or supplemental material provided by BRS, can result in deployment failure and personal injury or death to the pilot and any passengers aboard the aircraft.

This manual includes general guidelines for the mounting, use, and care of the BRS unit. Specific mounting challenges may occur on your aircraft. If *any problems arise* in the mounting of your BRS unit to your particular aircraft, contact BRS immediately for assistance.

OBLIGATIONS OF THE OWNER

1. Before delivery

Some aircraft owners may independently choose the parachute system they will buy. The BRS factory may not even be directly involved in the purchase of a unit, especially those obtained through dealers or second-hand from previous customers. The only way for customers to gain factory advice on the correct unit for a given aircraft is to consult the factory *before* accepting delivery. BRS units are expected to be highly reliable pieces of equipment. They also feature long service lives. This is only possible if the BRS unit is correctly suited to the aircraft on which it will be installed.

BRS Inc. encourages careful selection of the most appropriate unit, and the factory will provide purchase consultation free of charge. Once the purchaser has accepted shipment of the unit it will be considered "used" and a restocking, re-inspection charge may be applied if a return is desired. If you are reading this, you most likely have already taken delivery of your BRS Emergency Parachute System. However, it is not too late! It is better to pay a small restock fee than to install a system that may not work when you need it most!

⚠ WARNING

- **When selecting the proper unit, purchasers must not exceed the recommended or stated forces, speeds, capacities, or other factors regarding the safe use of a BRS system.**
- **Even after following all the recommended procedures described by the factory, the possibility of injury or death still exists.**
- **Parachutes sometimes malfunction even when they are properly designed, built, assembled, packed, maintained, and used. The results of such malfunctions are sometimes injury or death.**

2. After delivery

When shipped domestically, BRS systems are typically shipped to the dealer /customer in two separate containers. One is a large box containing the parachute, rocket igniter w/launch tube, activation handle, aircraft attachment bridles, and other misc. mounting hardware and parts. The second, a smaller box, contains the parts necessary to assemble the ballistic rocket, including: rocket body w/lanyards, propellant, and bulkhead.

In some cases, you may not receive both boxes on the same day. However, if 2-3 days have gone by and you still have not received them, please contact BRS to help track your shipment.

After receipt, please open both boxes, remove all contents, and verify that all parts are there (each box may or may not come with a detailed shipping list of what is supposed to be included). If you feel something is missing, please contact BRS immediately. Even if you do not plan on installing your system soon, it is still important to review all contents. Customers will be charged for any missing components that are discovered after 90 days from time of shipment.

Within the small box you will find an even smaller box containing the rocket propellant and rocket body. On the outside of this box should be a set of instructions for assembly of your rocket. If you do not see these, please contact BRS for another copy. The rocket assembly instructions are not within this document.

NOTE: IF YOU PURCHASED THIS SYSTEM FROM A PRIVATE PARTY, you need to make sure that you have all the components from the original order. You can contact the BRS factory with the unit serial number at any time to find out what was originally shipped with the unit, when it was built, when it is due for service, etc. You may also find out if it is the correct parachute for your aircraft. Please refer to the later section about switching units to other aircraft. Although the original buyer may have never installed this BRS system, the unit you now own is considered used. All warranties are transferable within the time limits of the warranty, as long as the parachute is the correct unit for your aircraft and is installed in a manner consistent with the guidelines of this manual. Used BRS units hold their value well and can be economical purchases for pilots seeking the safety of a ballistic parachute system. However, no one is served (you especially!) if you avoid obtaining factory advice about a used system.



System Label Sample

Repack info

The serial number for your BRS unit is imprinted on a small data label which appears as a part of a larger label (see above sample). Along with the serial number, a date shows when the parachute must be repacked. In addition, there is a small data label on the rocket launch tube and on the rocket case itself which indicate when the rocket is due for replacement.



Please be aware that it is quite common for the repack dates and rocket replacement dates to be different!

If you have ordered your system well before you are ready to install it, it is wise to review the contents of each box to ensure that you have received all of the components. After that, the unit should be re-packaged and stored in a cool, dark location away from curious children and/or adults. Remember, your unit contains an igniter and rocket propellant, which still have hazard potential even if not completely assembled.

WARNING

- **Never point the BRS unit toward anyone—including you—at any time! Treat the BRS unit as a loaded gun!**
- **Do not tamper with or attempt to modify or repair the BRS unit at any time.**
- **Do not under any circumstances replace any missing items with materials obtained from another source unless approved by BRS. Do not assume you are buying the same quality parts, even if the part numbers appear to be identical. You have peace of mind that your unit has all factory-approved parts *only* when you have obtained them directly from BRS.**
- **If you have too little or too much harness length... if you have too little or too much housing line for the activating handle... if the brackets, clamps, or other mounting parts do not seem to fit your aircraft as specified, please contact the factory for further information *before* modifying any component! The hardware provided for your aircraft is meant to be used in a very specific manner.**
- **BRS has gone to considerable effort to assure your BRS unit will fit your airplane in a manner that the factory finds best. This means more than just how it looks or how well it seems to fit your aircraft. For example, the forces transmitted to the airframe on canopy opening can be considerable (3-7 Gs, depending on many variables). In addition, the dynamic responses of the aircraft to the deployment of a parachute are not well understood by many people. These two factors receive much attention from BRS engineers. Changing the attachment points can render a BRS unit inoperable because the mounting point(s) are insufficiently robust or because the point of attachment relative to the aircraft's center of gravity does not permit the desired flight dynamics.**
- **It is important that you follow instructions carefully or consult with BRS about any change in the installation. A seemingly minor change could render your BRS unit incapable of performing its job in an emergency, or could interfere with its proper operation.**

3. After installation



Once the installation has been completed, you are required (not merely requested) to send photographs depicting the installation directly to the BRS factory. These photographs—several may be needed to fully show the installation in good detail—must include:

- (1) mounting of the container/rocket assembly on your airframe,
- (2) routing of the stainless steel cable or Kevlar® harness system
- (3) routing and securing of the activating handle and cable housing
- (4) direction of rocket fire relative to the airframe
- (5) modifications to any BRS-supplied hardware

These photographs should be sent *at once* when the installation is completed. Send to the address given at the front of this manual or email digital photos to: photoreg@BRSparachutes.com. A BRS representative will review your installation and let you know if there is a problem. A follow up letter or email is sent out to let all submitters know that their installation has been reviewed and may suggest minor changes or request more photos.

While we demand you send us these photographs, we very much want you to understand that this protects **you most of all**. Sending in your photographs is the final “Quality Control” check. We seek to provide you with the most reliable emergency parachute system possible.

⚠ WARNING

This is for your benefit and safety. The inspection of photographs or actual installation is done *free of charge* to you. If you do not submit photo verification, you incur the risk that the BRS system, as you have installed it, may fail to work properly, which could cause injury or even death as well as damage to your aircraft.



To activate your 30 Day BRS Parts warranty (see above), you must return the Owner Registration Form as soon as possible after purchase. When you include installation photos, your warranty is extended to 1 full year! If you cannot find your Owners Registration Form, please contact BRS for a replacement.

If you do not return your completed Registration Form, it is possible that BRS will not have your current name and address. Without this information, BRS cannot notify you of important information. If you are not the original owner, please contact BRS with your information so our customer database can be updated.

BRS wants to help you get the most from your new BRS unit. One way the company can do so is to supply valuable information about upgrades and new safety features that are available. Another way is to keep you advised of any Service Bulletins that will assure your BRS unit will perform as expected. Additionally, BRS can also remind you when your unit needs periodic maintenance.

The maintenance schedule for BRS products is defined in this manual and it is **MANDATORY** that all owners follow this. If the maintenance schedule is not followed, the parachute must be placarded as “INOPERATIVE” until maintenance can be performed.

LIMITATIONS OF BRS SYSTEMS

1. Your BRS system *does* have a low-altitude limitation.

Your BRS unit is designed for the fastest possible operation and inflation of the parachute. This means it can work from much lower altitudes than a hand-deployed, spring-deployed, or pilot parachute-deployed emergency system.

This, however, **does not** mean it will work from too low an altitude. How low is too low? That is a valid question that can't be answered easily, because no simple answers are available.

In some of the life-saving situations BRS has experienced, the individual deploying the system felt he was less than 100 feet above the ground. Yet, the deployments were successful. BRS cannot guarantee this would ever happen again. The circumstances might have all been perfect for a low altitude deployment.

If the craft had its surfaces intact... if the craft was flying level at the moment of deployment... if the forward speed was generous... if the pilot pulled the handle without fumbling... if the system had been correctly installed... if the engine was shut down... if, if, if. All these ifs represent some, but not all, of the conditions that aid a rapid deployment. And if the situation is optimal, theoretical projections show deployment can be rapid enough to save the craft and occupant(s) from extremely low altitudes.

2. Your BRS *cannot* compensate for poor piloting or inexperience.

You should *not* expect that the BRS can suddenly make you a better pilot. While BRS believes you made the right choice in adding a BRS emergency backup system to your aircraft, it does not mean that now you are safe from all aviation disasters. It is merely a backup, another chance, and is only part of an overall program of aviation safety.

3. Your BRS *cannot* guarantee that you will not be injured after a deployment, or that your aircraft will not be damaged.

While it is likely that using a BRS unit could indeed save your life (in some situations), it is not at all *guaranteed* to save you from injury or death, nor your airplane from damage. Assume that only you are responsible for the safe operation of your flight, and that you have a BRS for additional safety against the time when your skills, planning, judgment, and careful equipment maintenance are still not enough. When you use an emergency parachute system, you have entered a realm of flight where the unpredictable is the norm.

4. You *must not* “experiment” with your BRS unit.

WARNING

In no case should you “experiment” with your BRS. You should not fire it on the ground just to see if it works. Not only may you injure someone standing innocently

nearby, but you will incur hundreds of dollars of expense to repack your parachute and replace your rocket. In addition, firing your BRS experimentally will render it unusable on your airplane until the factory has serviced your unit.

BRS SYSTEM BASICS

The following discussion is useful to better understand the basics of what you are about to install on your aircraft. You'll come to depend on it and you'll want to understand it.

1. The Parachute

Round, non-steerable parachutes are used for aircraft recovery because their purpose is simple, to slow an aircraft to a descent speed that is conducive to a safe touchdown. It is this simplicity that enhances their reliability.

Parachutes are fabricated from woven textiles in the form of fabrics, tapes, webbing, and thread. The basic structure of a round parachute (shown in Fig. 1) consists of the canopy and suspension lines. The **canopy**, which creates the aerodynamic drag, is made up of a series of fabric panels or "gores" sewn together to form its desired shape. The canopy has a **vent** at its center to allow some air to escape in a controlled manner and thus reduce oscillations and provide a stable descent. **Vent lines** are attached to the perimeter of the vent and routed symmetrically across its center to provide structural support and maintain its shape.

The **suspension lines** are attached to the "skirt" of the canopy and converge to a **riser** or set of risers at the opposite end. The canopy structural integrity is enhanced by a "skeleton" of tapes and webbings sewn nearly perpendicular to each other to the top surface of the canopy fabric. **Radial bands** run from opposite suspension line attachment points, across the top of the canopy. The **skirt band**, **vent band**, and **circumferential bands** run around the circumference of the canopy. The precise geometry of the canopy shape, positioning of the structural reinforcement and choice of materials are all adjusted for each particular application, striking a balance between opening characteristics, strength, stability and rate of descent.

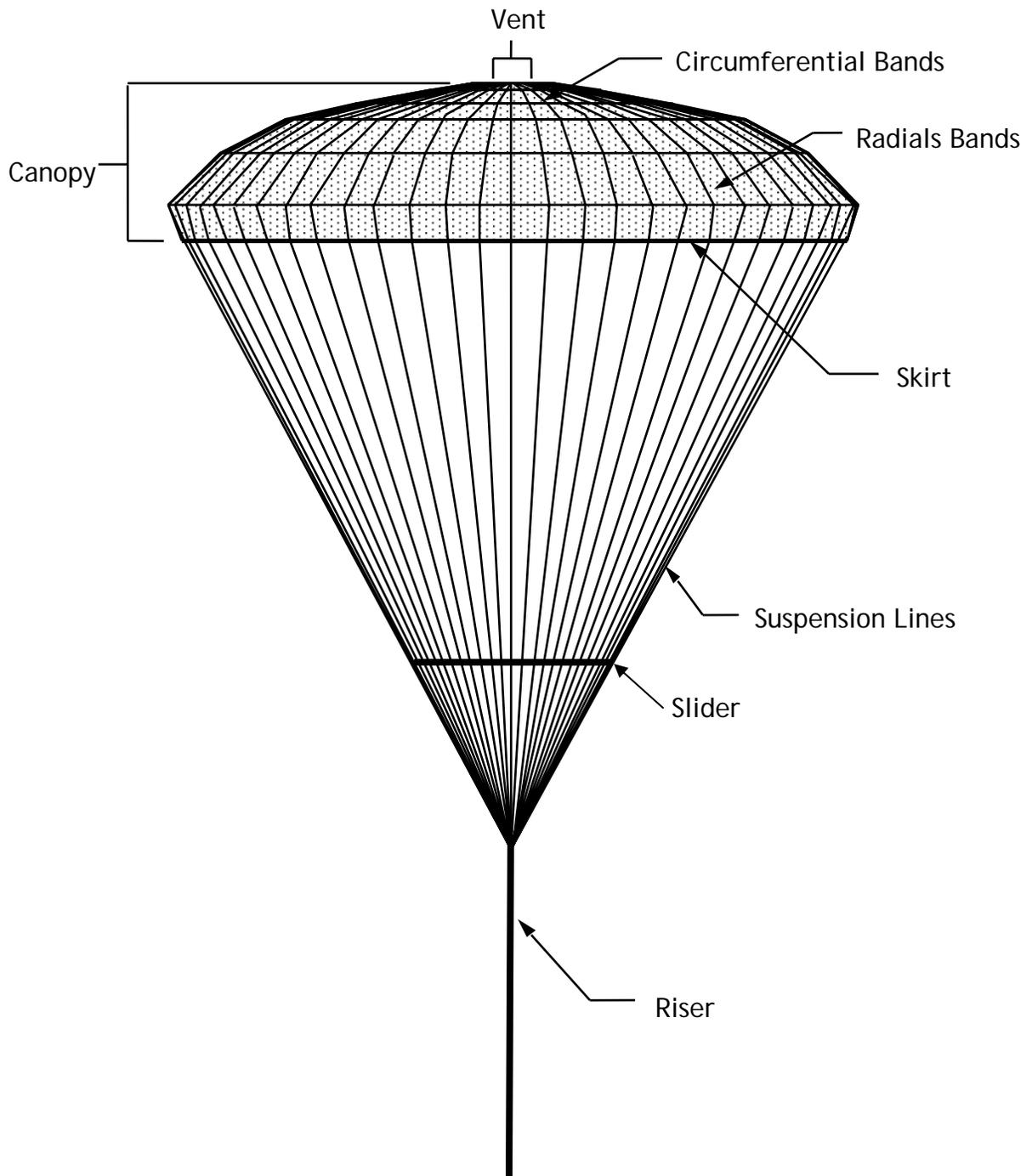


Figure 1.
BRS Parachute Assembly

With a few minor exceptions, all of the textile components in our parachute systems are fabricated from either Kevlar® or Nylon. The materials used in BRS parachutes, including the fabric, reinforcement tapes, suspension lines, and threads, are all woven to military or industry specifications that define specific parameters such as raw fiber materials, yarn count, yarn twist, weave type, and finish.

Parachute material strength requirements are ultimately based on deployment characteristics, or specifically, deployment loads. A typical deployment load profile begins with a snatch force which occurs when the parachute assembly is initially extracted from its container and pulled to full line stretch. This is usually not felt by the pilot/passenger. When air begins to fill the canopy, higher inflation loads result. The number and magnitude of the peak loads is dependent on airspeed at deployment, payload weight, and atmospheric conditions.

2. The Slider

After the parachute is completely extracted and exposed to the relative wind, it begins to inflate, generating drag forces to decelerate the airplane. The magnitude of these drag forces, or inflation loads, for a particular parachute design is a function of the airplane's weight, the airspeed at deployment, and the rate of inflation.

The inflation rate of BRS parachutes is controlled by a proprietary **slider**, an annular shaped fabric panel with metal grommets along its perimeter. The parachute suspension lines are routed through the grommets such that the slider is free to move along the suspension lines. The parachute is packed with the slider positioned at the top of the suspension lines. Since the diameter of the slider is significantly less than the open diameter of the canopy, it limits the initial open diameter of the parachute and its rate of inflation as shown in Fig. 2. Once the dynamic pressure acting on the system decreases to a safe level, the slider moves down the lines, allowing the parachute to inflate to its full diameter.

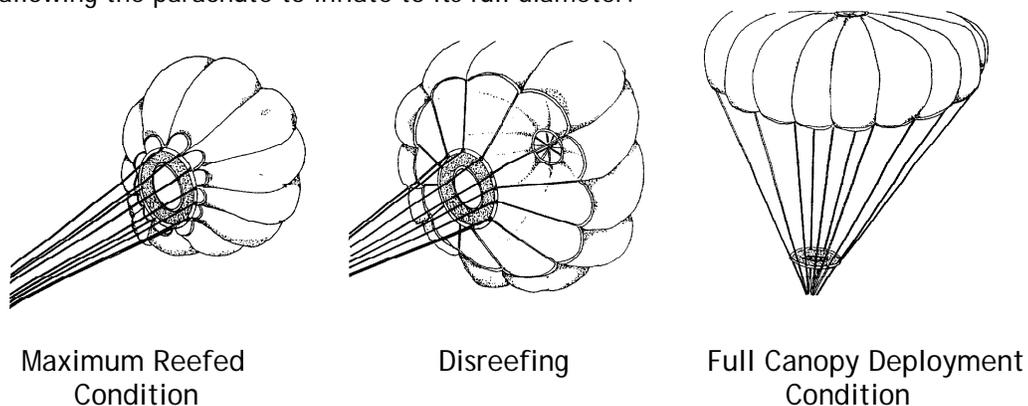


Figure 2.
BRS Annular Slider

Sliders can be "tuned" during development for a particular set of deployment conditions by adjusting their geometry. For example, increasing the size of the slider's vent will increase the airflow into the parachute and therefore increase the initial rate of inflation. Decreasing the fabric area will decrease the drag on the slider and allow it to disreef at a higher dynamic pressure, thereby increasing the final rate of inflation. BRS was the first to introduce and patent this technology for emergency parachute recovery systems (U.S Patent # 4,863,119).

3. The Rocket Assembly

All current BRS rocket motors use stored chemical energy in the form of a solid propellant to provide the thrust forces necessary to rapidly remove any enclosure cover and extract the parachute from its container. These rocket motors use a composite propellant, a heterogeneous mixture of ammonium perchlorate (AP) and aluminum powder (Al), the **oxidizer** and **fuel**. These are the most commonly used types of ingredients in modern solid propellants. A synthetic rubber **binder** is also necessary to provide a structural matrix to hold these ingredients together. Other typical propellant additives include burn rate modifiers to accelerate or decelerate combustion, curing agents to solidify the propellant at different rates, plasticizers to improve the processing properties, bonding agents to improve the chemical properties, and antioxidants to reduce chemical deterioration. The size, shape, and size distribution of the propellant's solid particles are also key factors in its burning characteristics.

Two versions of our larger rocket assemblies, the BRS 601 and BRS 901, illustrated in Fig. 3, consist of the **igniter, rocket motor base, and rocket motor**. The rocket motor components consist of the **motor case, aft bulkhead, propellant, and nozzle**. The motor case/aft bulkhead contains the propellant and serves as a pressure chamber when the propellant is burning. The composite propellant is cast into **grains**, or solid shaped masses that fit snugly inside the motor case. To provide consistent dimensional tolerances, the grains are cast inside a filament wound internal liner that also acts as an insulator to limit heat transfer to the motor case.

Our smaller rocket motors, the BRS300, BRS301, BRS440 and BRS460, do not utilize a rocket motor base, but instead attach directly to the igniter. They consist of a **motor case, propellant, nozzle**, and both an **aft bulkhead** and **forward bulkhead**, illustrated in Fig. 4.

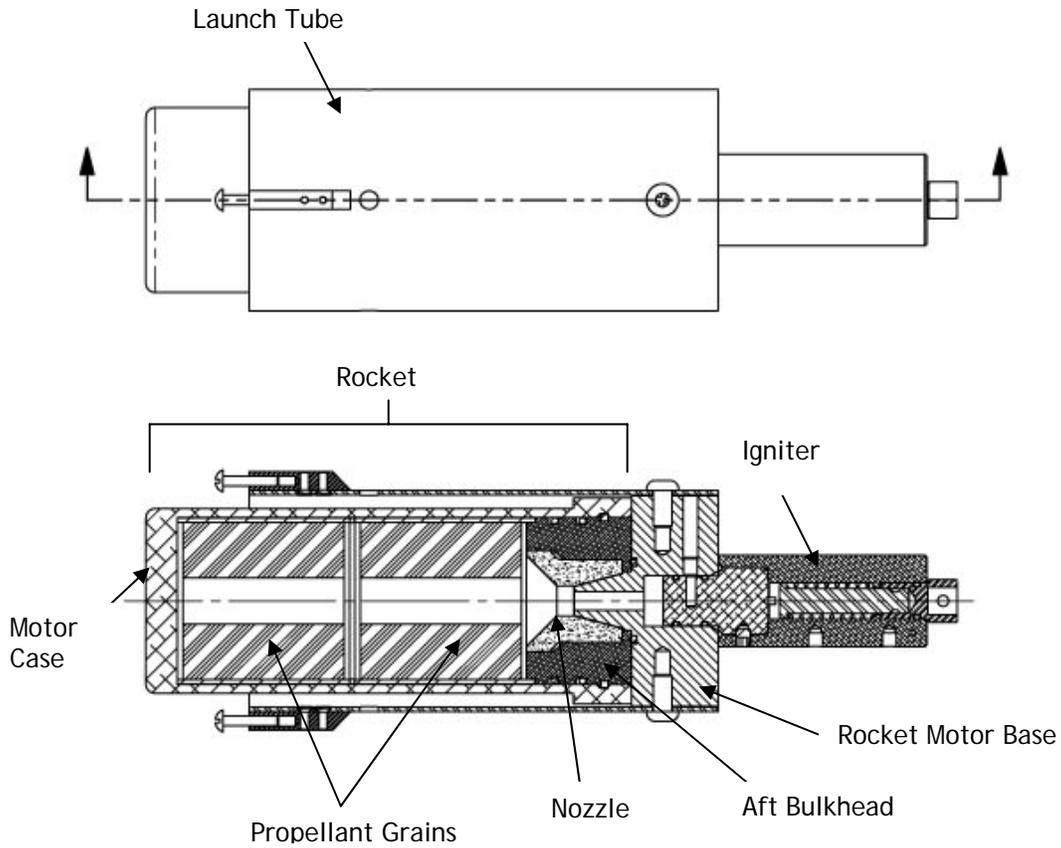


Figure 3: BRS-600/900 Rocket Diagram

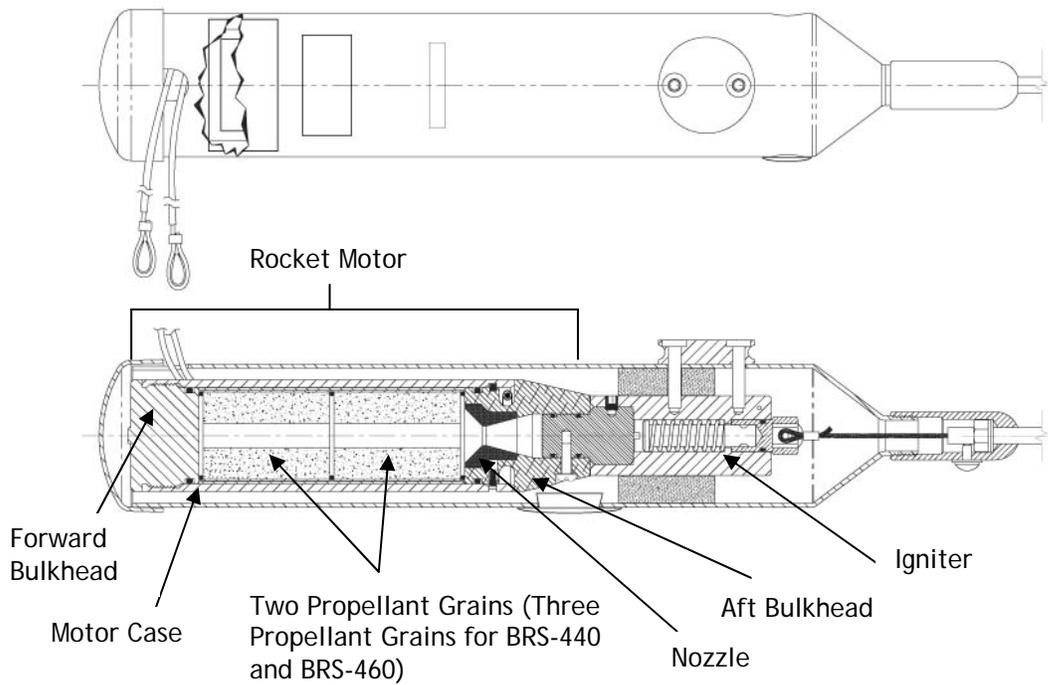


Figure 4: BRS-300/301/440/460 Rocket Diagram

The igniter, illustrated in a cut-away view in Fig. 5, is a mechanical device which requires no electrical source. The igniter consists of a **firing pin actuator**, a steel **spring**, a **plunger** to which the **activation cable** is attached, and two firing trains. Each firing train consists of a **firing pin** and **primer** which ignites a **primary booster** at the end of the igniter. In its normal position the firing pin actuator and plunger are interlocked with two small **ball bearings** held in place by the inner wall of the **igniter body**.

Pulling the activation cable compresses the spring and cocks the plunger. One half inch of plunger travel is required to release the ball bearings and allow the plunger to strike the firing pins with the stored energy of the compressed spring. The firing pins then strike the shot-gun primers which ignites a black powder and magnesium primary booster in the end of the igniter. The igniter is unarmed in its normal configuration since the spring is uncompressed and the plunger is separated from the firing pins by a 0.060 inch gap.

In the BRS 600 and 900 series rockets, the igniter primary booster ignites a secondary booster contained in the rocket motor base. The extra booster material is used to insure ignition of the larger rocket motor. The rocket motor base has a conical protrusion which sprays hot particles past the rocket nozzle and across the surface of the rocket motor's solid propellant grains. This extra booster is not present in the smaller BRS 300 or 400 series rockets.

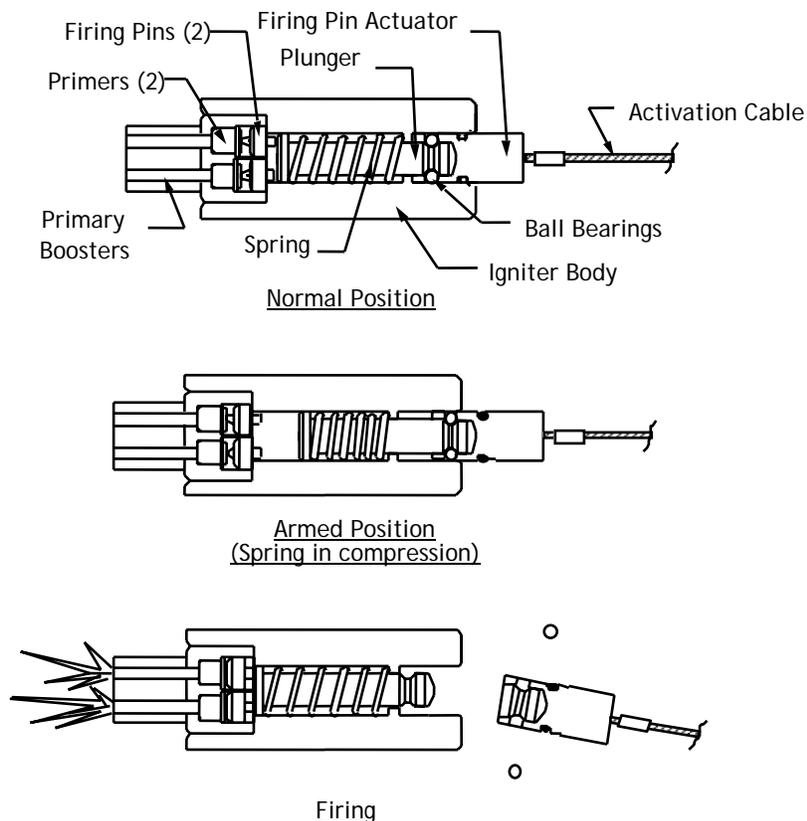


Figure 5: Igniter Activation Diagram

Once ignited, the grains will burn on all exposed surfaces to form hot gases that are exhausted through the nozzle. The propellant's performance is a function of its burning rate and the burning surface area of the grain. The geometry of the grain is therefore critical to achieving the desired thrust profile. Our rocket motors use grains with a cylindrical bores through their centers, or internal burning grains, to achieve the desired burn surface area.

Solid fuel motors have a flame, but this is not the problem some imagine for two reasons; one simple, one more complex. With an extremely high departure velocity in the first tenth of a second, the flame is gone before it can cause problems. The more complex explanation involves a pressure front set up by the ignited fuel. The main content of the rocket's exhaust is water vapor and non-flammable gases. These expand so rapidly that they will literally push away fuel fumes before they can get warm enough to ignite.

BRS currently certifies its solid-fuel rockets for twelve (12) years of service life. At that time, the old rocket must be properly disposed of and replaced with a new one. However, this means that a rocket shipped from BRS to a customer need *never* be returned to the factory for service, eliminating any owner difficulty in shipping hazardous goods.

4. The Activation Assembly

The rocket motor is activated by pulling a red activation handle mounted securely within reach of the pilot/passenger. This handle is connected to the rocket motor igniter with a flexible, stainless steel aircraft grade cable routed through a Teflon-lined housing. The handle is usually the only part of the system accessible to the pilot in flight.



Figure 6: BRS Activation Handle/Holder

Two separate and deliberate pilot actions are required to deploy BRS parachutes. The first action requires that the pilot remove the safety pin from the activation handle holder during the pre-flight inspection. The second action requires the pilot to pull the activation handle several inches out of the holder. The first few inches of motion take up cable slack that has been intentionally built into the system to prevent inadvertent activation due to flexing of the system or bumping the handle. The remaining motion (approximately ½") activates the rocket motor. Typical pull force requirements range from 30 to 70 lbs., depending upon friction variations in the routing, temperature, and overall length of cable/housing. This is why it's important to mount the handle in a location which provides sufficient mechanical advantage to the users.

The mechanical activation can be best compared to a firing sequence on a gun. While the analogy is not exact, the sequence is similar in that a cocking action occurs, followed by detonation of the primer (by propelling a hammer into dual igniters). In turn, the primers ignite the solid fuel. To the user, the two actions are transparent... one pull seems to do everything. Nonetheless the system indeed first cocks itself, *then* releases the hammer to contact the dual primers.

Proper installation of the activating housing and handle is imperative to proper operation.

⚠ WARNING

BRS owners must never tamper with the activation housing and handle assembly. The design intent of the assembly must be maintained for it to work properly. Any misassembled components could lead to serious injury or death.

5. The Bridles and Harnesses

The **Main Bridle** is the primary load bearing connection between the parachute and the aircraft directly, or between the parachute and multiple Harness attach straps, (as pictured below). On smaller, light-weight ultra-lights its very common to connect the Main Bridle to a single attach point on the aircraft, as they commonly have an attach point capable of supporting the entire aircraft.

Multiple **Harnesses** are required for frame type aircraft or other aircraft with structures which are incapable of carrying the parachute opening loads at a single point. Using the steel tube aircraft pictured below as an example, separate attach points are needed to spread the load to various parts of the structure, as it may be unlikely that a single point could absorb the parachute opening loads.

Depending upon the particular system and aircraft, BRS uses Kevlar® (and Nylon in limited conditions) webbing for risers, bridles, and aircraft connection harnesses. Some older units may have Stainless Steel cables used in lieu of a Kevlar bridle.

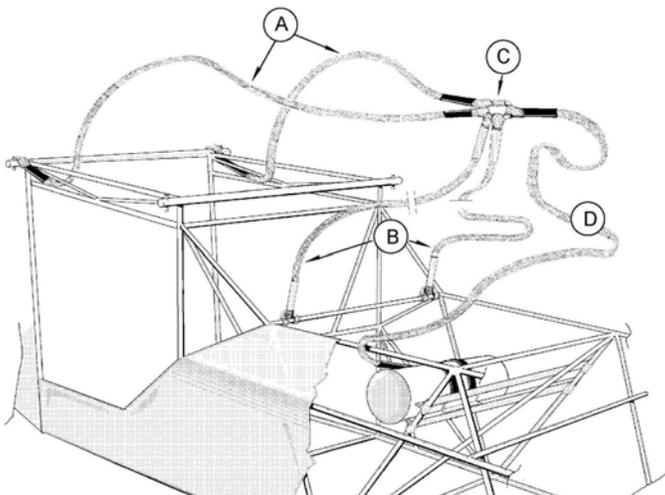
Note: Nylon is never to be used as a Main Bridle material as it is too easily cut by sharp points on the aircraft structure.

▲ WARNING

If your BRS kit was delivered with, and your instructions include a Main Bridle you MUST always include it in your installation, without exception! Failure to properly include the Main Bridle between the parachute assembly and the aircraft or Harnesses, will result in death or severe injury!

Note: Stainless steel cable is no longer offered by BRS.

All fabric webbing is protected against ultraviolet light damage (exposure to the sun) by full-length Nylon sheathing. After final assembly sewing, the thread is covered by opaque shrink tubing to prevent UV damage.



- A. Front Harnesses - Always Kevlar. Greatest proportion of parachute opening load is applied here.
- B. Rear Harnesses- Usually Kevlar, sometimes Nylon. Rear harnesses balance the airplane and determine the "hang angle".
- C. ½" Stainless Steel Quicklink- Joins all harnesses to Main Bridle.
- D. Kevlar Main Bridle - Again, always Kevlar. Allows connection between parachute location and harness confluence point.

INSTALLATION GUIDE

BRS has helped experimental aircraft manufacturers and builders with installation and mounting guidance for over 350 different aircraft designs in the last 25 years. However, this represents only a small fraction of the aircraft designs that are currently flying or being built. It is a very daunting task for BRS to keep up to date with every single aircraft design, especially those with only a few owners or builders in the entire world. Due to the nature of experimental aircraft, almost every one of these designs has something unique for that particular aircraft.

Most builders are aware that BRS has documented many of our designs with specific installation instructions. We continue to sell systems based on robust installations that have been repeated for years on aircraft kits manufactured by some of the more established companies (i.e. Apollo, Quicksilver, Challenger, Flight Design, Skystar, Rans). For many of these aircraft, there may be more than one option that will work and it is up to the buyer's discretion which to choose. For instance, one builder may want an internal soft-pack to save money and weight while another builder wants to save luggage space and opt to mount an external canister or VLS. In some cases, there is really only one option and it will be highly recommended that the builder use it. However, we are often approached by potential customers who wish to mount a BRS system to their aircraft, but don't know which one is best and what is required to do it properly.

This section of our manual addresses the fundamental items that BRS considers when designing or modifying an installation and will help prepare a potential BRS customer to evaluate his aircraft design for an installation that will stand the test of time and function properly if ever needed. As with the rest of this document, it is written assuming our customer is a mechanically-capable and safety-conscious builder and/or pilot.



Remember, the aircraft owner is ultimately responsible for ensuring that the installation design (whether provided by BRS, the aircraft manufacturer, or the customer) is sound. If you have any concerns or questions, please call BRS before completing your installation.

You may view the installation of our systems as simple and straightforward. Others may not. Whatever your view, please be assured that BRS engineers do not take their jobs lightly. In many cases, they are pilots like you and realize the importance of installing a parachute system that will work when needed. Some of the many challenges BRS engineers face when helping design an installation for a particular aircraft are:

- Aircraft are usually not designed for rearward and upward point loads that an inflating parachute imparts onto the airframe (up to 3-7 g's!).
- Aircraft are not necessarily designed to impact the ground with a 21-25 ft/sec. descent rate. (Sea level figures, high elevations require larger parachutes).
- Aircraft manufacturers frequently incorporate minor design changes and do not consider the effect upon a customer's need for a parachute (i.e. add or remove tubing, move fuel tanks, fairings, etc).
- Aircraft manufacturers increase gross weight capabilities for identical models of aircraft.
- Aircraft builders modify their aircraft to better suit their needs, not realizing the impact on the parachute and/or harness mounting and routing (i.e. changing engine sizes)
- Aircraft are usually not locally available for BRS engineers to work with.

- Some aircraft have no weight and balance information available to the builder.

Regardless of the obstacles, a safe, sound installation can most likely be accomplished if the BRS owner plans ahead and begins thinking about the installation before he/she purchases our life saving devices. The following are items to consider prior to a purchase, or at the least, prior to installation:

PROPER SYSTEM SELECTION

The appropriate BRS emergency parachute system for a given aircraft is initially based on two important specifications, dictated by the manufacturer or builder:

1. **Maximum GTOW (*gross takeoff weight*)** - the weight of a fully loaded aircraft will contribute directly to the loads that the parachute canopy will experience during inflation. It also affects descent rate, since each canopy shape and overall area is sized for a particular load range to maintain a survivable rate of descent. A canopy that is too small for the aircraft weight will cause the aircraft to hit the ground faster than designed!! **THIS IS AN ABOLUTE LIMIT!!**
NOTE: If operating in high elevations (above 6,000' MSL) , it is recommended to utilize a larger than normal parachute due to the higher descent rates associated with high density altitudes.
2. **V_{ne} (*maximum speed to never exceed*)** - remaining under the maximum tested deployment speed of a particular canopy is critical. The potential to increase speed beyond rated is going to exponentially increase the dynamic pressure on the canopy and reduce design safety factors. **AGAIN, THE PLACARDED MAXIMUM DEPLOYMENT SPEED IS AN ABSOLUTE LIMIT!!**

These factors together determine the potential maximum loads that may be applied to the canopy during various phases of the deployment. **Exceeding either of these conditions could seriously damage or even destroy the parachute during inflation.**

1. Size of System

A detailed chart of the BRS-6 models currently available for sale to the ultra-light, LSA, and experimental market can be found at the end of this document. Additional CAD drawings with overall dimensions are also available from BRS.

2. Type of System

Once it is determined which size is appropriate, the style of BRS system is your next decision. Each style has its advantages and disadvantages, depending upon: size and weight restrictions, level of weather protection necessary, likely mounting location, maintenance requirements, aesthetics, and more. **Note: Due to their sealed condition, Canister and VLS units have an altitude limitation of 8,000' msl or less. If flight is anticipated above that level, then Softpack type systems are recommended.** BRS systems are typically purchased in one of the following 6 styles:

A. **Canister (Sleeve Deployed)**

This series of Canister systems utilizes "sleeve deployment", which is a method of deployment that helps to control the parachute opening. Common on our smaller canopies.

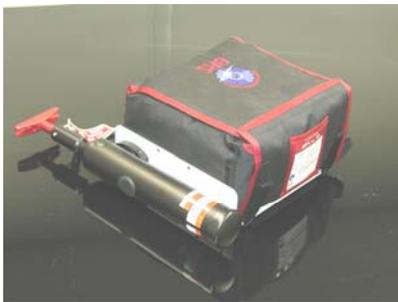


Models 600, 800, and 1050

The Canister systems are fully protected from the elements and are completely water resistant. It is very popular for open frame ultra-lights and trikes where weather contamination is a concern. Because of their insusceptibility to weather concerns, Canister units have a 6 year repack requirement.

The cylindrical shape of the canisters works very well on an interior mount as well (7" or 8" diameter x 18-22" long) lending itself to fitting into tight areas with fairly small frontal profile which allows for smaller egress areas. The Canister systems are generally heavier than an equivalent Soft-pack assembly by a couple pounds, depending on the specific unit.

B. Soft-pack (Sleeve Deployed)



Models 600, 800, and 1050

Soft-pack systems are so named due to the fact that the parachute is encased in a fabric container. The term "Soft" however, is a relative term, as the parachutes are still pressure packed resulting in a very stable, brick-like pack.

Although the Soft-pack systems have been used for years on open framed ULs and trikes, they may be best suited for interior use where they are protected from atmospheric concerns.

The downside to using the fabric containers is that they are not sealed and are susceptible to moisture, mold, insect, and/or rodent damage. For installations where the pack is external, and exposed to the elements, the parachute itself will require **yearly** inspections and repacks. If a Soft-pack is mounted completely internally and protected, it could have a 6 year repack interval.

The smaller models (600, 800, and 1050 (shown above)) are supplied in a nylon bag attached to an aluminum "L" frame with nylon straps. The frame can be attached to one of many mounting plates available from BRS which in turn can be mounted to an existing bulkhead or other flat surface. The frame also acts as a mount for the ballistic rocket.



Model 1350 Only

The smaller bags also have the ability to be removed from the frame if desired and mounted directly to the aircraft structure with these same straps or a set of flaps with (4) evenly spaced grommet holes on either side. Because there is no "L" frame, the rocket must be mounted separately to a sufficiently strong member near the bag mounting location.

The larger 1350 model (shown at left) is supplied in a nylon bag attached to an aluminum "U" frame with nylon straps. Because of its weight, there are no provisions for flaps with grommet holes. The rocket is attached directly to the frame and it is recommended that it not be mounted separately.

C. Soft-pack (Bag Deployed)



Model 1600/1800 shown
(Model 1350HS slightly
different)

For larger chutes, BRS prefers to use fabric bags rather than the nylon sleeves for deployment. For this design, the parachute canopy, suspension lines, and riser are S-folded and pressure packed into a rectangular steel jig. After heating to remove excess moisture and create a “set”, or form, to the jig dimensions, the ‘chute assembly is then transferred into a deployment bag and secured with locking pins. The deployment bag is surrounded by a retaining bag which is attached to an aluminum frame, via buckles or grommets. In the event of deployment, the entire deployment bag with the parachute is extracted. Again, as a fabric container, these units are not sealed from any environmental contamination and should only be installed internally, or under a protective cover. An external installation will require yearly repacks which, for this style, can be quite expensive. When installed internally, they should be inspected and repacked every 6 years. Models currently available in this style: 1350HS, 1600, and 1800.

D. VLS (Vert. Launch System, Sleeve Deployed)

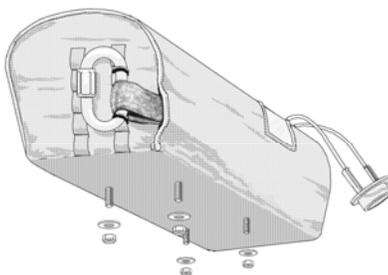


Models 600, 800, 1050, & 1350

This style is really a lightweight soft-pack sealed within a climate resistant container. It utilizes a sleeve deployed pressure packed parachute which is contained in a pin release closed bag under the ABS cover. The overall profile is lower and it lends itself well to external applications where the chute is located directly in the airflow over the aircraft wings. It is sealed and has the same level of protection as the Canister systems. Unlike the other styles, the VLS can only be mounted horizontally as it is designed to fire and extract vertically.

Note: Although it would seem logical to always install a ballistic parachute firing upwards, this is not always advised. Mounted on top to fire upwards may put the parachute directly into debris from a catastrophic wing failure. Since the parachute will always open in the same spot- directly down wind - it can be placed almost anywhere that provides clear area of trajectory.

E. 1350 “360” (Bag Deployed)



Models 1350 and 1350HS

The “360” is a pressure packed, “bag deployed” system designed to have maximum egress capability from its mounting location. This unit is bag deployed, which means that the entire parachute and line assembly is extracted from the outer, black, Velcro enclosed pack tray in a small, pressure packed bag, rather than in a long Nylon sleeve as previous units. The name “360” comes from the fact that the parachute is capable of being extracted in any direction, assuming the pack is sitting on a level, table-like surface. The outer container provides no restrictions.

The bottom of the assembly has 4: 1/4-20 threaded studs protruding from the interior aluminum support tray, to provide

means of attaching the packed parachute assembly to the aircraft. As seen in the drawing to the left. Both the 1350 and 1350HS must utilize our 600 Series rockets.



Models 1350 and 1350HS

F. 1350,1350HS Cylindrical Soft-pack

Although it appears to be a Canister system this unit is technically a Soft-pack. This Canister is not sealed or otherwise protected from rain or moisture, as the cover is fabric and the Canister has vent holes in the bottom.

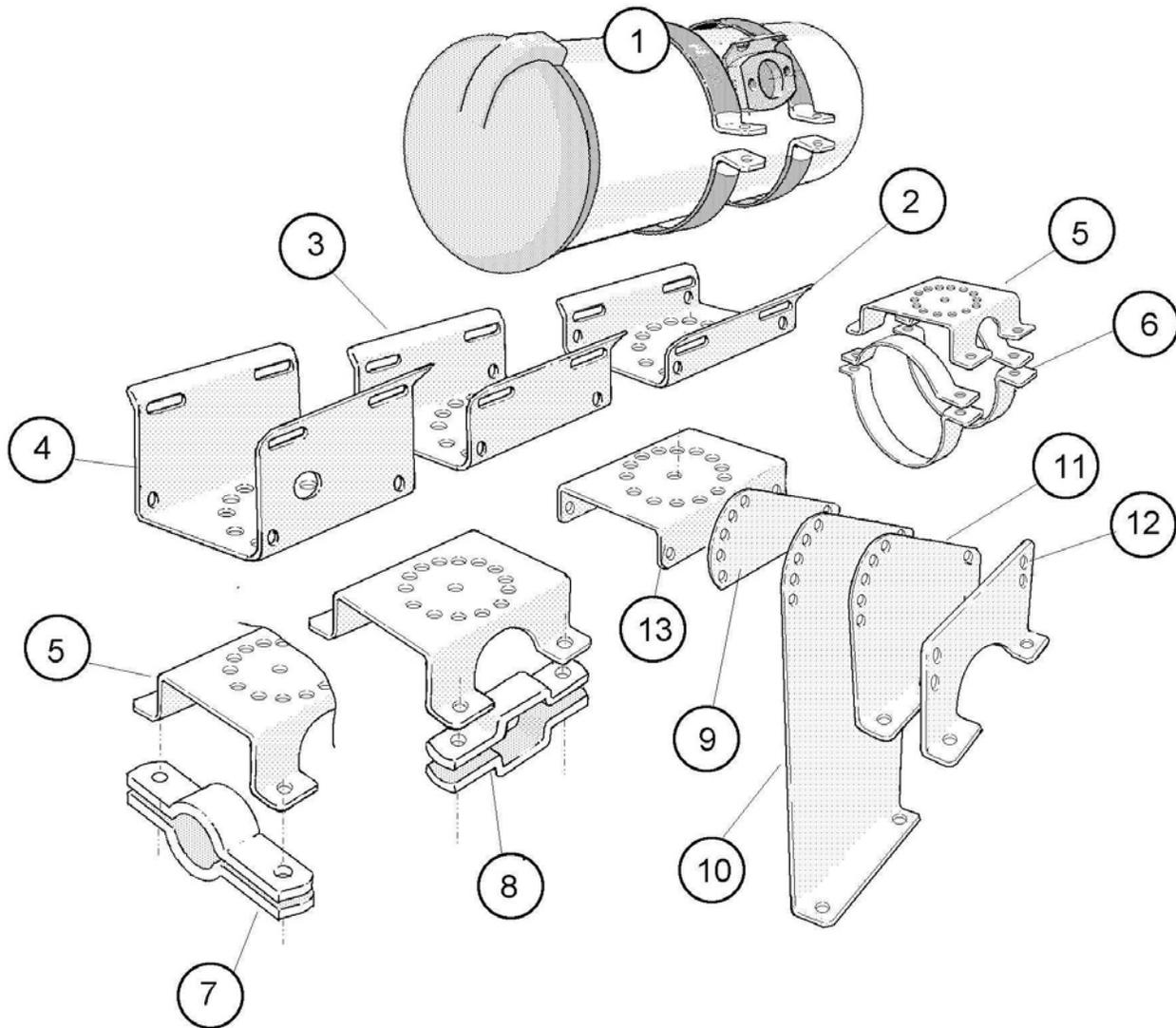
The Canister is 8" by 21" in total length. Due to the recoil forces from the activated rocket, this vented Canister utilizes a heavy mounting plate (Short CT Mount) which is bolted directly to the Canister and not connected with stainless steel bands as with the smaller units.

The position relation of the mounting plate and rocket is set in production and cannot be changed in the field. When you place your order, it is possible to request from BRS, the position in which would work best for your aircraft. With the mounting plate on the bottom, look at the Canister from the rear. The Rocket in the photo would be at the 12:00 position. You can request that the Rocket be positioned at the 9:00 or 3:00 positions as well.

This unit has a 6 year repack as it must only be used on an interior mount.

NOTE: These (6) styles have been extensively tested and are readily available. Customized packaging may be used in certain situations where the aircraft manufacturer is involved and the market will bear the additional costs associated with designing, building, and testing such units. Contact the BRS factory for more information.

Figure 7. Mounting Parts for the BRS 6



- | | | | | | |
|----|-----------|-------------------------|-----|-----------|-----------------------|
| 1. | N/A | 7" or 8" Canister Assy. | 8. | 008081-01 | 2" Square Clamps |
| 2. | 003225-01 | Short Modular Mount | 9. | 008104-01 | Triangular Side Plate |
| 3. | 003200-01 | Medium Mod. Mount | 10. | 008102-01 | Tall Side Plate |
| 4. | 003226-01 | Tall Mod. Mount | 11. | 008100-01 | Regular Side Plate |
| 5. | 008105-01 | Flat Mount Side Plate | 12. | 008101-01 | Short Side Plate |
| 6. | N/A | Mount Bands 3,4,5" | 13. | 003025-01 | Swivel Plate |
| 7. | N/A | * Mount Clamps | | | |

*Note: Mount Clamps are available to fit 1", 1 1/8", 1 1/4", 1 1/2", 1 3/4", 2" and 2 1/2" tube sizes.

SYSTEM MOUNTING

Mounting your BRS parachute and rocket may at first seem like a simple task. However, it is one of the most important tasks, and each BRS owner should consider the following:

1. *Normal Operations*

The first, most obvious thing to consider is the effect on normal operations required to fly safely. The unit should not be mounted where attachment brackets and or ultimate harness routing could lead to interference with control surfaces, cables, or hardware. You should not compromise the structural integrity of the aircraft by drilling or cutting unnecessary or poorly located holes and slots into tubing, sheet aluminum, or fiberglass. BRS has many sizes of mounting clamps and bands that require no drilling for square and round tubes. There are also stainless steel mounting plates that can be attached to these and positioned or rotated at various angles to clear obstacles. In the case of a pre-stressed aircraft skin (aluminum or composite), the installer should contact the aircraft designer/manufacturer to determine if removal of material will compromise the design, either structurally or aerodynamically. Adding a large parachute canister in the wrong location on top of an airfoil can create enough turbulence to cause excessive vibration or buffeting of control surfaces in the tail. Locating the system in front of cooling radiators or air cooled engines can cause engine temperatures to be higher than normal. There have even been instances where aircraft performance as well as stall characteristics, were affected by the presence of the parachute container in the airflow. If you have concerns over excessive drag or turbulence caused by the parachute, move it inside the aircraft.

2. *Pilot and Passenger Safety*

Along with the aircraft, it is equally important that the safety of the pilot and passenger is considered. It is recommended that the intended location of the parachute and attached rocket not be so closely mounted to the pilot or passenger(s) that it could be a burn hazard if the rocket were fired. Even though the rocket has a very fast exit, it still has the ability to scorch any body part that comes in contact with the rocket flame. For anything mounted closer than 16" from the pilot or passenger(s), an additional "blast" shield of Lexan®, aluminum, fiberglass, or even wood should be considered to protect from the rocket plume as it departs.

The mount should not require that harnesses be routed as to endanger the occupants head and limbs. It is a good idea to keep all attachments and routing outside of the fuselage "cage" or inner structure if possible. Another thing to remember is not to place your unit in a location where the direction of fire could be blocked by an arm or leg that is flailing about in a chaotic, emergency situation. **This is of special concern on Trikes.**

3. *Weight and Balance*

As with any item added to the aircraft, weight and balance considerations must be taken when determining a proper mounting location for a BRS parachute system. It should be located so as to not adversely affect aircraft weight and balance with regards to the center of gravity (CG). You may even find that the parachute system itself, positioned in a key location, may be useful in correcting an otherwise unbalanced aircraft. DO NOT assume that the BRS recommended installation for your aircraft is automatically



Do not assume that BRS installation guides account for CG changes on any aircraft. It is the responsibility of the pilot to ensure that the airplane is loaded properly. Operation outside of prescribed weight and balance limitations could lead to an accident, resulting in death or serious injury.

4. *Structural*

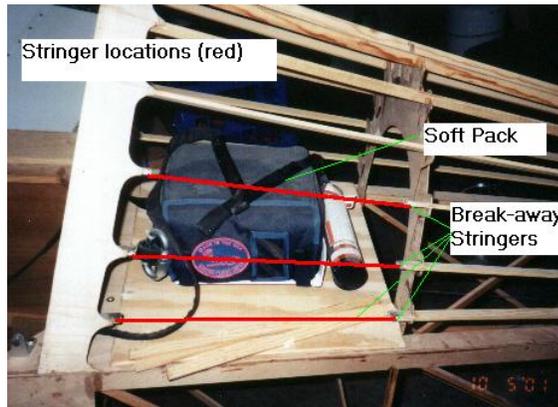
The attachment method and structure should be adequate to bear the weight of the parachute/rocket unit while flying, but also while taxiing on bumpy turf runways or in the event of hard or emergency landings. [14 CFR Part 23](#), which spells out design requirements for certified aircraft, and [ASTM 2245](#) which refers to design and performance standards for Light Sport Aircraft, requires that items attached inside the cabin, or occupied area, of an aircraft be able to remain secure during a downward load of up to 6g, forward load of 9g, sideward load of 1.5g, and upward load of 3g during emergency landings. The force of the rocket recoil must also be considered, but will typically be of smaller magnitude than what is required to secure the parachute. Attachment of the canister, soft-pack, or VLS mounts to structural aluminum plate or steel tubing is common. **DO NOT drill into structural elements of the aircraft unless approved by aircraft manufacturer or designer.** Use clamps whenever possible. Aluminum sheet, wood, or composite materials have different load carrying capabilities depending upon thickness or bend characteristics. Individual aircraft installation design diagrams may give specific guidance if BRS has this information to offer. Some aircraft will require structural enhancement to bear the weight.



Sample Canister Installation

This installation shows the Canister system installed behind the co-pilots seat in a steel tube aircraft, firing downwards (parachute doesn't care which way it's fired, it will always open in the same spot - downwind.) In this situation, positioning the unit so it fires upwards would've interfered with the complex wing folding mechanism. This gives it more clearance.

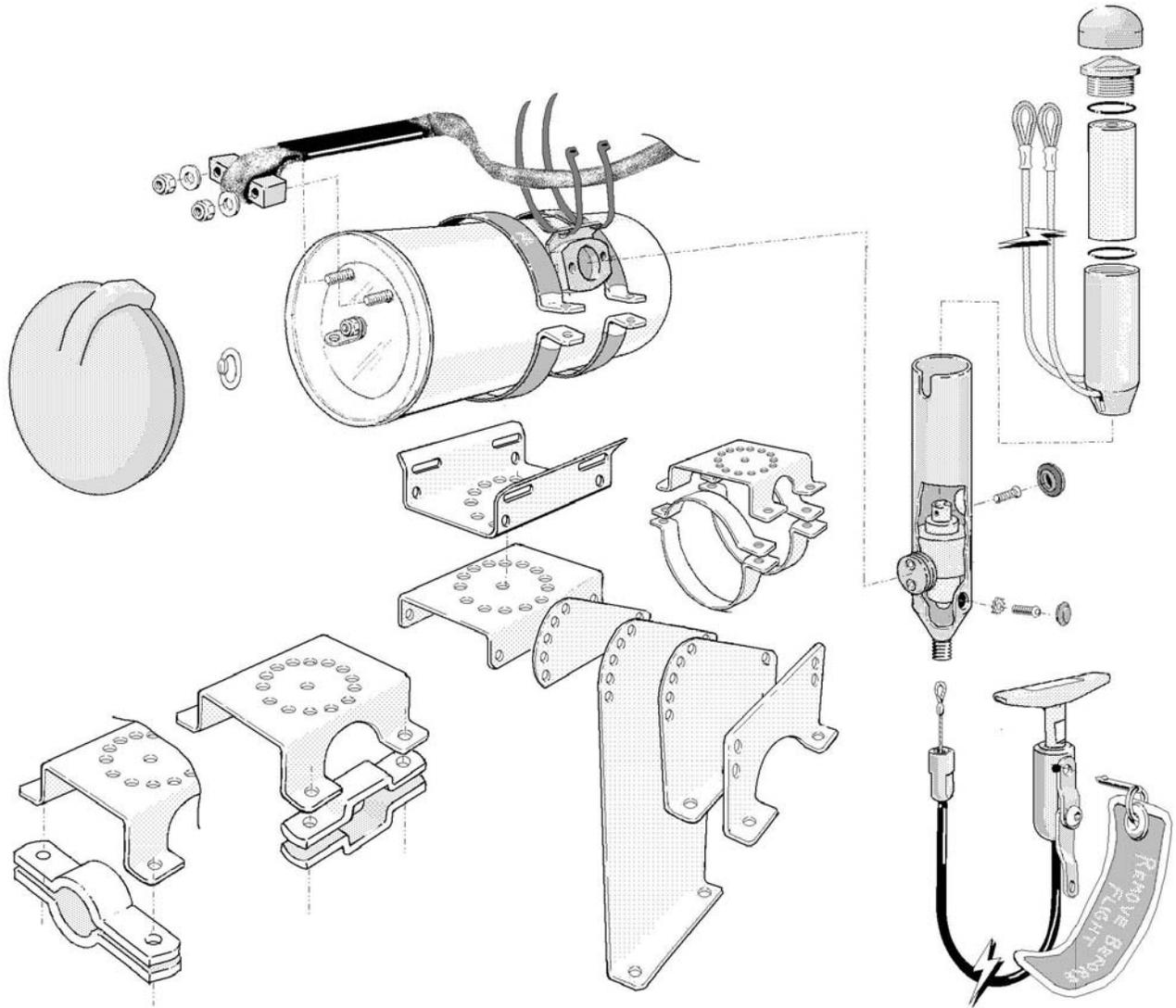
The unit is mounted to a couple of heavy (.185" thickness) aluminum rails, clamped to structural tubing aft of cockpit. The Main Kevlar Bridle routes downwards and up the right side of the aircraft to join with the Harnesses installed to the top of the aircraft.



Sample Soft-pack Installation.

Soft-pack installed in turtle-deck of wood UL type aircraft, firing directly to the side. Red lines denote sacrificial stringer sections installed to hold the form of the fabric around them. The stringers are short pieces laid in "pockets at each end, held in place only by the fabric stretched over them. On parachute egress, the stringer sections are free and produce no hindrance to parachute.

Figure 8. Rocket and Main Bridle Details





If you are unsure of the strength requirements for your particular system, do not proceed without first contacting BRS for further advice.

5. *Direction of Fire*

The rocket and parachute must have a clear path to exit the aircraft. The egress path must be clear of structure, tubing, control linkages, cables, and wiring. The only thing that can be in its path is a predictably frangible or easily torn material. The rocket is generally intended to fire to the rear, slightly downward, and slightly to the side (to avoid hitting any tail structure). **It is very important to avoid propeller entanglement...** meaning that the whole prop arc must be considered. (It is assumed that though pilots *should* kill the engine before deployment, this may not always be achieved by a distressed pilot.)

Ideally, the rocket and parachute should have a cone-shaped safety zone that, at about a 10' distance, would be 5' wide. The rocket path is not entirely arrow-straight when it first exits the aircraft, as there are factors that can affect its travel. The rocket may deviate slightly when it hits the end of the cable lanyards attaching it to the parachute, due to the mass being off-center to the initial rocket path. Also, the slipstream and relative wind will be hitting the parachute canopy as it exits the aircraft and this can affect rocket trajectory. Do not allow for a corridor that is too small for parachute egress.

Not only must the existing configuration of the aircraft be considered when you aim the system, but any potential changes due to a catastrophic failure must be taken into account. BRS units mounted on top of the aircraft, and intended to deploy above it, would be compromised by a failure of one or both wings in a positive mode. Therefore, the preferred direction of fire should be downward and to the rear.

IMPORTANT NOTE FOR OWNERS OF FLOAT-EQUIPPED AIRCRAFT:

Float-equipped or amphibious type aircraft can present a dilemma when considering the optimum mounting location. If the BRS unit is placed very low on the craft, firing down and to the rear, the BRS may constantly get wet. *Even though your BRS unit is virtually waterproof, constant exposure to water should be avoided.*

Also, the presence of floats may hinder a clean extraction and the required routing of harnesses could be more difficult. It may be that the only acceptable location is near the top of the aircraft, firing up.

The parachute does not care which direction from the aircraft it is fired...it will always inflate downwind (see Figures 9 and 10)! This is good as you can never predict which side will be up when the need for the parachute arises anyway. Please be assured that the parachute will always be above you and you will hit the ground first.

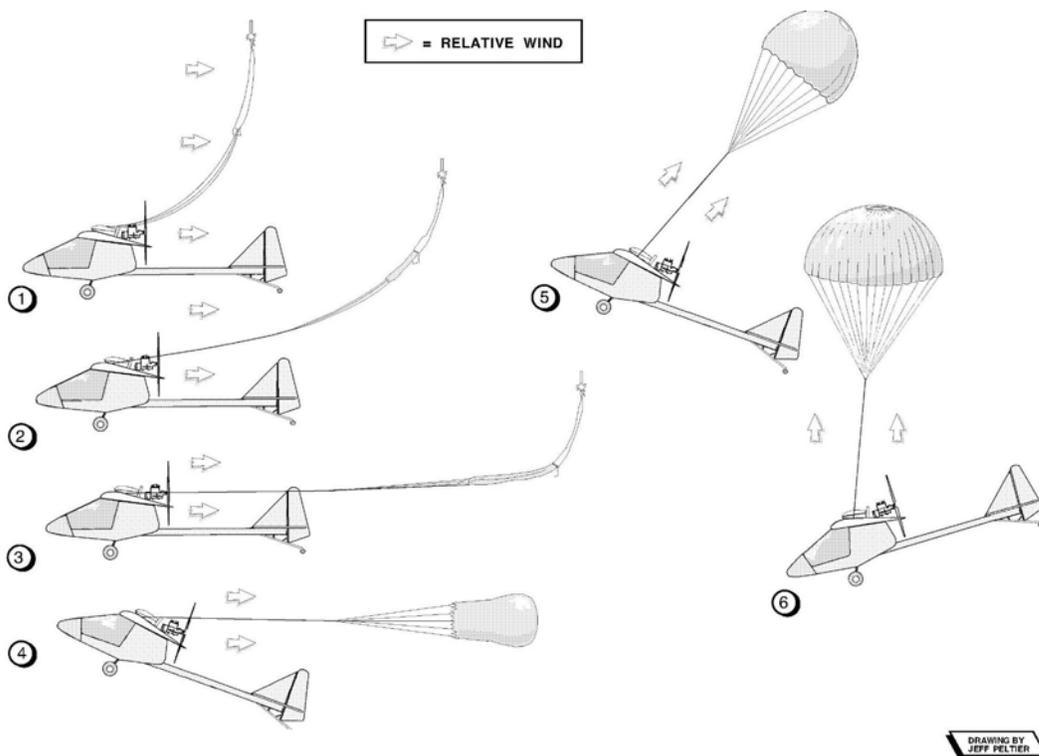


Figure 9: Deployment Sequence for Top Mounted Units

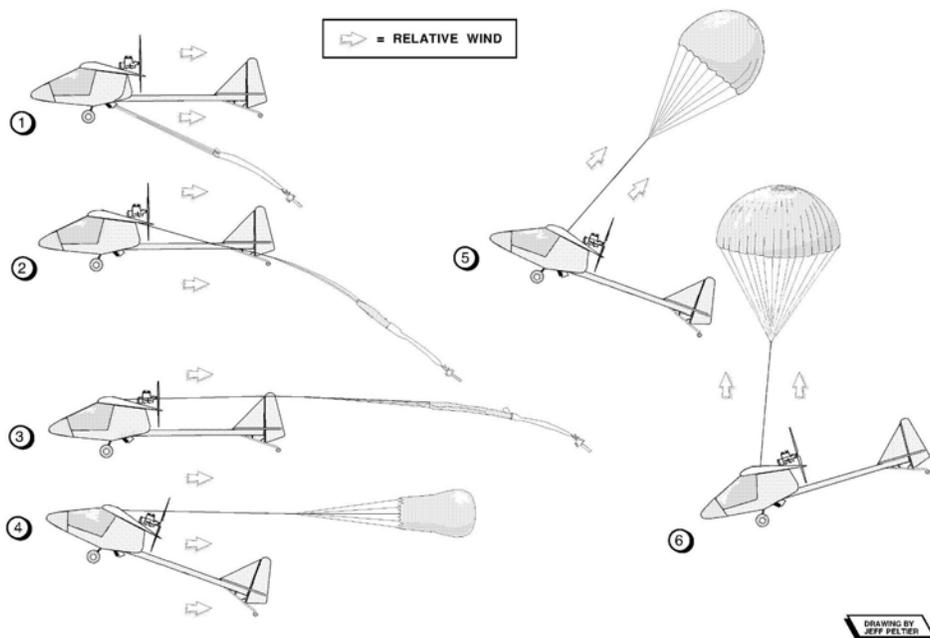


Figure 10: Deployment Sequence for Bottom Mounted Units

6. Egress

BRS rockets have incredible penetrating ability, but still need to tow the parachute out of the aircraft as well. Using up a significant portion of the rocket's total thrust energy to get out of the aircraft will hinder its ability to completely remove the deployment sleeve or bag as designed. The parachute can also become hung-up or damaged passing through an opening that is partially blocked or too small. Therefore, **it is imperative that careful consideration be given to creating a large enough port of exit or weakened panel for the specific unit being installed. All possible resistance or interference with the rocket's flight path should be avoided.**

BRS has tested the rocket's penetrating ability through two layers of unmodified 1.7 oz./sq. yd. aircraft fabric (Ceconite, Stits, Poly-Fiber). BRS has also experienced actual "saves" where several layers have been penetrated. However, a removable or weakened panel is highly suggested for anything heavier than 1.7 oz./sq. yd., especially pre-sewn sailcloth. This will prevent an excessive amount of the rocket's power being used *merely* to penetrate the "skin."

Some acceptable ideas for proper egress through medium or heavyweight fabrics (1.7 oz./sq.yd. or more):

- Completely remove a section of fabric 1" larger than the profile of the appropriate parachute and rocket. Leave open.
- Completely remove a section of fabric 1" larger than the profile of the appropriate parachute and rocket. Replace with lightweight fabric.
- Completely remove a section of fabric 1" larger than the profile of the appropriate parachute and rocket. Line the perimeter of the new hole with a strip of ½" Velcro® (sewn on is better). Add a new, larger piece of fabric with mating ½" Velcro® sewn on to cover the hole. Make sure that rocket will contact the new Velcro® attached cover along the edge and not in the center. The cover needs to peel back, not be pushed off.
- Cut a section of fabric 2" larger than the profile of the appropriate parachute and rocket, but leave the lower side intact, creating a flap. Add a strip of ½" Velcro® to the three sides of the flap and a larger strip (1-1/2" to 2") to the three edges of the hole.

Should your aircraft have an aluminum, plywood or composite skin, the port of exit will have other considerations. On many aircraft built from these materials, the skin is "stressed," that is, meant to be part of the structure. Cutting a hole without analyzing the material lost, may cause a serious loss of structural integrity. For such aircraft, only the airframe manufacturer can advise you adequately. Usually such a hole can be cut only if the adjacent area has been built up properly to carry the loads around the hole. For these types of materials, it will most likely require a blow-off (blow-out) cover. Such a cover may be flush mounted if a recessed "ledge" is fabricated around the perimeter of the hole and the cover is set down in it. The cover should be made and secured in such a way that the rocket will push it out of the way, rather than punch through it. The cover may need a fairly thick (>.100") piece of aluminum adhered to the cover over the rocket to ensure that it cannot penetrate the fiberglass. If necessary, contact BRS for viable options and suggestions for such removable covers, doors, etc.

BRS has tested rocket extraction through thin sheets (up to .063" thick) of ABS hair-cell plastic. ABS is brittle enough that "scoring", or cutting part way through one side with a sharp knife, will allow it to break along a predefined pattern when impacted from the inside with the rocket body. This is the same "frangible" material used to make the inner caps for the canisters and the top cover for the VLS style. Make sure that the rocket contact point is near the edge of the panel and not in the center.

BRS has performed countless parachute extraction tests through various combinations of materials and construction and has over 25 years of experience and exposure to thousands of builders. We know that the egress design on one aircraft may not necessarily apply to another. In some cases, we may have the option to do test firings through samples provided by the manufacturer or builder. Please contact BRS for advice and suggestions before cutting into your aircraft.

7. *Service and Inspection Access*

Since all systems need to be inspected and repacked at least every 6 years (sometimes every year), it will save you time and frustration if you consider mounting locations and methods that will make the parachute and rocket easy to access for inspection and/or removal. Putting an internally mounted soft-pack in an area completely covered with fabric will look nice, but will require cutting the fabric at least every 6 years. A visual inspection of the system every time you fly is a good idea and your installation should allow you to see what you need to.

PARACHUTE ATTACHMENT

1. *Ultimate Loads, Rated Loads, and Safety Factors*

BRS has tested each of the canopies referenced in this manual to meet the requirements of the new ASTM (American Society of Testing and Materials) Standard F 2316, "Standard Specification for Airframe Emergency Parachutes for Light Sport Aircraft". Part 6.2.1 requires multiple drop tests to verify the parachute canopy strength. This standard also mandates that these drop tests be successful when performed with combinations of weight and deployment speed that will result in a design safety factor of at least 1.5. For these drop tests, on-board data acquisition equipment was used to monitor force (in Gs) imparted onto the test weight by the parachute during the deployment sequence. The maximum force measurements in both the reefed and disreefed conditions (see Figure 11) are considered the *ultimate loads*, since the test incorporated the design safety factor. **NOTE:** Ultimate *load* should not be confused with ultimate *strength* because, unlike other mechanical testing, the ultimate loads may be near, but never at the failure point.

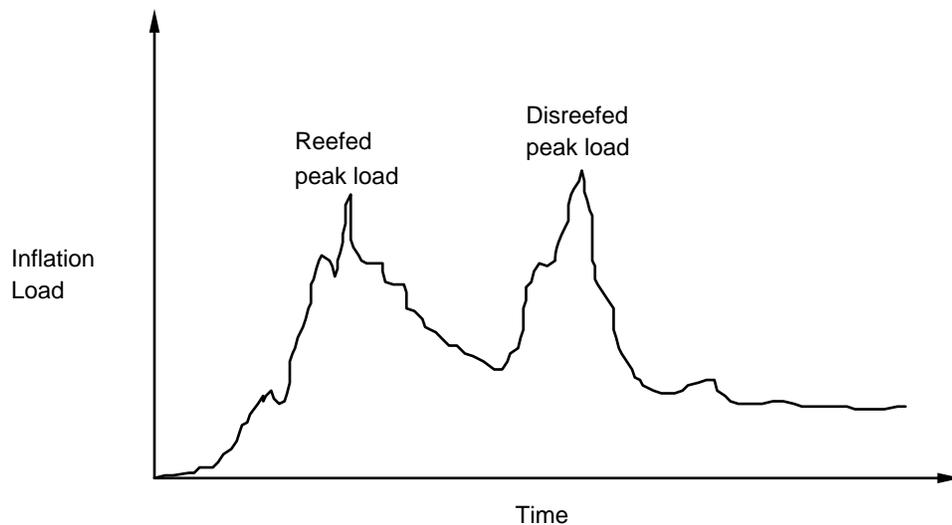


Figure 11: Typical Inflation Load vs. Time Profile

If additional drop tests are done with deployment weights and speeds at limits prescribed on BRS placards and marketing literature, the resultant forces are called *rated loads*. Rated loads have no safety factor added. For some canopies, BRS may not have rated load information.

Since performing even a small series of flight tests with each aircraft is usually cost prohibitive, our prescribed aircraft attachment strength minimums is normally calculated from rated or ultimate loads obtained from these dead-weight drop tests. Due to drag differences of a small, dead weight (usually pallets with barrels or lead-filled steel slugs) vs. a disabled aircraft with a significant surface area, the ultimate loads from drop tests will most likely be conservative. This may lead to fairly conservative strength requirements that some home-builders or manufacturers may have trouble meeting. Additional engineering work may have to be done to distribute these loads onto more points on the aircraft or optimize harness lengths.

Now, after reading the above, if you are thinking that you should use the parachute size (or manufacturer) that offers the lowest ultimate (or *opening*) load, please consider this:

The magnitude of an ultimate load is relative to what you are trying to accomplish. You can put a larger parachute onto your aircraft and, due to a longer time required to fill and inflate the canopy, opening loads will be lower. However, a longer opening time equates to increased altitude loss before complete inflation...not something you want if you are only 100-200 ft. in the air. A lower descent rate and opening load will do you no good if you hit the ground before it inflates.

In automobiles, the faster you want to stop, the harder you need to hit the brake pedal. In parachutes, the quickest opening possible, given the deployment conditions, comes from the smallest, hardest-opening canopy. However, now your aircraft will have to be built to withstand the higher loads and the higher descent rates and this is not possible in some cases.

Therefore, it is a tradeoff, and BRS designs canopies to optimize a *combination* of opening time, load, and descent rates, not just one aspect. Aircraft builders need to choose the parachute that will most likely survive the deployment and lower them down at a safe rate of descent. They must then design their attachments as necessary.

2. *Aircraft Structure Analysis*

Aircraft are designed to fly. They are designed to take their greatest loads vertically through the aircraft structure, as these are the lift loads. The requirement to resist excessive drag loads is much less. Unfortunately, that is exactly what an inflating parachute puts onto an airframe: significant drag and force in a direction most likely never designed for.

During the initial deployment sequence, the force vector coming from the inflating parachute (directly inline with the parachute riser) is always with the relative wind. The initial position of the parachute riser could then very easily be nearly parallel (<10° from horizontal) to the aircraft's longitudinal axis if deployed from an aircraft flying straight and level. **From our test experience, this tremendous initial force, or "reefed" force, from the parachute drag could be as high as 6 or 7 g's!** Imagine (for a 1000 lb aircraft) a force of 3-4 tons pulling on the airframe rearward, trying to force the aircraft center of gravity to align with it. Now imagine if this aircraft was constructed of thin plywood or fiberglass!

When designing the harness assembly and attachment location(s), you must always keep in mind the magnitude and direction of the loads that will be applied to the aircraft during deployment. Due to the potential of high loads pulling on the airframe in the aft direction, the addition of simple, structural compression members may be necessary, especially in wooden and fiberglass aircraft. Most aircraft are also not designed for the localized point loading that parachutes induce. The more the load can be spread out into the airframe, the better. You must contact the aircraft manufacturer for input if you are concerned about your aircraft's construction and strength.

It is also critical to have the harness/es placed so that it takes maximum advantage of the natural balance of the aircraft. Load distribution among multiple attachment points can be adjusted by changing the location of attachment points and lengths of harnesses. More on this subject is found in "Harness Design Analysis".

When an object is suspended from a cable, the object will always adjust its position until its center of gravity (CG) is in line with the suspension cable. The same holds true for an aircraft attached to a parachute. During the entire extraction and inflation sequence, the force magnitude and vector will be constantly shifting with time as the parachute inflates and the aircraft moves to keep the CG in line with the parachute riser. Since there are an infinite number of possible deployment weight and speed combinations for each emergency, it is impossible to determine exact minimum strength requirements for any given aircraft structure. In almost all cases, conservative data from ultimate load dead-weight drop tests (as discussed in the previous section) is the only method of determining how strong the structure of the aircraft must be to successfully survive a parachute opening.

With this data, BRS can provide anticipated loads for your particular application using aircraft geometry and performance information supplied by the manufacturer/builder. At the end of this manual, you will find a blank "*Loads Determination*" form. You should complete this and send in to BRS to help you determine how strong your attachment points must be. This requires knowledge of the aircraft center of gravity envelope as well as dimensional relationships between the CG and the proposed attachment points.

3. *Harness Design Analysis*

For many ultra-light aircraft, a single "keel" or "root" tube runs forward and aft along the aircraft centerline. This tubing is usually aluminum or steel alloy and can be either square or round. If the aircraft maximum gross weight and speed are low enough, a single harness (main bridle) attached at the fully loaded CG is typically sufficient to handle the opening loads and balance the aircraft for descent.

For heavier (and wooden or composite) ultralights, multiple attachment points are preferred to help distribute the loads and allow for a proper descent attitude. Two shorter harnesses attached to opposite ends of the “root” tube is common. Other recommended locations may include gear legs, longerons, firewalls, engine mounts, spar carry-thrus, and/or cabanes. The multiple harnesses should converge to a point that is usually 4-8 ft. above the aircraft and directly overhead of the CG, with the aircraft in the desired touchdown attitude. They are coupled together with a large, stainless steel quick link and joined to the parachute riser with a single, main bridle and another quick link.

At least (3) or (4) separate attachment points are recommended for wooden or composite ultralights as there is commonly no single “strong” structural member. In some (rare) cases, a “basket” or “hammock” of webbing is made to sling underneath a wooden fuselage to minimize destruction at the time of deployment. For composite frames, adding structural hard points using steel or aluminum will most likely be necessary to handle the loads in the aft and upward direction. Reinforcement with additional compression and/or tension members or additional plies of fiberglass or wood may be needed.

A few things to consider about harness configuration:

A. Aircraft Dynamics at Deployment

The proper location of the multiple harness attachments can actually help reduce the loads that a parachute may apply to the airframe, and even help reduce the loads on the canopy itself. By attaching the front harness(es) to points above and forward of the aircraft CG, an inflating parachute will tend to pitch the aircraft nose up (Figures 12-14), thereby presenting the bottom of the aircraft to the relative wind (due to the CG alignment characteristic described earlier). This creates a condition similar to an accelerated stall and immediately slows the forward speed of the aircraft. A slower aircraft speed at the point of full inflation equates to lower loads on the canopy and translates to lower loads on the airframe. The rear harness(es) will act to limit the degree of the stall and also keep the tail positioned correctly for touchdown.

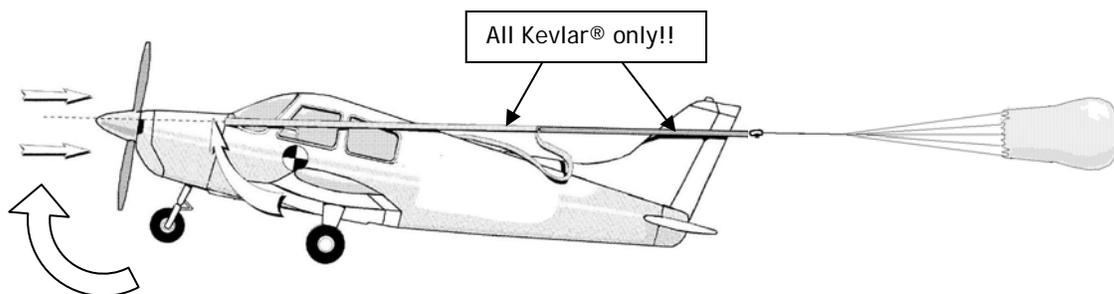


Figure 12: Deployment, Reefed (with recommended attachments, forward and above the aircraft CG.)

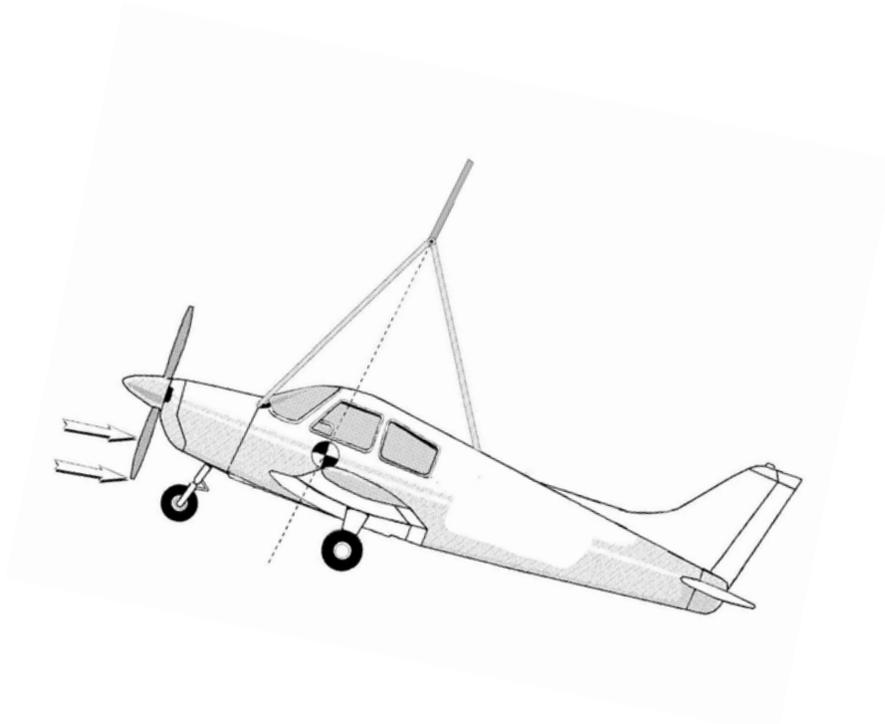


Figure 13: Inflation, Disreef (with recommended attachments)

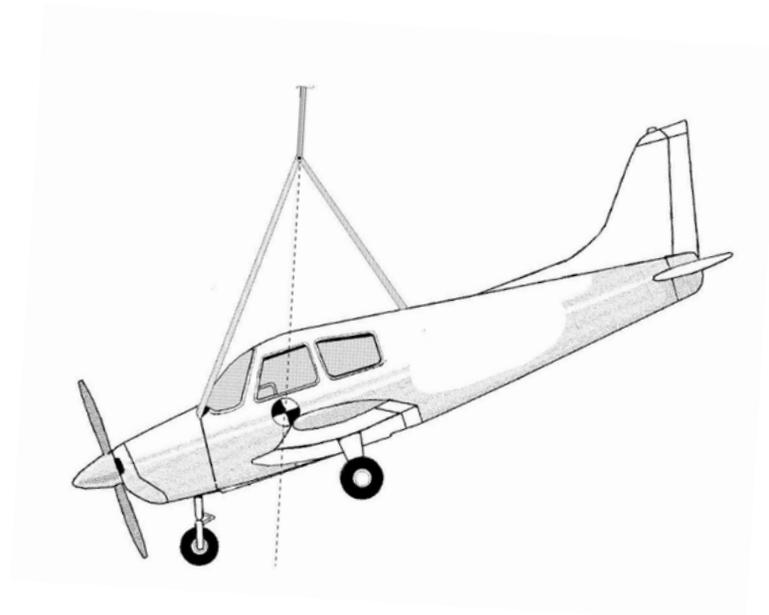


Figure 14: Descent (with recommended attachments)

The designs of high-wing aircraft are well suited for the preferred attachment method described above. Typically, a main front wing spar connection on either side of the fuselage is ideal for the front attachments, as its location is well above and forward of the aircraft CG. In many cases, the rear wing spar connection or carry-thru may be used as the rear harness attachment location. If not, there is typically sufficient structure near the tail-cabin interface.

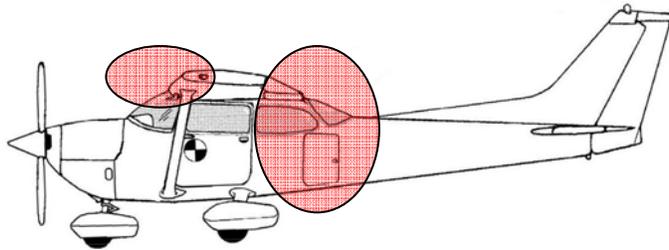


Figure 15: Attachment Locations, High-Wing Aircraft

Unfortunately, the designs of low-wing aircraft are not as straightforward. Considered by many to be the strongest part of the aircraft- the front spar and carry-thru, is usually situated below, and may be only slightly ahead of the aircraft CG. If one were to attach to the spar in this case, the nose of the aircraft will be forced down to allow the aircraft to align its CG with the parachute riser. Nosing over will only ACCELERATE the aircraft during the initial deployment instead of decelerating as desired. If the parachute and aircraft actually survive the increased loads, you will still be faced with a nose-down touchdown attitude.

Note: Do not become fixated on utilizing the front spar and carry-thru members as your primary front attach point. While it is a strong-point of the aircraft, this is only true for the loads in which it was designed. Great care must be used in determining the ability of any point on the aircraft to handle the estimated loads appropriately.

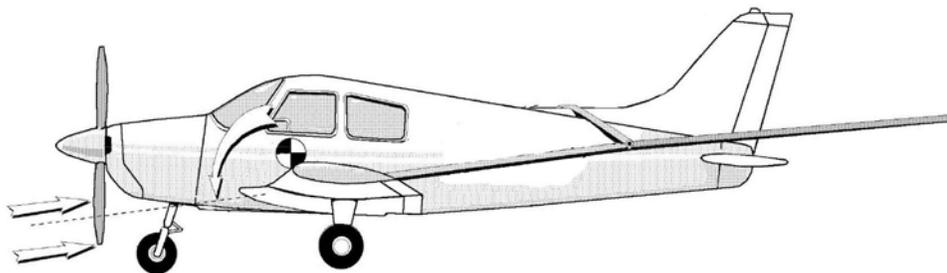


Figure 16: Deployment, Reefed (w/ incorrect attachments)



Figure 17: Inflation, Disreef (w/ incorrect attachments)

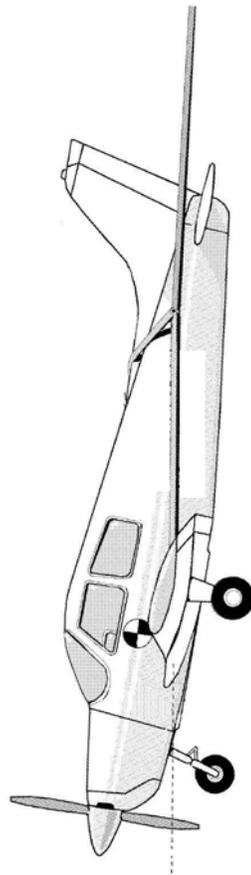


Figure 18: Descent (w/ incorrect attachments)

To avoid this, it is recommended that front attachments for low-wing aircraft be at or near the top of the engine firewall. This location will again allow the

aircraft to pitch up upon deployment (although not as severe as a high-wing) and stall the aircraft. The rear attachment(s) should be at or near the bulkhead separating the tail of the aircraft from the main fuselage cabin.

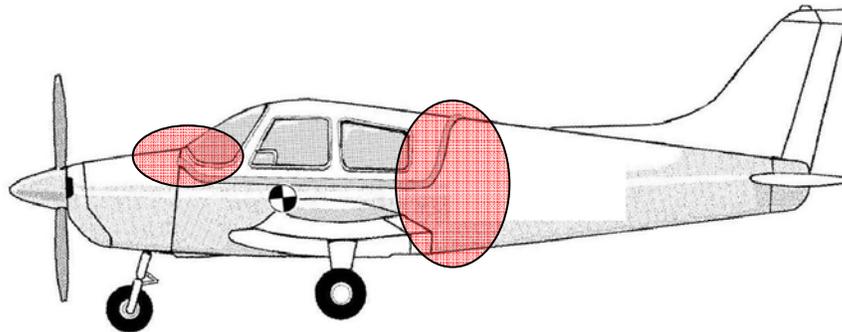


Figure 19: Attachment Locations, Low-Wing Aircraft



In many cases, BRS can provide anticipated loads using geometry information supplied by the manufacturer/builder. It is then highly recommended to complete a structural analysis of the aircraft, with these loads applied. BRS is not the aircraft designer, nor builder, and can only make educated suggestions based on past experience. It is the responsibility of the aircraft owner to determine if these suggestions apply to his/her aircraft.

B. Aircraft Descent and Touchdown Attitude

Determination of this touchdown attitude should consider the following:

1. In most cases, the touchdown angle should be such that the lower spine (lumbar region) does not carry the impact load in direct compression. The greater the touchdown angle, either nose or tail first, the less the spine will have to endure. However, the initial touchdown angle may only constitute a part of the entire touchdown event, as the aircraft may rotate after initial contact and create a secondary impact at an entirely different angle.
2. The gear design of the aircraft is critical in determining which end should descend first. For tricycle gear aircraft, the nose gear should contact first. At the rate of descent of most BRS parachutes, a nose-first, initial impact will most likely collapse the nose gear as well as the supporting structure (i.e. engine mounts, firewall, etc). This will help absorb a significant amount of energy upon landing. There is little data suggesting the preferred angle of descent for tail wheel aircraft. Some testing in Germany for sailplanes showed that aircraft with a tail-low attitude were somewhat unstable during descent, causing the tail to guide the aircraft erratically. For the purpose of stability and

predictability, it is best if “tail dragger” aircraft descend under canopy in a generally level or slight nose-low condition.

3. If a nose-down touchdown is desired, the aircraft should be equipped with at least a “4-point” individual restraint system for each occupant. A “3-point” restraint, similar to a car lap and shoulder belt, may be insufficient to avoid contact with glare shields, control yokes, or the instrument panel.
4. A tail-down touchdown would likely require the rear harness to be longer. Increasing the length of the rear harness can be detrimental if it is too long and allows the aircraft to be flipped on its back during initial deployment.

C. Propeller or Empennage Entanglement

For aircraft with the engine up front (“tractor” type), propeller entanglement is not a serious concern when determining harness and bridle lengths. This is mainly because of the tendency of the parachute canopy to open behind and above the aircraft, except in cases of severe tumbling or other catastrophic conditions. **For those with the engine behind the pilot (“pusher” type), the parachute behavior is a major concern and needs to be heavily considered when designing bridles for such aircraft.**



AGAIN, IT IS VERY IMPORTANT THAT THE ENGINE BE SHUT OFF BEFORE DEPLOYING A BRS PARACHUTE. FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY OR DEATH. The Kevlar® that BRS uses for harnesses and bridles is very resistant to cutting, yet could still be severed. Unfortunately there is nothing that can be done to guarantee that this won't happen. However, there are a couple of steps that must be taken to increase the probability that your chute (and you!) will survive.

1. BRS insists that, for single attachment designs (ultralights only), there be at least a 10 foot* section of Kevlar® between the aircraft attachment point(s) and the nylon riser of the parachute assembly. In the case of pusher aircraft, if the propeller is still turning, there is a very high possibility that the bridle will come into contact with it. By keeping the nylon riser far enough away from the prop after extraction, it ensures that the Kevlar®, not the nylon, will bear the prop strike. **If** the Kevlar® survives contact with a turning propeller, it may wrap up into the hub of the propeller and stop it, break off the propeller blade, or just glance off. In these cases, you are thankfully still attached to the parachute, although possibly descending at a nose down attitude.
2. For aircraft with multiple attachment points, the same 10 foot* rule must be used from the convergence point of the front and rear harnesses or attachments that are down to gear legs. Obviously all attachments should be on the forward side of the propeller.

** Some instances may require more distance to clear the propeller.
Please contact BRS for a recommended length if you are unsure.*

3. When you are mounting and aiming your parachute and rocket, make sure that the trajectory will carry the parachute well out of the path of the propeller. Keeping your mounting location as far away from the propeller as possible will always be safer.
4. If your aircraft has a T-tail, it is also imperative that sufficient length be used for the bridle to help the nylon riser clear and avoid contact with the tail.
5. If your aircraft has had a catastrophic structural failure or mid-air collision, the results may be such that the aircraft wings or tail section is whipping about and causing the parachute harnesses to be wrapped up within the wreckage. Using a lengthy Kevlar® bridle/harness system will help keep the nylon riser and suspension lines at a sufficiently safer distance.

4. Harness Routing

Once the harness attachment points and minimum lengths have been established, it is important to decide how the harnesses will be routed and protected/concealed as they travel from the attachment point to where the parachute is mounted and installed. For many open air ultralights and trikes where the attachment locations are near the parachute, the harnesses are simply S-folded and stowed, using plastic tie wraps to secure them. However, for more complex routing, the following "best practices" need to be followed:

- A. Because of the importance of bridle and harness routing, BRS will usually advise a specific path which is least likely to conflict with control mechanisms or entangle with the propeller and drive train. On some aircraft, especially those that were modified from the airframe manufacturer's design, the suggested routing path may not be appropriate. *If you feel the BRS-suggested routing is wrong for your aircraft, please contact BRS before installing.*
- B. Harnesses should not be routed as to endanger the occupants head and limbs. It is a good idea to keep all attachments and routing outside of the fuselage "cage" or inner structure if possible.
- C. Most models use Kevlar® bridles and harnesses in lieu of steel cable, especially on enclosed cabin aircraft. Kevlar® should be S-folded or laid flat for compact storage and, if possible, should be shielded to help keep it from being exposed to the sun or other elements. The bridle should fit without excessive length and without coming up short. *If you feel you have been supplied the wrong lengths of bridle or harnesses, please contact BRS- before installation, if possible..*
- D. Assure the bridle or harness routing does not interfere with the rocket firing. For example, do not route the bridle directly in front of the exit end of the parachute canister (over the plastic caps for the canister and VLS, or over the softpacks Velcro flap). The rocket may be deflected

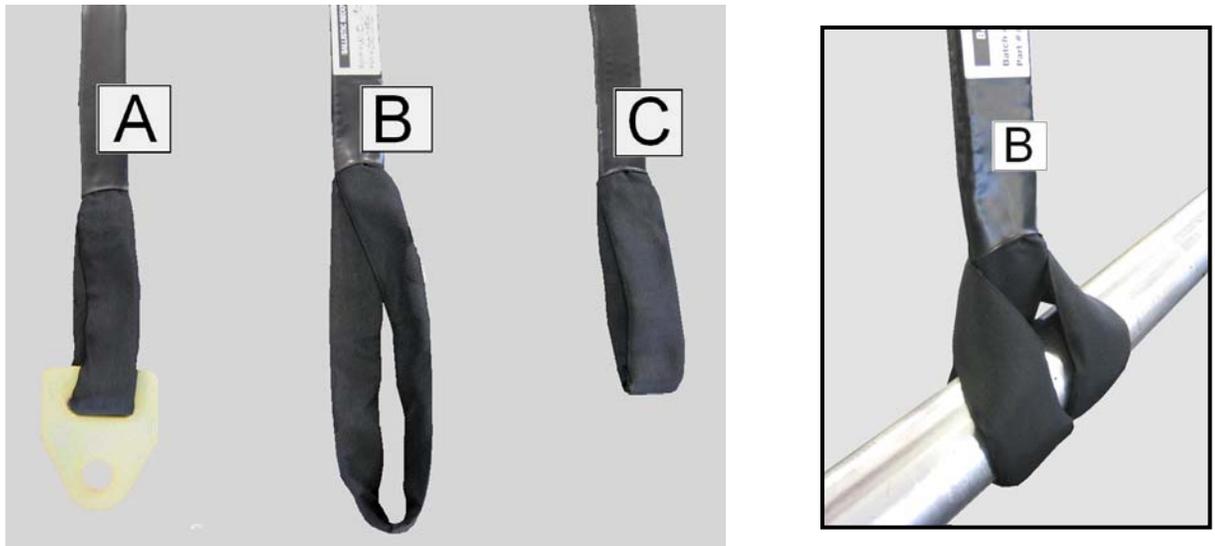
considerably if it strikes the bridle, and this may cause a malfunction of the extraction.

- E. Assure the airframe bridle or harnesses will not rub against abrasive metal parts or components of your airplane. Make sure this is true not only in its fixed routed position, but once it starts to transition behind and, eventually, overhead of the aircraft. BRS engineers have already considered such potential when designing the installation; following those guidelines should avoid problems. The routing should keep the harnesses and bridles from being damaged during disassembly and/or transport of the aircraft. *If you feel the provided instructions won't work on your aircraft, please contact BRS before proceeding.*
- F. Assure the main bridle is routed to the same side of the aircraft as the rocket discharge (so the aircraft is not flipped over on canopy opening). Visualize the parachute deploying from its container. When the bridle is pulled tight by the opening forces, it should be free to straighten out without wrapping under the airframe. Routing the bridle on the same side the rocket will fire is key to the correct unleashing motion.
- G. After the above items are taken into consideration, plan your routing and measure the necessary lengths for each harness in its stowed configuration. Usually the longest required length will help us determine the minimum length of the front harnesses. The rear harnesses are usually sized according to desired touchdown attitude.
- H. When the optimal routing is determined and lengths are verified, secure the airframe bridle and harnesses with the provided nylon tie wraps so that they are very well attached. They should be no less than 6-8" apart, especially the ones holding the main bridle anywhere near the prop arc. In some situations, you may double them up, where failure of one would be an in-flight safety issue. Ultraviolet (sun)light damage will seriously weaken nylon tie wraps. Assume that over a period of time, some of these ties may come loose or break off. If so, the owner must assure the bridle should *still not* interfere with the operation or strength of the aircraft. **BRS highly recommends that you replace all nylon tie wraps at least every 6 (six) months if they are subject to any exposure to sunlight.**
- I. Again, be absolutely sure the bridle does not interfere with the prop arc. If a propeller should strike the bridle with any force, the integrity of the BRS bridle may be weakened dangerously. Though testing has not revealed any particular vulnerability, any propeller has the ability to undermine the strength of BRS bridles or sever them completely.

5. *Harness End Types*

Regarding *not* the attachment *location* but rather the *means* of connection to the airframe, you have three choices for harness terminations:

- A. **“A” End** - In some cases, where there is a desire to attach to a flat structure (i.e. firewall or fuselage skin of a composite or aluminum aircraft), a metal tab is sewn into a loop at one end of the harness. This tab has a ½” dia. hole for an AN-8 bolt (or AN-6 with a bushing). Other uses include attachment to existing bolts at wing spars and gear legs, or welded tabs on tube frame aircraft. The opposite end of the harness is always a “C” end loop. This method is rarely used anymore.
- B. **“B” End-** This type of connection is used on structural frame members. It is attached to tubing (for example) by passing the large loop end around the tube, then passing free end through large loop and cinching up on it. (See photo on right). The large loop is constructed with a “1/2 turn” in the web to ensure it lies flat around the tube when connected properly. This is the most common attachment method.
- C. **“C” End-** This is a short loop (5” in length) designed to be used with the large stainless steel quick links that are common with BRS systems. Both ends are of this style.



On some designs, specific attachment points may require custom attachment fittings that are not available from BRS. Special situations require consultation with BRS engineers and fittings may have to be sent to BRS for sewing onto the harness prior to installation.

ACTIVATION HANDLE MOUNTING

As with bridle and harness routing, the placement and mounting of the activating handle is best done with some preplanning. It is paramount, of course, that the handle be in a place easily accessed by the pilot and/or passenger in a situation of great stress. The most obvious mount location is in some place where the pilot and/or passenger can physically see the mount. You must also assume that the aircraft may be experiencing high G-loads which may not permit you to easily raise your hand above your head or to places that are otherwise awkward.

It is probably best to actually sit oneself in the cockpit, and physically consider where the optimum location is. BRS can suggest specific locations but handle placement is a rather personal decision. Assure you can reach the selected position from all seats. Place the handle in a location that can't be easily bumped while entering or performing normal aircraft control movements. For best leverage, place the handle so that it is facing you and you will have to pull it towards you to activate it. Keep it low to allow you to reach it in a high G-load emergency situation.

For tandem aircraft, BRS offers a Dual Handle Activation Assembly. This system utilizes 2 independent Handle Assemblies that are each unaffected if the other is compromised for some reason.

With the current handle design, the activating handle may be freely rotated in its holder to provide a better position for activation. This is may *not* be true for older models series (i.e., BRS-4 and earlier).

BRS can provide handle mount clamps for various sizes of tubing or can supply a simple standoff to mount the handle holder to a flat surface with an existing fastener. Either mount is equally desirable; again, the primary consideration is ease of access and use. If you have further questions about its installation, contact BRS.

The safety pin only secures the firing handle to its mount. It does not prevent triggering if the housing is pulled forcefully. For example, if you were to remove the canister mount and pull the whole canister and rocket away from the handle, the rocket could fire because the action is the same as if the handle was pulled. Of course, you should not remove and pull the canister; this is merely an example to explain the possibility. If the housing (the plastic sheath protecting the activating cable inside) is properly secured along its path with durable attachments, the unit has little likelihood of deployment by force exerted on the housing itself.

Installations with sloppy or dangling housings are not adequately safeguarded against activation by a force pulling directly on the housing. If you have any questions on this subject please contact BRS for advice.

ACTIVATION HANDLE ROUTING

Ideally, it is best to run the cable housing in a straight course from the rocket to the mounting location. However, this is usually not possible or practical on most aircraft. In these cases, you must assure that the housing routing follows these simple rules:

1. The housing should be secured along its route. To prevent any chance of firing the rocket because the housing—not the handle—is pulled forcefully, it is preferred that the housing be attached or secured.
2. Whenever the housing makes a turn (90° bends or even 180° bends), it is optimal if that turn goes outside of a tubing member so that the turn has a “pulley” point (a point you pull against when the housing makes a turn).
3. A straight a line as possible, or turns with large radius’ should always be considered when designing a routing for the BRS Activation Assembly. Shorter is always better where the Activation Housing Assembly is concerned.



Never allow the Activation Housing to be “coiled” anywhere along its routing. This will create excessive frictional forces inside the Housing, possibly preventing system activation when needed, which could result in death or serious injury.

4. When the optimal routing is found, secure the activating housing with the provided nylon tie wraps so that the housing is securely attached. As with the tie-wraps securing the Harness Assemblies, these tie-wraps should also be inspected frequently and replaced annually if exposed to UV degradation.

NOTE: If you find the housing to be the wrong length—short or long—consult the drawing again. The wrong length probably indicates that the recommended installation was not followed exactly. While every attempt has been made to supply the correct housing, it can be changed by purchasers if necessary. Before ordering a different housing length, it is strongly recommended you consult with BRS first. Engineers will accommodate your request if they find no error with the method you suggest.

Generally you will follow the instructions provided by BRS engineers for your aircraft. If such instructions are not available, it will be necessary for you or the airframe manufacturer to work with BRS to find the optimal routing of the activating housing.

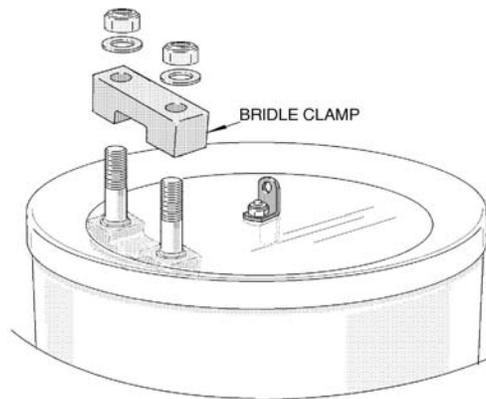
Attaching the Rocket, Lanyards, and Main Bridle to the Parachute

The following information shows specific detail on attachment of the rocket lanyards and the main bridle to the various styles of BRS-6 units. It is important to remember that the rocket will be the first thing to leave the unit and **THE LANYARDS CONNECTING THE ROCKET TO THE PARACHUTE MUST NOT BE ROUTED UNDERNEATH OR BEHIND THE MAIN BRIDLE**. Also, be sure that the small link gate (and large link gate for softpacks) is closed and threadlocked per the following instructions.

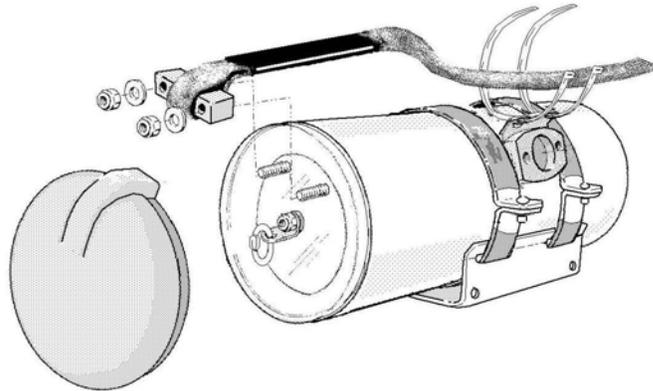
Normally the rocket launch tube assembly is attached to the parachute container when the unit is shipped. However, in certain cases, the rocket is shipped separately and Figure 9 shows how to attach the rocket to its mount via (4) ¼-20 set screws prior to attachment of the rocket lanyards. This shows only the method for the BRS300, BRS301, BRS440 or BRS460 rocket. The BRS601 launch tube assembly is simply attached via (3) ¼-20 pan head screws from the underside of the mount. For more detail, refer to rocket assembly instructions that are included with your rocket.

These steps can be followed in reverse to detach the rocket, lanyards, and main bridle for preparation of the unit to return to BRS for service (see page 72).

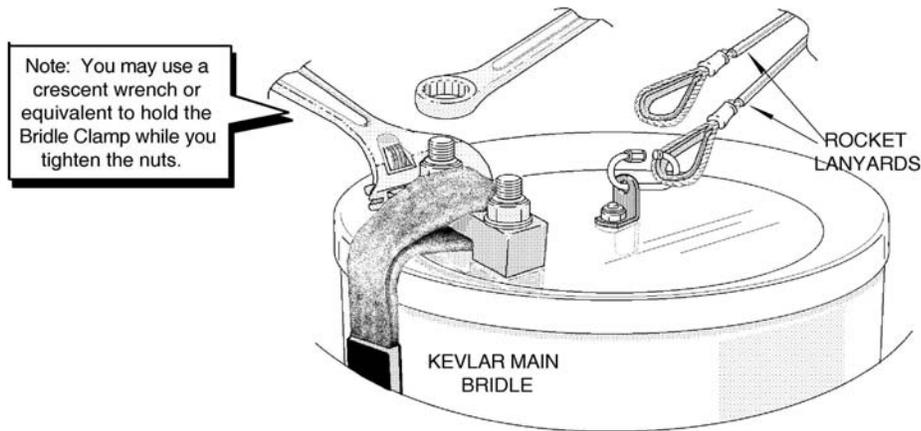
1. Canister



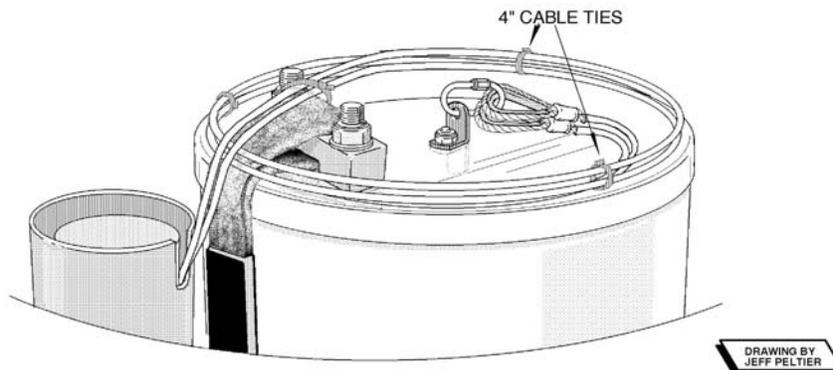
Install Main Kevlar® Bridle by first removing nuts that secure Bridle Clamp in place. Remove Bridle Clamp.



Once the Bridle Clamp has been positioned, secure the Main Kevlar Bridle to the Link Plate on the side of the Pedestal with the Plastic Cable Ties provided.

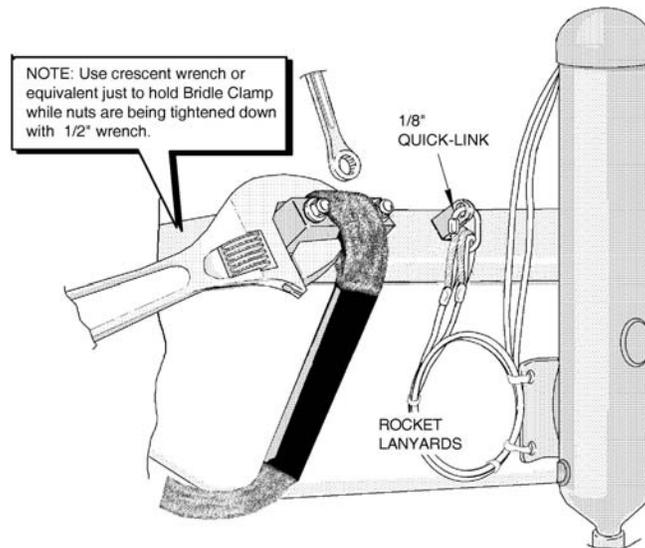
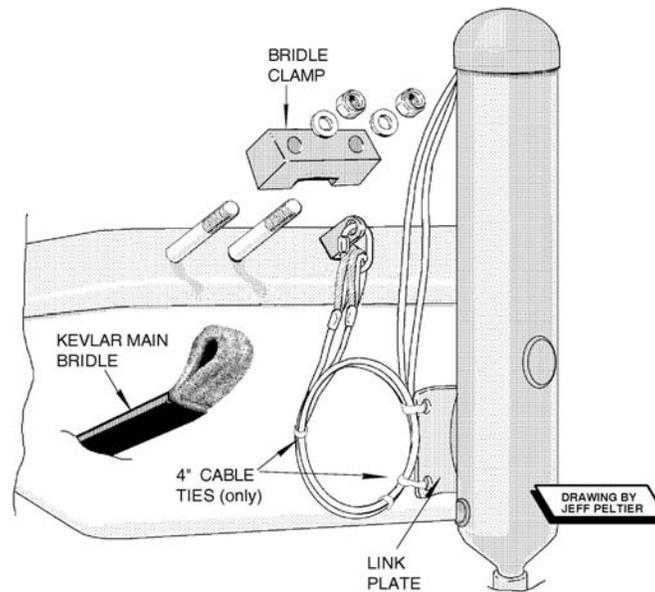


Install Main Kevlar® Bridle by passing Bridle Clamp through loop in Bridle. Position Clamp back over bolts protruding through cap with Bridle in place. Reinstall hardware.



Coil Rocket Lanyards as shown to pay out naturally when the Rocket fires. Connect ends of Rocket Lanyards to 1/8" link on the canister Inner Cap. Use small amount of removable threadlocker (blue) and close gate with proper wrench. Use 3-4 small 4" lg. plastic tie wraps to secure Lanyards in place, facilitating installation of canister Outer Cap. Install plastic Outer Cap and Rocket Cap.

2. VLS



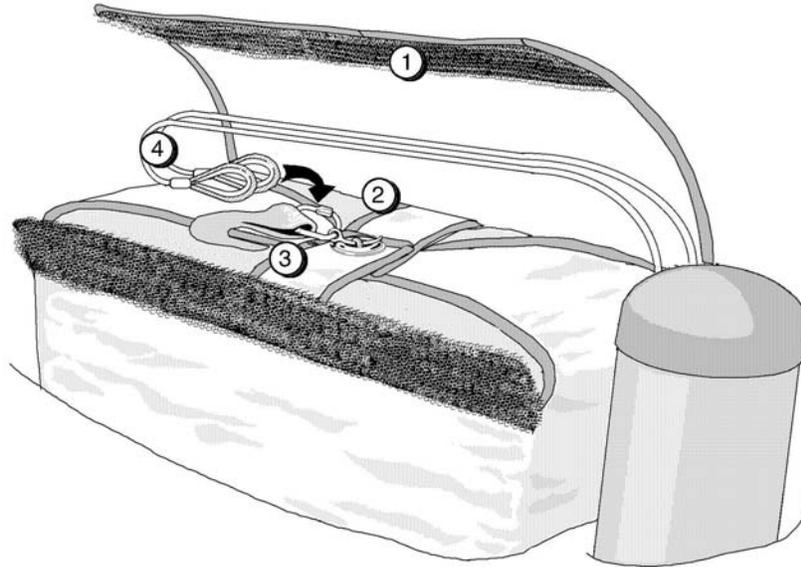
Install Main Kevlar® Bridle by first removing nuts that secure Bridle Clamp in place. Remove Bridle Clamp. Install Main Kevlar® Bridle by passing Bridle Clamp through loop in Bridle. Position Clamp back over bolts protruding through cap with Bridle in place. Reinstall hardware.

Stow excess Main Bridle by S-folding and securing with cable ties (3/16" max.). Excess Bridle should be stowed nearest to rocket end of VLS box.

Coil Rocket Lanyards as shown to pay out naturally when the Rocket fires. Connect ends of Rocket Lanyards to 1/8" link on the VLS Cap. Use small amount of removable threadlocker (blue) and close gate with proper wrench. Use 3-4 small 4" lg. plastic tie

wraps to secure Lanyards in place. USE ONLY THE 1/8" X 4" LG PLASTIC TIE WRAPS TO SECURE THE ROCKET LANYARDS, NOT THE LONGER ONES PROVIDED. Install Rocket Cap.

3. Softpack



NOTE: THE RELEASE PIN IS HELD IN PLACE BY #3 COTTON BREAK CORD. ITS PURPOSE IS TO KEEP PIN FROM FALLING OUT. DO NOT REMOVE IT- IT WILL BREAK WHEN ROCKET PULLS ON IT!

Open Velcro opening flap to expose pin release system.

Connect ends of Rocket Lanyards to 1/8" link under Velcro opening flap of softpack. Use small amount of removable threadlocker (blue) and close gate. Do not over-tighten barrel on link gate.

Make sure Incremental Bridle (sewn webbing loop with yellow Kevlar® covering) is attached to 1/8" link also.

Coil Rocket Lanyards as shown to pay out naturally when the Rocket fires and close Velcro opening flap. Install Rocket Cap.

Install Main Kevlar® Bridle to large 1/2" link on the side of the pack (usually opposite of the rocket mount). Use small amount of removable threadlocker (blue) and close gate with proper wrench. Again, do not over-tighten.

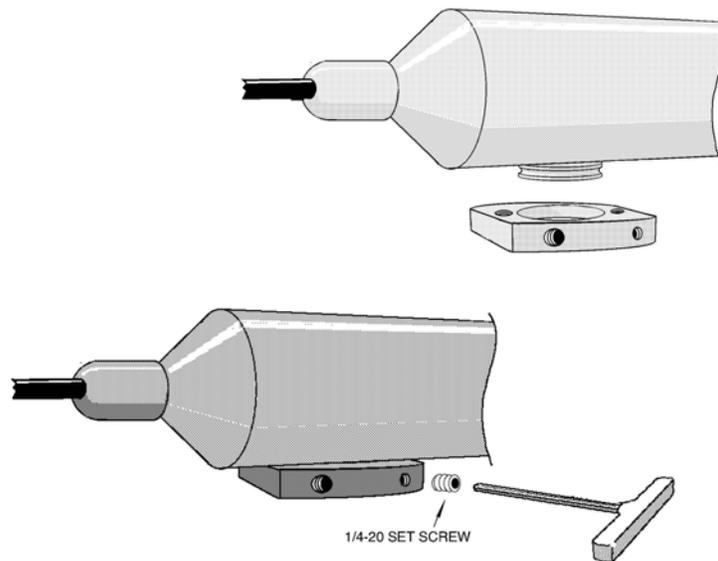


Figure 20: Rocket Attachment (BRS 300 and 400 Series Rockets)



Now that you have successfully installed your BRS system (and hopefully sent in photos and warranty registration), it is not time to go flying just yet. Before you do, please continue on to the next sections where you will find all the information necessary to operate and maintain your BRS system properly to provide the maximum chance of success.

INSTALLATION NOTES

In addition to this Manual, you may receive a separate set of instruction sheets for installing your BRS unit onto a particular aircraft (except for most custom orders). These instructions are generally not highly detailed, but give general guidance to aid in installation. Please make note of the following:

- a) The additional information you receive may be for a different aircraft. If there are similar aircraft with similar installation guidelines, BRS may opt to use one document for both aircraft.
- b) The depiction of your unit on the drawing may differ from the actual product received due to product enhancements or generic configurations that are set up at the factory.
- c) In some cases, the desired location and/or orientation of the rocket to the parachute container may differ from what was received. In trying to streamline our production processes, BRS has chosen to deliver all canisters with the rocket at the 12 O'clock or top position (opposite modular mounting plate) and all softpacks with the rocket positioned horizontally. Instructions on how to modify these factory defaults will be included with each unit.

It is imperative that you follow the installation instructions as closely as possible, using common sense and good mechanical aptitude as necessary. If you have a differing opinion of a proper installation than that of the documentation provided with your unit, or your aircraft differs from what's depicted, please consult the BRS factory before proceeding.

Again, thank you for considering BRS for your ballistically-deployed emergency whole-airframe parachute needs.

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OPERATION

The BRS-6 product you have purchased is a rocket-deployed emergency parachute system for use on experimental , LSA and ultra-light aircraft. It is designed to recover the aircraft in life-threatening emergency situations, lowering the aircraft with occupants, to the ground with a survivable rate of descent. Your BRS-6 system is activated by pulling on a T-shaped handle that must be mounted within easy reach of the pilot and/or passengers.

This section is a general guideline for the **operation** of all BRS systems installed on experimental aircraft. **It is absolutely mandatory that you read this section in its entirety before operating an aircraft with a BRS-6 Emergency Parachute System. In addition, it is also advised that you read the remainder of this manual.**

BRS™-6 SYSTEM OPERATIONAL LIMITS

Detailed parameters can be found at the end of this manual, and CAD drawings with overall dimensions are available from BRS.



NORMAL PROCEDURES

Installation of a BRS system does not change the normal procedures necessary for safe operation of your aircraft. The following preflight procedures should be added to the normal aircraft preflight and all items should receive as much attention as any other part of your aircraft before flight:

BRS Pre-Flight Checklist

- ✓ **Remove any and all protective covers from the BRS unit**
i.e. plastic or other wrapping that may protect the unit from moisture between flights.
- ✓ **Check service dates on data label for expiration**
- ✓ **Check security of airframe connections**
Inspect Nylon Cable Ties for UV damage. (Cable ties must be replaced every 6 months.)
- ✓ **Check integrity of airframe bridles**
Both at terminals (look for deformed thimbles on steel bridles) and along its length. Look for torn plastic coating (stainless steel) or fraying (Kevlar®) that may reveal wear.
- ✓ **Check routing of airframe bridle**
Though your installation should have assured no interference, check *again* to be sure the bridle is *still* well secured so as not to interfere with:
 - a) the firing of the rocket or the extraction of the parachute,
 - b) the propeller, or
 - c) any control linkages.
- ✓ **Check parachute container and rocket mounts for:**
 - a) security that it will not move in-flight,
 - b) that the rocket is *still* aimed in the correct direction, and
 - c) that the container is still positioned as originally desired.
- ✓ **Check all bolts and nuts (3 threads showing, min.)**
- ✓ **Check activating handle for:**
 - a) removal of Safety Pin and Flag,
 - b) kinks or other damage to the activating housing, and
 - c) security of the housing (not dangling or stretched, plus *still* fastened along its route).
- ✓ **Check stainless steel link security**
- ✓ **Check sealed cap security (on canister and VLS only)**
- ✓ **Check exterior cap security (on canister only)**
- ✓ **Check Velcro flap security (on softpack only)**
- ✓ **Check egress cover security (if installed)**
- ✓ **Passenger briefing**
- ✓ **Review emergency procedures described below**

NOTE: The above preflight checklist is meant to be used *in addition to* your regular aircraft preflight checklist. It *is not* intended to be a substitute for any other preflight checklists. Another copy is included at the end of this Handbook that can be removed and used separately.



EMERGENCY PROCEDURES

This section identifies the situations for which the system should be activated, outlines the proper activation procedures, describes the deployment environment, and describes the post-touchdown activities.

1. Deployment Scenarios

The following scenarios describe situations in which activation of the BRS system may be the only means to save the airplane occupants from serious injury or fatality. These scenarios do not represent all possible situations nor do they represent situations in which activation of the BRS system is the only option.

⚠ WARNING

The BRS system is intended to be used only in an extreme emergency in which recovery of the occupants of the airplane using other **EMERGENCY PROCEDURES** is not possible. If the airplane is controllable and structurally capable of flying to a safe landing site, the BRS system **SHOULD NOT BE ACTIVATED**. If the airplane is uncontrollable and/or a forced landing on extreme inhospitable terrain cannot be avoided, the BRS system **SHOULD BE ACTIVATED**.

⚠ CAUTION

The extreme emergency in which the BRS system must be activated requires that it be activated in a timely manner. **Do not wait** until the airplane has exceeded the airspeed and load factor operating envelope, is at an altitude which does not allow the parachute to fully deploy prior to ground impact, or is in an extreme attitude.

BRS systems are not intended to be a substitute for good pilot judgment, skills and training, proper preflight planning, proper aircraft maintenance and preflight inspections, and safe aircraft operations.

Mid-air collision - A mid-air collision will completely disable most aircraft. Most mid-air collisions occur at relatively low altitudes or in the landing traffic pattern. If a mid-air collision occurs, the pilot must immediately determine if the airplane is controllable and structurally capable of flying to a landing site. If not, the pilot should activate the BRS system immediately.

Structural failure - A structural failure can result from many conditions: encountering a severe gust at speeds above the aircraft's structural cruising speed, exceeding design load factor at speeds above the aircraft's maneuvering speed, wake turbulence or a degrading and/or defective aircraft structure. If a structural failure occurs, the pilot must determine if the airplane is

controllable and structurally capable of flying to a landing site. If it is not, the pilot should activate the BRS system immediately.

Loss of control - Loss of control could result from a control system failure, wake turbulence, severe airframe icing or pilot disorientation. If control can be recovered before the aircraft is in danger of ground impact, the pilot should do so and not deploy the BRS. If the airplane cannot be controlled, the pilot should activate the BRS system immediately.

Stall/Spin on approach - The stall tightening to a spin due to pilot distraction on landing approach is a dilemma long faced by aviation. With its low altitude recovery capability, the BRS unit could save some occurrences from becoming fatalities. The BRS unit is not guaranteed to fully decelerate an aircraft from extremely low altitudes, but a spin below 500 feet is a grave problem, and the BRS unit may offer your only alternative.

Engine-out over hostile terrain - An engine-out emergency should not be a reason to deploy the BRS unless the terrain below will not accommodate a safe landing. If the surface is extremely rough, a safe landing may be impossible. At night or in ground fog conditions, visibility may not permit a safe landing approach. If a safe landing is not possible, the pilot should activate the BRS.

Pilot incapacitation - Passengers must be briefed on the BRS location and operation prior to take-off. If the pilot is incapacitated and cannot fly the airplane to a safe landing and the passenger does not have the training or skills to fly the airplane to a safe landing, the passenger should activate the BRS.

Some situations provide scenarios where BRS system deployment is not desirable. These have a central theme: if the aircraft can still be controlled, continue flying the airplane to a safe landing.

Out of fuel, with landing areas within reach - If a landing area is available and the aircraft is controllable, the airplane should be flown to a normal landing.

Lost, with fuel remaining - Getting lost, or being uncertain of control of flight, may seem a life-threatening situation. If sufficient fuel remains and if the airplane is controllable, the airplane should be flown to a safe landing.

IMPORTANT NOTE: The above review is *not* intended to be a complete listing. Flight is sometimes described as long periods of complete boredom punctuated by brief periods of total fear. While a humorous oversimplification, it is a meaningful statement in that flight can suddenly present a hazard that demands fast, correct action. While this asks a lot of ordinary humans, it does not mean you should always resort to your “ace in the hole...” your BRS.

2. Proper Activation Procedures

As with any aircraft emergency situation, it is essential to practice simulated activation procedures, so that a sequence of pilot actions comes naturally. During an extreme emergency, the pilot's senses and faculties will be highly stressed.

▲ CAUTION

It is not reasonable to think that you will act calmly and logically, if you do not practice a sequence ahead of time. You should also assure the activating handle is usable during a stressful condition, which demands thoughtful handle placement.

Before flight, be sure to remove the safety pin (the flag is intended to help you remember this). Procedures in the following operational checklist assume that this has been done and are immediate action items, which should be committed to memory:

- ✓ **KILL THE ENGINE (engine "kill" switch or pull mixture)**
- ✓ **PULL THE ACTIVATING HANDLE... hard continuously!**
- ✓ **SECURE RESTRAINT SYSTEM**
- ✓ **ASSUME EMERGENCY LANDING POSITION**

The following amplified procedures elaborate upon this operational checklist. These procedures include information not readily adaptable to a checklist format, and material to which the pilot could not be expected to refer to in an emergency.



KILL THE ENGINE

It is very important to stop the engine before firing the BRS. While on some aircraft (tractor-mounted engines for example), engine shut-down is not mandatory, it is a valuable practice. On pusher-engine aircraft, shutting the engine down (or at least moving the throttle to idle thrust) may make the difference between a successful deployment and a failed one. In either case, a distressed aircraft will be safer to its occupants if the engine is not still running.

▲ DANGER

POWER TO THE ENGINE MUST BE SHUT OFF BEFORE DEPLOYING A BRS PARACHUTE. FAILURE TO DO SO MAY RESULT IN SERIOUS INJURY OR DEATH. As stated earlier, the Kevlar® that BRS uses for harnesses and bridles is very resilient to cutting, yet could still be severed if the engine is not shut off and the propeller is still turning! If a bridle or harness does survive contact with a moving propeller, it may nonetheless be drawn into the prop's hub, possibly causing a malfunction or at least an improper descent attitude.



PULL THE ACTIVATING HANDLE

Grasp the entire handle in your hand and pull vigorously from the handle holder. Do not use only a couple fingers. The handle has been designed to be gripped with a gloved hand. Although only a small movement is needed to cock and detonate, you should pull a longer length to be sure you've pulled enough. *You cannot pull the handle too far.* If the activating handle housing is well secured along its length, the complete pull

(both above actions) may be as little as 3 inches. However, it is best if you plan to pull it at least six inches.

The first movement of the handle “arms” the system. The BRS unit *is not* an explosive waiting to go off. It must first be armed—or “cocked”— to put the system in readiness for detonation. Though you should feel no difference in handle pressures, the second action created by a generous pull of the handle is to release the hammer which will cause the rocket motor to ignite.

▲ WARNING

If the activating handle housing is very loose, making the required pull longer, it is possible during a high-stress situation to not be able to pull the handle far enough to detonate the rocket. This may also be due to cockpit confinement whether by design or damage to the cockpit area. The only possible prevention of such a dilemma is to properly secure the activating handle housing along its chosen route.

▲ CAUTION

While the handle has also been designed not to snag on clothing on entry/exit or during aircraft control movements, it is the responsibility of the pilot to be careful of movements around the handle after first assuring a good location for the handle mount.

3. Post-Activation Environment

Parachute Inflation Location

The parachute will always inflate in the same place, and it's very logical when you think about it. The parachute *always* inflates “downwind” of the aircraft.

Many pilots have thought that firing the BRS rocket upwards would be optimal. As the aircraft will eventually be underneath the canopy, this misconception is quite understandable. However, the final relationship of canopy over aircraft does not have much to do with the best direction to launch the rocket.

The inflation location being in the aircraft’s airflow explains why BRS recommends firing somewhat rearward, slightly to the side (to miss tail surfaces), and downward. Some aircraft simply cannot use this method, resulting in top-mounted installations.

Aircraft attitude after deployment

Once the action described above occurs, the aircraft will be in a different aerodynamic environment than during normal flight. As the rocket launches, the sleeve (or bag) enclosed parachute, suspension lines, and riser are extracted and the entire assembly moves rearward (due to relative wind influences).

The first pull is called “snatch force.” This is the action that occurs when the extracted parachute and all suspension lines and risers have reached the fullest extent of their length. Snatch force is a function of the inertia of moving components (rocket, parachutes, lines, riser, bridles). When they reach this point, the aircraft with all its prior momentum will pull against these components of the BRS unit. Snatch force is significantly less than opening shock and can rarely be felt by the pilot/passengers.

As the air fills the canopy, the forward motion of aircraft will be slowed, rather quickly. When this happens the nose will be raised, also rather sharply, just as if you

had pulled the joystick back forcefully. The second force, called “opening shock,” occurs when the canopy fills (after the slider disreefs). This action will occur very briefly after any snatch force is felt (approximately one half to one second, depending on parachute design). The force of opening shock is significantly greater than snatch force. For most persons, this will be the main force felt. Opening shock can generate loads of 3-7 Gs.

As the parachute opens, the aircraft will feel as though the “brakes” are being applied sharply, and may be accompanied by a very noticeable pitch up attitude. Actually, the aircraft will be slowed in its forward motion, and the parachute—providing this deceleration—will actually move forward relative to its opening location. The new relationship of canopy to aircraft is now in its descent mode (that is, canopy “above” aircraft). Descent of both aircraft and parachute will be approximately 20-25 feet per second (which translates to about 14-17 miles per hour).

Following the rapid slowing of the aircraft, an oscillation will follow. This is a period when the aircraft swings in a pendulum manner until it stabilizes directly below the canopy. While this pendulum effect is dampened quickly by the aircraft structure, periods of instability may re-occur due to varying atmospheric conditions on descent.

▲ WARNING

If the aircraft speed was high at deployment, this de-stabilization can continue longer. If the altitude at deployment was low (a relative factor; “low” may be 100 or 500 feet), the oscillations may not cease before the aircraft reaches the ground. If the latter is true, the aircraft may strike the ground in an unusual attitude, which could result in injury or death to occupants. (see “Touchdown Point,” below).

Some control of the aircraft may still be present, but don’t count on any at all to direct you to a chosen landing area. You may be able to direct the aircraft another way—assuming control surfaces are intact and receiving enough airflow—but you will not be able to move any direction except with the wind. If you are flying a tractor-engine design, and your engine is still running, testing has shown it possible to tow the parachute somewhat, but you should still shut down before impact. Only use the towing capability in a life-threatening situation, and then shut down again! Towing does increase the rate of descent.

4. Touchdown Environment

Touchdown point

Unlike sport parachuting, where an experienced skydiver can expect to land extremely close to a predetermined landing spot, an aircraft under its BRS canopy has very little directional control.

As you will probably have very little chance to choose when to deploy your BRS, the combination of an unplanned deployment and lack of directional control will take you “wherever the wind blows you.”

Though in some cases, the aircraft may be able to exert some control over heading, you cannot assume this opportunity. Therefore, you must expect the worst.

Touchdown Speed

As stated above, vertical velocity could be as high as 20 miles per hour (and perhaps higher depending on ground elevation). This speed may not sound fast, but think of striking a fixed object while running at 20 miles an hour. You would surely sustain an injury.



SECURE RESTRAINT SYSTEM

Many aircraft—from ultralights to older general aviation planes—have only a lap seat belt. While this suffices in some situations, it may well not be satisfactory in the case of, for example, a structural failure or midair collision. A more secure restraint system is necessary if any type of radical flight activity (unusual attitude) results which could cause a pilot (or passengers) to be thrown around violently. Four or five point seatbelt systems, provide a high level of security. Properly installed, they should keep pilots and passengers with their aircraft, held firmly in their seat. Whatever restraint system you might have, now is the time to tighten it down.

BRS recommends that all aircraft have, at least, a lap belt with shoulder harness for each occupant.



ASSUME EMERGENCY LANDING POSITION

It is wise to plan a posture that will protect you (and any passengers) the most in the case of a rough terrain touchdown. A recommended emergency landing body position (shown to the left) should be assumed by all occupants. Both hands should be placed behind the head with the fingers locked together. The elbows should be pulled forward to protect the side of the head and face. The upper torso should be erect. Though the descent rate of about 14 to 17 miles an hour is typically not severe in most situations, the exact angle of impact, coupled with an aircraft still oscillating under canopy, could cause the landing touchdown to be sufficient to cause injuries or worse.



NOTE: The exact speed of descent cannot be determined ahead of time due to many variables involved. For more details, see the precautionary information in the section called "LIMITATIONS OF BRS SYSTEMS."

Note: Stunt car drivers use a technique of pulling themselves forward to and holding onto the auto's dashboard. This keeps them from slamming into it, and largely avoids injury to them. A similar tactic may be considered if it might work in your particular aircraft.

In addition to vertical velocity, the aircraft may still be oscillating (see above) and the wind may be causing significant amounts of drift. Try to consider the direction of such movements just before touchdown occurs.

If so equipped, move seats to the rear to gain maximum distance from instrument panel and controls. Open doors prior to touchdown to ensure they can't be jammed shut by possible distortion of fuselage due to impact.

Post-Touchdown Activities

Once the aircraft has contacted the ground, and after you've checked for injuries that might be worsened by moving, plan to extricate yourself as quickly as possible. In some threatening cases, it may be best to move even if injuries are present; this decision must be made by the pilot and his/her passengers.

Exiting the aircraft while in a stressful environment may not happen mechanically. It is recommended that you (and your passengers!) practice escape techniques before any actual need occurs. After touchdown, allow the aircraft to come to a complete stop before getting out unless it's apparent that the aircraft is being dragged towards danger.

Upon exiting the aircraft, move to the upwind side to keep from being injured by the moving aircraft if the canopy were to re-inflate.

If you should end up in power lines (carrying electrical current), *do not under any circumstances* touch any metal parts. Also shout this precaution to anyone attempting to help you. If a rescuer touches a metal part of the aircraft while he stands on the ground, he could be electrocuted. Confine your movements until qualified personnel can come to your assistance.

If in the event of a water landing, doors should be propped prior to water contact.

5. Other Safety Item Suggestions

As a company specializing in safety products for airplanes, BRS would be remiss in not also advising the use of related safety products. Three devices come to mind in conjunction with the BRS unit.

BRS recommends that all pilots wear a helmet while flying open-cockpit aircraft. If the aircraft structure of an enclosed aircraft is not "friendly" to humans, that is, if care has not been exercised in the design, a rough accident might cause the head to strike portions of the aircraft. In all such situations, a helmet is advised, *if* that helmet meets current acceptable ratings for cranial protection. A helmet can also do double duty as protection against ear damage caused by continuous noise and, if foam filled, as a floatation device for water touchdowns.

It is also recommended that you reconsider the accessibility of your aircraft's kill switch. (Some aircraft do not refer to the engine shut down as a kill switch.) In a high stress environment you may fumble for an engine shutoff switch. Countering the need to have the kill switch accessible in all in flight postures is the need to keep it somewhat hidden from tampering passengers or curious children.

A last item on the safety list is fire extinguishing equipment. This may seem a weight and cost penalty until you think of the chance of an in-flight fire.

When you perform your regular aircraft preflight, you should also include a thorough inspection of the BRS unit. You may wish to blend the following points into your customary procedure, or you may wish to review them before or afterwards.

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MAINTENANCE

or

“INSTRUCTIONS FOR CONTINUED AIRWORTHINESS”

This section contains factory recommended procedures for proper handling and servicing of BRS systems for experimental aircraft. It also identifies certain inspection and maintenance requirements, which are **MANDATORY** if your BRS system is to retain its ability to function properly in an emergency situation. Any repairs, repacking, or inspecting of BRS systems must be performed by the factory or BRS Authorized Service Center (except for handpacked softpacks-see below). *At present, the only licensed repair facility other than the BRS factory in MN is “BRS Packstation-Speyer” (website: www.brs-service.de) in Speyer, Germany. All licensees are subject to review and their privilege may be revoked at any time; check with the factory for the current information on this subject.*

▲ WARNING

Unauthorized personnel should not attempt to modify, repair, or disassemble BRS systems at any time. BRS Inc. has gone to considerable effort to assure that the system will function reliably. Any change in its installation may render the system incapable of proper operation in an emergency. Modification of any component part of the BRS unit, or failure to strictly follow the procedures and directions set forth in this manual, can result in deployment failure and personal injury or death to the pilot and passenger(s) aboard the aircraft.

Treat your BRS rocket like a loaded gun. Take all appropriate precautions to see that other persons cannot tamper with your BRS system. The rocket ignition unit is not armed until the handle is pulled, and will not fire until the handle is pulled somewhat further from the housing. However, most children can accomplish this pull, and actions should be taken to prevent tampering. Use added care to inform passengers to be careful around the activation handle.

Do not “experiment” with your BRS system or fire it on the ground just to see if it works. People may be injured, property damaged, and thousands of dollars of expense will be incurred to repack the parachute and replace the rocket. In addition, firing the BRS system experimentally will render it unusable until the factory has serviced it.

1. *Mandatory Canopy Inspections and Repacks*

In addition to the preflight inspections described earlier, BRS parachute containers must be removed from the aircraft for factory inspection and repacking at intervals determined by the style of unit and the mounting location. The following chart illustrates the differences:

<u>Style</u>	<u>Internal Mount</u>	<u>External Mount</u>
Canister	6 yrs.	6 yrs.
VLS	6 yrs.	6 yrs.
Hand-Packed Softpack*	6 yrs. (2 yrs. if partially enclosed)	1 yr.
Pressure-Packed Softpack	6 yrs. (2 yrs. if partially enclosed)	1 yr.

This repack schedule is only valid for current BRS products and BRS products produced after 1995 (BRS-5 or newer). If you have an older unit, please contact the BRS service department with your serial number for service options relative to your specific unit.

*** NOTE:** Hand-Packed softpacks (currently the Model 600 only) do not necessarily need to be returned to the factory for routine service. They can be inspected and repacked by certified FAA riggers familiar with round emergency parachutes. Instructions are available from BRS.

2. *Unscheduled Canopy Inspections and Repacks*

The following situations will require that you send the BRS unit (minus the rocket!) back to the factory between routine repacks:

1. If the aluminum canister or fiberglass VLS box has received damage such as crushing or partial destruction.
2. If there is any breach of the inner cap on the canister or upper cap on a VLS unit.
3. If there is any tear or signs of damage to a softpack bag or contents.
4. If the parachute itself has gotten wet or been exposed to other contaminants.
5. If the parachute is deployed, either intentionally or accidentally.
6. In all other situations where you may be uncertain of the reliability of the unit due to some type of abuse, exposure, or wear.

You are encouraged to contact the factory for any additional problems. If possible, BRS will assist you over the phone. If BRS cannot be sure of the required action, you may be asked to return your unit to the factory.

IMPORTANT NOTE: Should you use your BRS unit in an actual emergency, return the entire unit for inspection by BRS. The company tracks all uses of BRS units with keen interest to see how and why it was used, what the results were, what injuries or damage may have resulted, and if any improvements to the device are possible, once the learning experience is gained.

MONEY-SAVING NOTE: If you send in your unit (any model) for service in the slower months of the year, you will receive faster turnaround service. You may also be able to save substantially on the cost of service. Typically, BRS offers cash savings if you send

in your unit during the months of October through January. These offers are subject to change without notice and may be withdrawn at any time.

Many owners wait until the main flying season is about to begin and then send in their unit. They are often dismayed at the longer turnaround time and will pay standard prices for service during the main season. Planning ahead to remove and send in your unit during the months above can relieve frustration, have you better prepared as the flying season starts, get your unit back quicker, and save you money. Call BRS for the latest repack and service information.

3. Rocket Replacement

All BRS rocket motors must be replaced by their date of expiry. These service dates are printed on placards on the sides of the parachute container and rocket. When the rocket is due for replacement, **DO NOT** ship it to BRS!! It is highly illegal and dangerous for our customers to ship loaded rockets and propellant without the proper packaging and documentation.

When the time has come for replacement, please contact BRS for service instructions on how to safely disassemble your rocket and dispose of it properly.

4. Parachute Service Life

BRS has determined that nylon parachutes that have been inspected and maintained according to the above repack and service schedules may be approved for a maximum service life of 24 years from date of manufacture. **This requires that the parachute and slider fabric are strength tested by BRS after 18 years (or 2 scheduled repacks).** If granted, this typically equates to: (1) original pack, (3) scheduled repacks, and (1) rocket replacement during the service life of a well-maintained unit.

5. Owner Maintenance

Not all situations will require removal and shipment of the unit to BRS, as indicated above. Surely, if BRS can help keep your unit in proper operating order *while on your aircraft*, this is the best solution. To achieve this goal, you must take preventative maintenance actions, as described below:

A. Container Damage

The BRS parachute is often packed under tremendous pressure (up to 40,000 pounds) so that its size can be contained in as small a container as practical. It is then inserted into a container prior to installation on your aircraft. These containers offer considerable protection for the parachute. Rain, ultraviolet sun rays, and other elements of nature will generally not affect parachutes packed within a Canister or VLS box. However, should they become badly damaged; the extraction of the parachute may be adversely affected.

Take extra precautions to see that your container does not receive such damaging abuse. Gravel strips, or landing areas with rocks could cause BRS units to become damaged, if they are mounted low to the ground. Abuse can also happen while someone uses heavy tools around your BRS unit (perhaps striking the unit while working on another part of your aircraft). Another common place for aircraft—and BRS unit—abuse is “hangar rash,” or more specifically, damage that happens while moving aircraft in, around, or out of storage facilities. Careful preflight inspections should reveal canister damage.

B. Container Contamination

Our softpack bags will help with UV protection, but will not repel any significant amount of water or other fluid contamination. Our sealed containers (canisters and VLS box) will typically protect your BRS parachute from most forms of contamination. It can be said that these BRS styles are “virtually water proof”, but cannot be guaranteed, due to circumstances beyond our control.

A heavy rain, or frequent rain, or use on floats should not cause the BRS canister or VLS box to become wet inside a factory sealed unit, thanks to many innovative BRS features. However, under harsh circumstances anything is possible. By frequent inspection, you should be able to tell if moisture has infiltrated your system over time. *If* your parachute does get wet, the damp nylon fabric could cause the canopy to not fill properly, or as quickly as needed by the situation. In addition, the extra weight of the water may hinder the rocket during extraction.

Many ultralight installations will place the BRS unit in some proximity to fuel systems, either by fuel tanks, fuel lines, or through exposure to fuel during refueling operations. Fuels, oils, and other fluids may get inside the canister or come in contact with the rocket motor and cause contamination problems.

The simplest solution to these or other forms of contamination is to be very careful about exposure to these elements. Covering your BRS unit with plastic or other moisture repellent materials should help keep your systems from sustaining any contamination.

▲ WARNING

Any non-BRS supplied covering of the unit must be removed before flight, or the unit may fail to perform properly (see “BRS Pre-Flight Checklist”).

Even simpler solutions—to water contaminants at least—are to hangar your plane, or keep it in some low-moisture environment. Also, flying your aircraft only in dry conditions will reduce the likelihood of moisture contamination. These measures, however, may not prevent contamination by fuel, oil, and other contaminants.

If you believe you have moisture intrusion and possible damage, you should call the BRS factory. If you have a sealed canister or VLS unit, it was weighed before it left the factory and the weight is imprinted on a data plate and also within the cover of this manual. By removing the unit and weighing it, you can determine if moisture or other contaminants have entered the container (a few ounces over the printed weight may not necessarily indicate a problem). In the

unlikely event of contamination, you will remove and send in *only* your parachute canister.

C. Environmental and Storage Conditions

BRS parachute systems have been evaluated for operation in temperature conditions of -40° to 120°F (-40 to 48.9°C). It is also important that long-term storage temperatures not exceed these limits. However, short-term exposure (less than 24 hours) to temperatures between 120°F and 180°F will usually not harm the system. For installed systems, storing the aircraft in a cool, dry location (less than 70% humidity) will keep your BRS unit in the best condition and there will be no need for any maintenance other than repacks at the above prescribed intervals.

D. Corrosion

Corrosion is a frequent problem for metal surfaces which are frequently exposed to water, specifically saltwater. Float equipped aircraft are most susceptible, but any aircraft near large bodies of saltwater are vulnerable to corrosion. If you have a canister unit, a quick freshwater rinse (including under the outer cap for canister units) may help mitigate the effects over time. Applying aftermarket corrosion inhibitors to all exposed metal components may also be useful.

Over the years, BRS has paid particular attention to the corrosion resistance of its products. With the exception of a few zinc-plated steel clamps, all metal components of BRS units (including rockets) are fabricated from either stainless steel or anodized aluminum.

If you have a concern about corrosion, you should consult the BRS factory. It is very possible that factory personnel will request that you first send photos of the affected parts. If technicians cannot determine the extent of the damage from photos, they may request you send the parts in for inspection.

Special Note Concerning Stainless Steel Fasteners.

As previously stated, to prevent corrosion, all BRS fasteners are now stainless steel. To prevent "galling", a common phenomenon of stainless nuts and bolts which causes them to irreparably bind together, a couple of things may help.

1. Put a small amount of "anti-seize" compound on the threads before joining together.
2. Screw hardware together at a slower rate than normal. Heat build-up in the threads is a factor in galling. DO NOT use powered screwdrivers on stainless steel hardware.

E. Vibration-Related Problems

As with nearly all components of ultralight aircraft—and many other types of aircraft—vibration can be a significant problem. Especially in two-stroke engines, with their higher RPMs, vibrations over a sufficient period of time can undo nuts, wear out bushings, cause metal fatigue, and other difficulties. In some cases, these problems can be rather hard to spot.

Be sure to frequently inspect the following, for vibration-related problems:

1. Cracks near holes for unit and handle mounting hardware
2. Nuts and bolts attaching the unit to the airframe. (NOTE: A dab of paint on the visible extension of a bolt's threads can make this check very quick and accurate.)
3. Nuts and bolts on the unit itself
4. Nuts and bolts on the handle mount
5. The routed bridle and the activating housing, even when fastened by nylon tie wraps, may be loosened by vibration.
6. The mount of the unit to the airframe may have changed position. This could cause the rocket to fire in an inappropriate direction.
7. Any portion of the system—bridle, housing, nylon bridle, or other component—if *between two metallic parts* could be worn significantly by vibration. It is best if such "sandwiching" of components is avoided, however, a preflight check should be performed regularly on any such sandwiched parts. **NOTE:** Please also see "BRS Pre-Flight Checklist"

F. Ultraviolet Degradation

Very simply, UV degradation is exposure to sunlight. As most pilots will already be aware, the sun can be a powerful enemy. *All* materials are subject to deterioration from prolonged exposure to sunlight. Some materials will degrade quite rapidly, such as synthetic fibers and plastics.

On all models, extensive efforts have been made to shield degradable parts from exposure to the sun. All Kevlar® webbing and stitching are sheathed with black nylon or rubber coating. All components of the parachute assembly (Kevlar® and nylon) are covered with either an opaque ABS cap or durable Cordura® fabric bag. For canisters, the outer cap shields the inner cap from excessive exposure. If your outer cap shows damage, order a replacement from BRS. They are fairly inexpensive and can be easily replaced. A BRS canister should never be externally installed with the outer cap removed.

⚠ WARNING

The inner cap is not a user-replaceable item. Attempting to reseal or otherwise repair the inner cap could cause a failed deployment!

The nylon ties used to secure the bridle and activating housing are UV-stabilized, but can become brittle fairly quickly. They are inexpensive and should be replaced every (6) months regardless of exposure.

Only one sure way exists to prevent UV damage: keep your aircraft out of the sun. A hangar or other aircraft storage is optimal, but a simple opaque aircraft cover would be a wise investment.

⚠ WARNING

Any covering of the BRS unit must be removed before flight, or the unit may fail to perform properly (see "BRS Pre-Flight Checklist").

G. Protection from Tampering

A red handle—with a waving red warning flag—should warn most people from tampering. But it is exactly this kind of “attractive nuisance” that indeed *may* attract some curious persons.

Always make sure the safety pin and warning flag are in good shape, that the flag is not tucked away, that the warning text is still readable, and that pin and flag are inserted in their proper storage position *at all times, except during flight operations*.

WARNING

Treat the BRS rocket as you would a loaded gun. Never point it at anyone, including yourself, and take all appropriate precautions to see that other persons cannot tamper with or play with your BRS unit. The BRS unit is *not* armed until the handle is pulled, and will not fire until the handle is pulled somewhat further from the housing. However, this pull can be accomplished by most children, and actions should be taken to prevent tampering for this reason.

6. Preparing Your System for Repack/Return

For all BRS systems due for repack, it is no longer possible (or necessary) to return the rocket motor for service as customers do not have the proper authority to ship rockets and/or igniters. Current models all offer a user-removable rocket motor, so that once it is shipped from BRS as new, it should *never* be returned to the factory.

When you require repack/inspection service, you now send *only* the parachute container. This means the fabric softpack, aluminum canister, or fiberglass/plastic VLS box. You will not return the rocket motor and BRS does not need to inspect bridles or mount hardware unless damage or deterioration is present. Please refer to specific instructions found on Pages 49-53 for attachment/detachment steps of the rocket, rocket lanyards, and main bridle.

Disassembly and removal of rocket

When you require factory work on any part of your BRS canister or VLS box (includes container and parachute), you need to remove the rocket. This can be easily accomplished by first removing the activation handle assembly (Figure 10) and then removing the main bridle, rocket lanyards, and rocket itself from the unit (reverse steps shown on Pages 49-53).

When returning your BRS system to the factory for service, please pack your unit thoughtfully and carefully.

Charges for factory services for any BRS model must be quoted at the time the unit is received at the factory. These charges vary as BRS costs change and BRS cannot quote costs more than 60 days in advance. If you call BRS, a general service price sheet can be mailed to you, but even this is only a guideline until the unit can be examined in person by BRS technicians.

Having your BRS unit serviced is somewhat like needing auto body work to repair the damage from an accident. If you call a body shop, asking for a quote over the phone, they will always require you to bring in your car for a detailed estimate of the damages. The case is very similar for BRS. Units can receive such a wide spectrum of

owner care, or the damage can be so different from unit to unit, that it is impossible to accurately state the service charges prior to a full factory inspection.

However, once you've sent in your unit, it will be extensively examined. An estimate of the charges will be prepared *before* the work has begun. If you supplied a valid phone number *and* the best time to call, a BRS technician will attempt to reach you to discuss the proposed charges. You may respond to these estimates and will be asked for your approval to begin work.

NOTE: Work will *not* begin until you have been contacted about the service fees. If you do not include a phone number with suggested contact time, it may not be possible to reach you. Should this situation arise, your unit may be significantly delayed in receiving service through no fault of BRS. If you do not hear from BRS in a reasonable time, it is *your* responsibility to contact BRS for further advice.

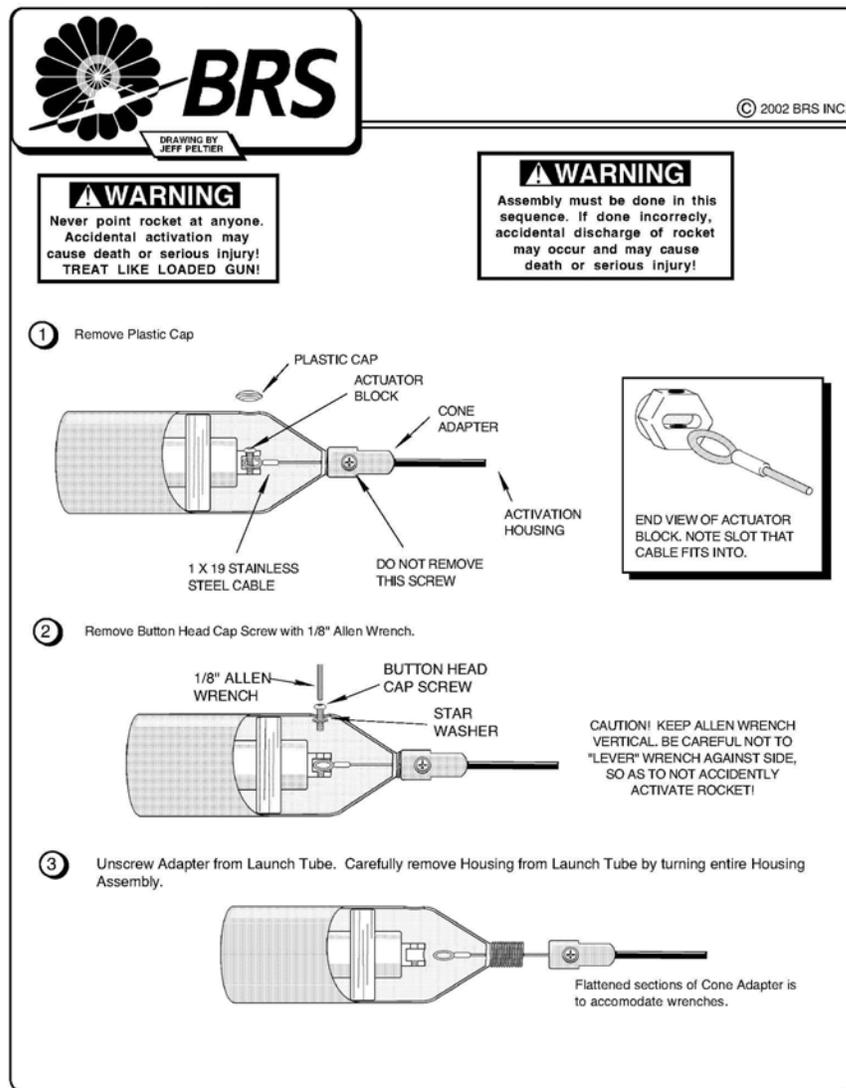


Figure 21: Removal of BRS Activation Assembly from Rocket for units produced prior to early 2010.

⚠ WARNING NEVER POINT ROCKET AT ANYONE! ACCIDENTAL ACTIVATION MAY CAUSE SERIOUS INJURY OR DEATH. TREAT LIKE LOADED GUN!

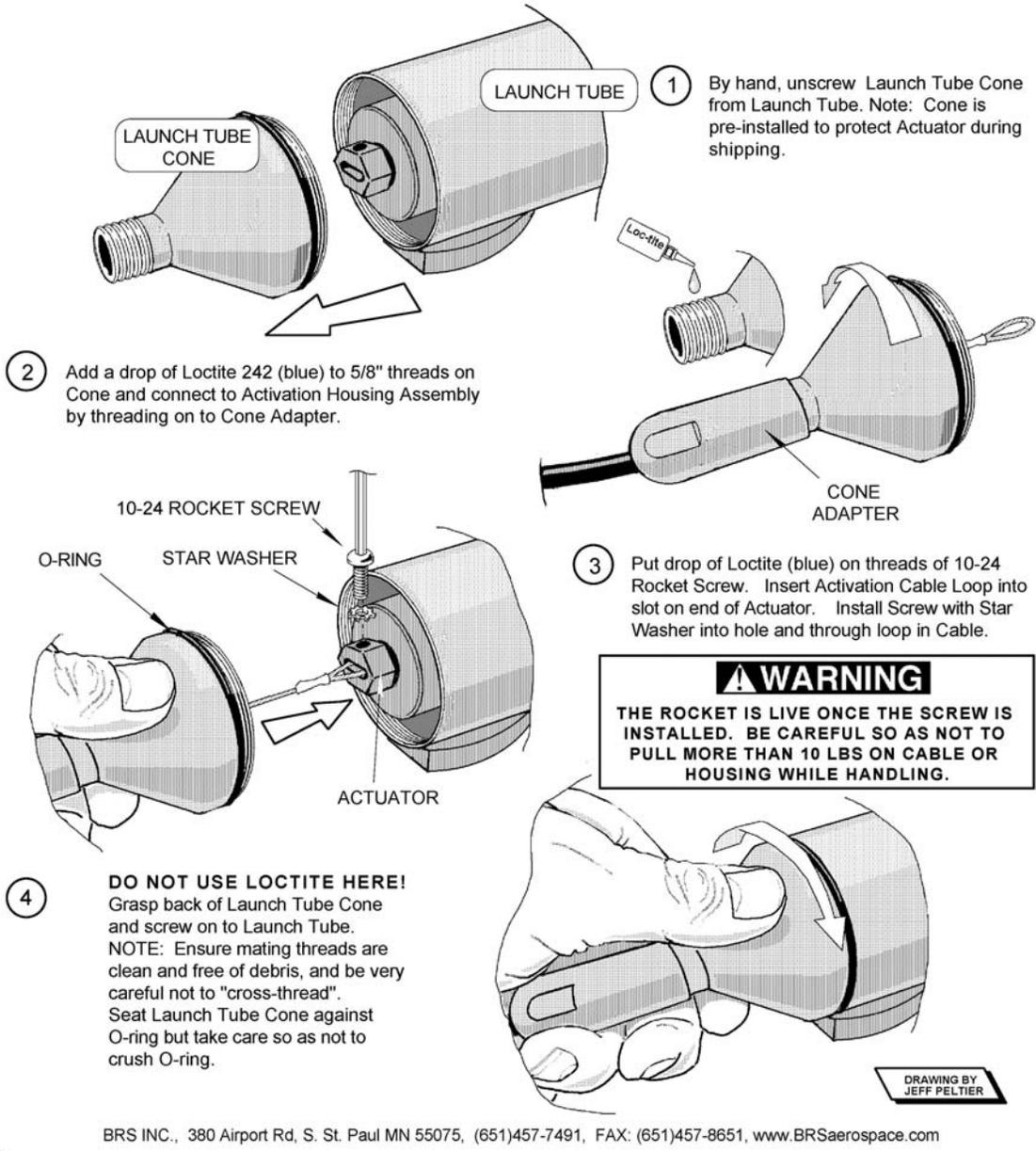


Figure 22. Installation and Removal (start with number 4) of BRS Activation Assemblies for units produced after early 2010.

*****International shipments—IMPORTANT!*****

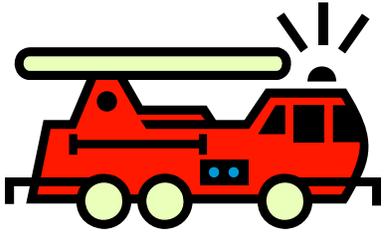
To assure BRS does not have to pay duty or tariff charges on your BRS unit when returned for maintenance, it is mandatory that you mark your shipping container, *and* all copies of shipping documents as follows: **“U.S. Goods, Returned”**

If you fail to do this, BRS may be assessed a duty charge, and if this cost cannot be reversed, BRS will have to pass this charge along to you the customer. If you have any questions about this procedure do not hesitate to contact BRS or your local international dealer

7. Switching your BRS system to another aircraft

One of many benefits of your BRS system is its generic adaptability to various aircraft. It is possible to switch your unit to another aircraft *if* you pay attention to two important details.

- A. Be sure the unit you own is correctly suited to *both* the weight and speed of the new aircraft. A label on your unit says which size it is. **If the new aircraft exceeds the limits on your parachute system (either in speed or weight), do not use it on your new aircraft. If you exceed the limitation of your parachute system, it may fail to perform as expected. Consult BRS for further advice.**
- B. Be sure you get new mounting hardware and new installation instructions for your new aircraft. Almost every aircraft will require different mounting hardware, activation handle lengths, and/or attachment bridles. Hardware should come only from BRS to assure full compatibility. Failure to heed these instructions could render a system unable to perform as expected.



INFORMATION FOR EMERGENCY PERSONNEL

Airplane crashes are rather rare events, thankfully. This helps illustrate that aircraft, whether commercial airliners, general aviation aircraft or recreational sport planes, are quite safe when flown by competent pilots.

However, the rare nature of these crashes also means that those who arrive first at the scene of an accident (rescue workers, investigating officers, fire fighters, and other safety personnel) may be overwhelmed or not recognize the parts of the aircraft particularly well.

One potential hazard rescue workers may encounter is an unfired, rocket-deployed emergency parachute system. While these devices are intended to save lives, they have the potential to cause injuries or even death to rescue workers. Take for instance the following scenario:

An emergency call takes you to the scene of an aircraft accident. Victims inside may be injured. You want to act quickly but people at the scene warn you about a rocket-deployed parachute installed on this airplane. The pilot did not activate the safety device and now you may find yourself working on or near the airplane with its ballistic device still ready to fire. You want to help the victims, but you don't want to harm yourself or others around you. Perhaps the occupants escaped without serious injury and may be out of the plane, but the wreckage must be dealt with and a damaged aircraft with a ballistic-deployed parachute can be lethal. What do you do?

In the hope of preventing a secondary tragedy, this document attempts to address the safety questions facing emergency personnel.

SUMMARY... But Please Read the Entire Section

The following summary provides the minimum steps to disarm a BRS rocket motor:

1. **Locate** the BRS parachute system by finding the RED activation handle and tracing it to the parachute pack. Note presence or absence of safety pin. Pin if necessary. NOTE: Keep in mind that a badly damaged airplane *may* have already put the activating housing into a stretched state that could be close to firing.
2. **Identify** the rocket motor launch tube (photos below). Note where the activating housing attaches to the base of the launch tube.
3. **Cut** the activating housing at the base of the launch tube using a bicycle cable cutter (identified below) or equivalent.
4. **Remove** the still-live rocket motor to a secure place and contact BRS for further directions about permanently disabling it.

What Does "Ballistic" Mean?

The term ballistic in this context has nothing to do with guns or ammunition. Instead it refers to a means of extracting a parachute. For Ballistic Recovery Systems (BRS) today, this means a solid-propellant rocket.

Used as intended, these BRS-brand emergency parachute systems have saved over 213 lives. More correctly stated - they save lives if used. However, the pilot must elect to deploy the system, unlike an airbag which deploys automatically when certain conditions develop. Because the pilot (or his passenger) must pull the activating handle, sometimes the units are not used.

The pilot may have felt he could rescue the plane from its predicament. Or he may have been unable to deploy for physical or other reasons, such as being at very low altitude. Regardless of why a ballistic parachute was not used, the fact remains for safety personnel that when handling an accident where a BRS unit was not deployed, a potentially dangerous device now confronts them.

How Dangerous Are They?

The rocket motors are ignited by pulling an activation handle in the cockpit. They then accelerate to an extremely high departure velocity in the first tenth of a second after ignition. While the total firing period is only one second, someone in the path of an escaping rocket could be seriously injured or killed. These are powerful rockets (about 2-3 inches in diameter and 8-10 inches long) that work very efficiently.

The danger to safety personnel may now be more obvious. A rescue worker who disregards the position of the ballistic parachute system, or who moves the aircraft without determining the existence of a ballistic parachute system may put him or herself in considerable jeopardy. BRS has worked with NTSB and FAA personnel, as well as rescue personnel throughout the country and around the world. We have assembled this information for safety personnel to disarm these systems, but caution is required.

AT THE SCENE- Important Steps to Protect Yourself and Others

A BRS unit is comprised of four major elements that emergency personnel need to consider:

1. Activation Handle
2. Activation Cable/Housing
3. Rocket Motor Assembly
4. Parachute Container

STEP 1: Locate the BRS system

The first thing emergency people may see is a red *activation handle*. This will be located near the seats, as it obviously must be close to the pilot. The red handle on BRS units will connect to a stainless steel activation cable which is routed inside of a thin, black, flexible housing that links the handle to the igniter. In some two-seat aircraft, there may be two separate activation handles, with two cables routed to a single igniter.



Current BRS activation handle w/safety pin installed

In the picture above, you will notice that the handle is secured with a safety pin. This is to remain with the handle until the aircraft departs for flight, at which time the pilot *should* remove the pin. However, in some cases, this pin may not have been removed and is still in place. A first step for emergency personnel is to mentally note absence or presence of this pin. If it is absent, you should place some type of 3/16 inch pin or rod into the handle holder, if available. This provides some measure of security as you proceed to further disarm the system.

Rescue personnel should follow the activation cable to where the parachute container and rocket are mounted. The activation housing joins the firing handle on one end to the rocket motor on the other.

▲ DANGER

Pulling either end away from one another can fire the unit!!

Normally the handle and the parachute unit will be mounted securely, but as stated above, in an accident, orientation may change. Rescue workers, police officers, and fire fighters should initially exercise extreme care when working around these systems, especially if the airplane is severely broken up or the activation cable appears to be tightly stretched.

STEP 2: Identify the rocket motor/launch tube

Once you have located the parachute container and rocket system, examine it to determine which type you have:

For smaller systems (BRS-1350 and smaller), there is a 2 ¼" diameter launch tube, 12-14" in length, normally attached to the container or frame. In some cases, it may not be attached, but should be located very near the parachute. This type has the rocket hidden within the tube, with the activation cable entering the tapered, threaded end of the tube and the lanyards to the parachute exiting the larger, open end of the tube (which may or may not have a plastic cap over it).

For larger systems (BRS-1350HS and larger), it is combination of a 3" diameter x 6 ½" long tube around the rocket and a 1 ¼" diameter x 4 ¼" long adapter tube where the activation cable connects. The parachute lanyards are attached to a pickup collar located at the open end of the launch tube.

A rocket motor assembly consists of two principle parts: The *rocket body*, which will leave the launch tube when fired; and the *igniter*, which remains in the launch tube after ignition. The

rocket bodies for the smaller rockets (BRS-300/460 and BRS301/440) are black in color. The rocket body for the larger rocket (BRS-600) is red in color. In either case, the activation cable/housing will lead right into a threaded nipple at the bottom of the launch tube and attach to the igniter.



BRS-300/400 Type Launch Tube with Rocket Body (contained inside tube)



BRS-300/400 Series Type Rocket Body



BRS-600 Launch Tube and Rocket Body (protrudes out end of tube)

If the airframe has experienced significant breakup, there is a very good chance that the rocket motor has been initiated. Telltale signs of this would be the parachute canopy extracted from it's container, the rocket motor is no longer in the launch tube, a burned appearance on the lanyards joining the rocket motor to the parachute or being unable to locate the rocket motor at all. A rocket motor that has separated from the igniter poses no significant hazard, unless it is exposed to fire. Experience has shown that a rocket motor subjected to high temperatures (fire) will not ignite in a normal manner and launch. Rather, they have been observed to burst in a relatively non-threatening display.

⚠ WARNING

After a determination is made that the rocket is live, under no circumstances should rescue personnel place any part of their person in front of the launch tube. Clear a 90 degree area in front of the rocket motor, extending 100 feet out, if possible.

THE ROCKET MOTOR IGNITER IS NOT AN ARMED, HAIR-TRIGGER DEVICE. It normally requires a deliberate pull of about 30-70 pounds to cock and fire the system. Both cocking and firing are accomplished by one pull of the handle. Because of the design, the handle will come free of the handle holder and travel slightly under **two inches** unimpeded. Then, spring compression begins. At that point, the system needs only about **1/2 inch of additional movement to ignite.**

Under certain circumstances, crash forces may physically separate the rocket from the igniter. This separation alone greatly reduces risks. The igniter contains two shotgun primers and a

small amount of black powder/magnesium mix. The output is a loud report and a flash of flame. This could cause minor injury, but it is not particularly dangerous. Should one encounter this scenario, cutting the activating cable is still desirable.

STEP 3: Cut the activation cable and housing

Now that you know a little more about what you are dealing with, the quickest and safest method of disabling the BRS systems is by severing the activation cable, preferably as close to the rocket launch tube as possible. Care must be taken, however, not to twist the housing while cutting it.

BRS STRONGLY RECOMMENDS using a bicycle cable cutter, which is sold in several brands and models from most bicycle supply shops. The model shown below, *Shimano TL-CT10*, is also available on the Internet through many dealers. Other cutters are acceptable (such brands as Felco, Greenlee, etc) as long as they are designed to cut steel cable in a shearing manner instead of pinching and crushing.



▲ WARNING

DO NOT ATTEMPT TO CUT THE ACTIVATION HOUSING WITH AN ORDINARY BOLT CUTTER OR SIDE CUTTER!

The cutters described above make a worthy addition to any rescue organization's standard tool box; being useful for cutting fences, steel cables, and other obstacles which may prevent workers from reaching the scene of an accident or freeing occupants.

Once the housing and cable are successfully severed, the system is rendered relatively harmless and rescue operations can proceed as necessary. However,

▲ WARNING

YOU HAVE ONLY CUT THE CABLE. THE ROCKET IS STILL CAPABLE OF IGNITION UNTIL IT IS EITHER FIRED OR COMPLETELY DISASSEMBLED. PLEASE HANDLE UNIT WITH CARE.

STEP 4: Removal and disposition of rocket

Later, after immediate concerns have been addressed, emergency workers are advised to remove the rocket motor and to completely disarm it by removing the rocket fuel, and firing the igniter. Alone, separated from the igniter, the rocket poses very little danger, but it should be stored in a secure location. BRS will provide assistance for this effort, which can be obtained by calling 651-457-7491 during business hours, CST.

Some agencies that BRS has communicated with take a very conservative position regarding how best to handle an unfired rocket. They feel that this is work best left to the local bomb squad. We leave such decisions entirely up to the individuals in charge at the scene. However, if the above steps are followed and normal precautions observed, we feel that disarming the system can be safely accomplished by emergency personnel without undue risk.

BRS™-6 System Parameters

Note: All BRS 6 parachutes are “Slider” equipped.

SYSTEM	600	800	1050 ASTM	1050 DAeC	1350	1350HS	1600	1800
Maximum deployment weight (1)	600 lbs 272 kg	800 lbs 363 kg	1050 lbs 475 kg	1050 lbs 475 kg	1350 lbs 612 kg	1350 lbs 612 kg	1600 lbs 726 kg	1800 lbs 816 kg
Maximum deployment speed	138 mph 222 km/h	138 mph 222 km/h	138 mph 222 km/h	172 mph 276 km/h	138 mph 222 km/h	184 mph 296 km/h	138 mph 222 km/h	175 mph 282 km/h
Canister System Weight (2)	22 lbs 10.0 kg	23 lbs 10.4 kg	28 lbs 12.7 kg	28 lbs 12.7 kg	N/A	N/A	N/A	N/A
VLS System Weight (2)	23 lbs 10.4 kg	25 lbs 11.3 kg	29 lbs 13.2 kg	N/A	34 lbs 15.4 kg	N/A	N/A	N/A
Soft-pack System Weight (2)	18 lbs 8.2 kg	19 lbs 8.6 kg	24 lbs 10.9 kg	24 lbs 10.9 kg	29 lbs 13.2 kg	33 lbs 15.0 kg	35 lbs 15.9 kg	37 lbs 16.8 kg
7" Canister Dimension (L x Diameter) (3)	18x7 in 46x18 cm	21.5x7 in 55x18 cm	21.5x7 in 55x18 cm	21.5x7 in 55x18 cm	N/A	N/A	N/A	N/A
8" Canister Dimension (L x Diameter) (3)	N/A	18.5x8 in 47x20 cm	18.5x8 in 47x20 cm	18.5x8 in 47x20 cm	N/A	N/A	N/A	N/A
VLS Dimension (L x W x H) (3)	18x12x8 in 46x29x19 cm	N/A	N/A	N/A				
Soft-pack Dimension (L x W x H) (3)	11x10x6 in 28x25x15 cm	12x10x6 in 30x25x15 cm	13x10x6 in 33x25x15 cm	13x10x6 in 33x25x15 cm	16x10x6 in 41x25x15 cm	20x9x6 in 51x20x15 cm	20x9x9 in 51x22x23 cm	20x9x10 in 51x22x24 cm
CANOPY	600	800	1050 ASTM	1050 DAeC	1350	1350HS	1600	1800
Gores	28	28	30	30	32	32	36	36
Repack cycle: Canisters and Internal Soft-packs	6 years	6 years	6 years	6 years				
Externally Mounted Soft-packs	1 year	1 year	1 year	1 year				
Canopy Life Limit	24 years	24 years	24 years	24 years				

- (1) Maximum weight does not include weight of parachute system.
- (2) All weights are approximate and include appropriate rocket. Overall system weights will increase with inclusion of activation assembly, mounting hardware, and attachment bridles.
- (3) All dimensions are approximate and do not include appropriate rocket, frame (softpack only), and rocket mount.

Note: The chart below only shows the several versions of rockets that may have been used on a particular system, for general interest purposes. The end user cannot actually order a specific type of rocket for his system, this is already pre-determined by BRS.

ROCKET	600	800	1050 ASTM	1050 *DAeC	1350	1350HS	1600	1800
Solid Fuel Rocket	BRS-301	BRS-301	BRS-440	a) RDS-285 b) BRS-300 c) BRS-301 d) BRS-460 e) BRS-440	BRS-440	BRS-601	BRS-601	BRS-601
Minimum Peak Thrust	87 lbs	87 lbs	87 lbs	a) N/A b) 67 lbs c) 87 lbs d) 79 lbs e) 87 lbs	87 lbs	133 lbs	133 lbs	133 lbs
Rocket Life Limit	13 years	13 years	13 years	a) N/A b) 12 years c) 13 years d) 12 years e) 13 years	13 years	12 years	12 years	12 years

Note: All BRS Rocket assemblies utilize a manual Igniter. The Igniter contains redundant primers with pyrotechnical boosters.

* Depicts BRS Rocket Assemblies certified under regulations defined by the "Deutscher Aero Club". Not applicable in the U.S.

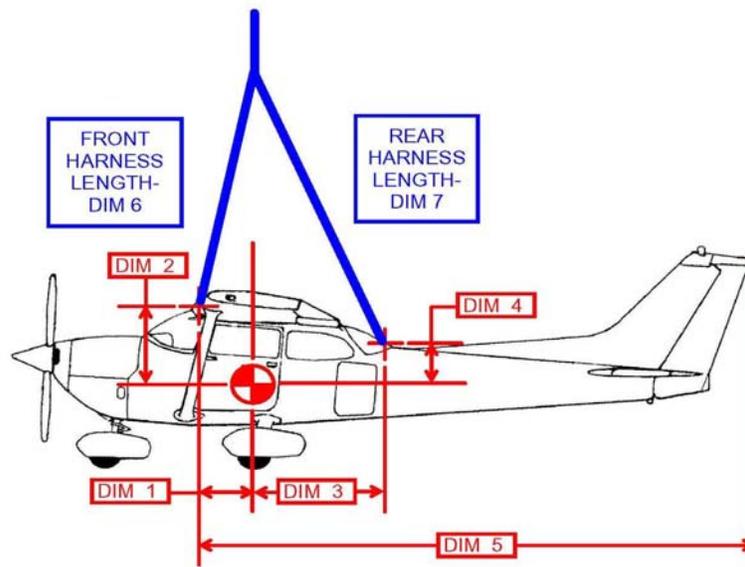
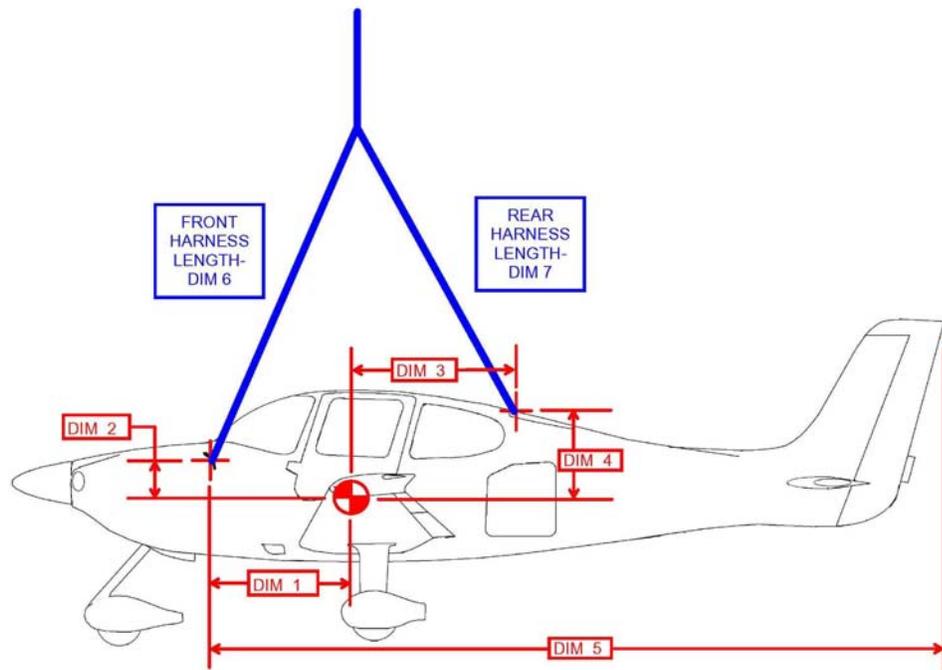
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CUSTOMER LOADS DETERMINATION WORKSHEET

AIRCRAFT NAME:
MANUFACTURER:

AIRCRAFT SPECIFICATIONS	VALUE
Maximum Gross Takeoff Weight	
Cruise Speed (specify units)	
(Vne) Speed (specify units)	
Wingspan	

REQUIRED MEASUREMENTS	
DIM 1 (Horz. Distance from aircraft CG to Front Attachment Point)	
DIM 2 (Vert. Distance from aircraft CG to Front Attachment Point)	
DIM 3 (Horz. Distance from aircraft CG to Rear Attachment Point)	
DIM 4 (Vert. Distance from aircraft CG to Rear Attachment Point)	
DIM 5 (Horz. Distance from Front Attachment Point to Aft of Tail)	
DIM 6 (If Known, Existing Front Harness Length)	
DIM 7 (If Known, Existing Rear Harness Length)	



Just as a recap, here are some “common sense” rules about your BRS (not in any particular order)...

1. Do not install your BRS unit so that it may be firing through the propeller arc.
2. Do not install your BRS unit firing forward. If the unit is fired forward, you will run into it.
3. Design the installation so that your BRS is removable for servicing.
4. Install Activation Handle in an easily visible and accessible location. The handle should be positioned so that the passenger can reach it, but its under pilot control.
5. Install BRS unit only to fuselage structure, or landing gear leg. Never install inside wing panels or to wing struts. If you have a wing failure of some type the unit could be pointing at you.
6. Never fly with the “Remove Before Flight” flag and pin installed into the handle.
7. Once you’ve installed your BRS system, always re-calculate (or re-weigh) for weight and balance.
8. Be sure to send in installation photos to BRS for that experienced pair of eyes to inspect your installation.
9. Do not attempt to repair a cracked or broken Canister or VLS cover. Do not try to secure a loose cover with any kind of tape. Unit must come back to BRS for repair.
10. Inspect your BRS unit often for cracks, corrosion etc. Inspect Handle by twisting it in its holder to ensure it hasn’t become corroded internally.
11. Do not allow people or pets to stand directly in path of rocket. **TREAT LIKE A LOADED GUN.**
12. Do not activate your BRS “just to see if it works”. That is very dangerous and expensive.
13. Do not disassemble your BRS “just to see **how** it works. Also, dangerous and expensive.
14. You must use the Kevlar Main Bridle between the parachute and aircraft. If you don’t, the Nylon riser will get cut by the propeller or other sharp bits on the airplane.
15. Your Rocket Lanyards must be attached to the small #3 Link under the Canister Cover, the back of the VLS Cover or under the Cover of the Soft-pack.
16. When routing Main Bridle, make sure it is not passing directly in front of Rocket or egress end of parachute assembly.
17. Brief your passengers on the BRS and its use. Tell them YOU are in control of it and that they should never touch it unless you are incapacitated.
18. If aircraft is stored outside, and your BRS will be exposed to the elements, put a water and UV proof cover on it. **REMOVE BEFORE FLIGHT!!**
19. Saltwater spray or environment destroys everything eventually (as you probably already know). If you live in coastal regions, you may need to send your unit back for servicing and repair sooner than normal because of the accelerated deterioration.
20. The stitched portion of the Kevlar Harnesses is always covered in black heatshrink. The Nylon Harnesses are always covered in white.
21. Never modify parts of your BRS, especially the Cover or Activation Handle Assemblies without written permission from BRS.
22. Always mount the BRS unit to structure which will provide security to the unit under at least a 10g load, for crash protection. This requirement may be higher depending on the class of aircraft.
23. **NEVER ATTEMPT TO SHIP A ROCKET OR ROCKET FUEL ANYWHERE!** Extremely high penalties may be inflicted upon you! Contact BRS for proper disposition of all BRS pyrotechnical devices.
24. Always install BRS unit so that it will fire into “clear air” when needed. Do not point it at aircraft structure, cable etc.

BRS Pre-Flight Checklist



- ✓ **Remove any and all protective covers from the BRS unit**
i.e. plastic or other wrapping that may protect the unit from moisture between flights.
- ✓ **Check service dates on data label for expiration**
- ✓ **Check security of airframe connections**
Inspect Nylon Cable Ties for UV damage. Cable Ties must be replaced every 6 months.
- ✓ **Check integrity of airframe bridles**
Inspect Harnesses for security and wear.
- ✓ **Check routing of airframe bridle**
Though your installation should have assured no interference, check *again* to be sure the bridle is *still* well secured so as not to interfere with:
 - a) the firing of the rocket or the extraction of the parachute,
 - b) the propeller, or
 - c) any control linkages.
- ✓ **Check parachute container and rocket mounts for:**
 - a) security that it will not move in-flight,
 - b) that the rocket is *still* aimed in the correct direction, and
 - c) that the container is still positioned as originally desired.
- ✓ **Check all bolts and nuts (3 threads showing, min.)**
- ✓ **Check activating handle for:**
 - a) REMOVAL OF "REMOVE BEFORE FLIGHT" FLAG AND PIN!,
 - b) kinks or other damage to the activation housing, and
 - c) security of the Housing (not dangling or stretched, plus *still* fastened along its route).
- ✓ **Check stainless steel link security**
- ✓ **Check sealed cap security (on Canister and VLS only)**
- ✓ **Check exterior cap security (on Canister only)**
- ✓ **Check Velcro flap security (on Softpack only)**
- ✓ **Check egress cover security (if installed)**
- ✓ **Passenger briefing**
- ✓ **Review emergency procedures described below.**
 1. Shut off power to the engine.
 2. Pull BRS Activation Handle. Continue pulling until system activates.
 3. Tighten up seat belts and shoulder harnesses.
 4. If possible, stow loose items in cockpit.
 5. Prepare for landing. Brace against structure.
 6. After landing, wait for aircraft to stop, then get out and immediately go upwind to avoid aircraft running over you if it starts being dragged by canopy.
 7. If possible or necessary, deflate canopy by grabbing it by its vent lines (small hole at top of canopy) and pulling it around into the wind .. Roll it up or place rocks on it to ensure it doesn't re-inflate.

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