

Contents

- `01. Object
- `02. Photographs
- `03. General Overview
 - 01. Interface Lines
 - 02. Emergency Releases
 - 03. Bridle
 - 04. Lift Line
 - 05. Primary Release
- `04. Components Descriptions
 - 01. Interface
 - `A. Interface Links
 - `a. Body
 - `b. Protector
 - `B. Interface Lines
 - `a. Short
 - `b. Long
 - 02. Emergency Releases
 - `A. Carabiners
 - `B. Emergency Release
 - `a. Foundation Loop
 - `b. Foundation Loop Retainer
 - `c. Lanyard
 - `d. Lanyard Sleeve
 - `C. Recovery Release
 - 03. Bridle Assembly
 - `A. Lift Line Recovery Safety Assembly
 - `a. Core
 - `b. Body
 - `c. Weak Link
 - `B. Bridle
 - 04. Lift Line Assembly
 - `A. Carabiner
 - `B. Carabiner Stabilizer
 - `C. Swivel Link
 - `D. Swivel Link Retainer
 - `E. Swivel
 - `F. Lift Line
 - `G. Eye Splice Collar
 - `H. Stop Assembly
 - `a. Seizing
 - `b. Collar
 - `I. Anti-Fouling Tube
 - `J. Thimble
 - `K. Anti-Fouling Tube Stowage Tie
 - 05. Primary Release
 - `A. Keel Attachment
 - `b. Keel Attachment Loop
 - `c. Keel Attachment Loop Retainers - Proximal and Distal
 - `B. Trigger Tab
 - `a. Base
 - `b. Pin Retainer - Upper
 - `c. Grommet
 - `d. Pin Retainer - Lower
 - `C. Trigger Pin
 - `a. Base
 - `b. Thimble
 - `c. Nico
 - `d. Protector
 - `e. Keeper
 - `D. Four-String
 - `a. Loops
 - `b. Four-String Retainer
 - `E. Lanyard Assembly
 - `a. Body
 - `b. Marker
 - `c. Marker End Sleeves
 - `F. Safety
 - `a. Body
 - `b. Pin
 - `c. Sleeve
 - 06. Tether Assembly
 - `A. Line
 - `B. Grip
 - `C. Link
 - `D. Link Interface Line
 - `E. Reel
 - 07. Balloon Launch Kit Zipper Bag
 - 08. 2 Meter FM Radio
 - 09. Knots and Splices
- `05. Installation - From Storage Configuration
 - #1. Interface Lines
 - `A. Two Point Suspension, Tether Blocks:
 - `a. Available
 - `b. Unavailable
 - `B. Three Point Suspension
 - `C. Four Point Carabiner Suspension
 - `a. Carabiners Configuration
 - `b. Interface Line Installation
 - `E. Fuel Lines
 - 02. Bridle Assembly
 - 03. Lift Line Assembly

- `A. Thimble Removal
 - `B. Threader
 - `C. Anti-Fouling Tube Installation
 - `D. Thimble Reinstallation
 - `E. Anti-Fouling Tube Seating
- 04. Primary Release Installation
 - `A. Clearance Adjustment
 - `B. Orientation
 - `C. Hang Loop Routing
 - `D. Insertion
 - `E. Lark's Head Formation
 - `F. Safety Routing
 - `G. Seating
 - `H. Safety Engagement
 - `I. Kingpost Opening Boot
- 05. Glider Connection
- `06. Installation - Storage Configuration Details
 - 01. Four-String Engagement
 - 02. Lift Carabiner Stabilizer
 - 03. Primary Release Safety
- `07. Equipment Care
- `08. Preflight - Day Minus One
 - 01. Lines
 - 02. Fisherman's Knots
 - 03. Bridle Releases
 - 04. Lift Carabiner Stabilizer
 - 05. Swivel
 - 06. Primary Release Safety
 - 07. Gloves
 - 08. Preparations
- `09. Field Procedures
 - 01. Field Size
 - 02. Gondola
 - 03. Glider
 - 04. Interface Lines
 - 05. Anti-Fouling Tube Stowage Tie
 - 06. Radio
 - 07. Tether
 - 08. Lift Line Loading
 - 09. Glider Positioning
 - 10. Inflation
 - 11. Zipper Bag
 - 12. Bridle Installation
 - 13. Tether Crewperson
 - 14. Hook-In
 - 15. Glider Readyng
 - 16. Connection
- `10. Flight Procedure
 - 01. Lift Line
 - 02. Weigh Off
 - 03. Glider Positioning
 - 04. Glider Lift-Off
 - 05. Tether Disengagement
 - 06. Initial Climb
 - 07. Ascent
 - 08. Lanyard Clearing
 - 09. Arming
 - 10. Proning Out
 - 11. Descent
 - 12. Release
 - 13. Stall Recovery
 - 14. Mid-Air Avoidance
- `11. Suspension Recovery
 - 01. Bridle and Lift Line
 - 02. Emergency Release
 - 03. Anti-Fouling Tube
 - 04. Stowage
 - 05. Recovery Release
- `12. Relaunch Procedures
 - 01. Cleaning
 - 02. Emergency Release
 - 03. Recovery Release
 - 04. Lift Line
 - 05. Bridle
 - 06. Primary Release Lanyard
 - 07. Glider Connection
- `13. Emergency Procedures
 - 01. Emergency Glider Separation
 - 02. Lift Line Jettison
 - `A. Arming and Releasing
 - `B. Minimum Required Load
 - `C. Weak Link
 - `D. Bridle Wrap
 - 03. Landing With Glider
- `14. Components
 - 01. Interface
 - 02. Emergency Releases
 - 03. Bridle Assembly
 - `A. Lift Line Recovery Safety Assembly
 - `B. Bridle
 - 04. Lift Line Assembly
 - 05. Primary Release
 - `A. Keel Attachment
 - `B. Trigger Tab
 - `C. Trigger Pin
 - `D. Four-String

- `a. Loops
 - `b. Retainer
 - `E. Lanyard Assembly
 - `F. Safety
- 06. Tether Assembly
- `15. Materials
 - 01. Line Strengths
 - 02. Quick Link
 - 03. Carabiners, Aluminum, Self-Locking - Minimum Strengths
 - 04. Ronstan RF78A Swivel
 - 05. Release Strength

`01. Object

The stall resulting from a balloon drop is not, as one might think, a little worse than a no wind cliff launch. The one experienced by this author was, unfortunately, not documented but estimated by the balloon crew to kill a thousand feet.

The primary design and operational goal is to get the glider off the ground and to whatever a safe altitude is with no danger of premature separation with the load being transmitted through a release mechanism which actuates with low lanyard tension.

Note: It must be ensured that the glider's stability system (luff lines, sprogs) are properly adjusted before use in a drop.

`02. Photographs

Photographs illustration the components described herein are available at:

<http://www.flickr.com/photos/aerotowrelease/>

`03. General Overview

01. Interface Lines

Interface lines are engaged at structural attachment points on opposite sides of the gondola.

02. Emergency Releases

Balloon pilot accessible emergency releases are connected to the interface lines.

03. Bridle

A bridle is connected at both of its ends to the emergency releases and drapes underneath the gondola.

04. Lift Line

A second major line is vertically suspended, via a carabiner connection, from the bridle.

05. Primary Release

A release mechanism is secured to the keel of the glider and is connected to an eye in the bottom end of the lift line.

`04. Components Descriptions

01. Interface

`A. Interface Links

Four, installed Protector end up at end of Interface Line in Long Configuration.

`a. Body

Quick link, steel, 16/64.

`b. Protector

04/64 leechline, secured below barrel base with Double Overhand Noose, routed across to spine, wound back to origin, routed back across to and turned over spine, finished with Half Hitches around both spanning sections.

`B. Interface Lines

Two, 16/64 Sta-Set Polyester Double Braid, two Configurations:

`a. Short

Coiled into three loops, ends joined with Figure 8 Bend.

`b. Long

Doubled, ends joined with Figure 8 Bend, with Retainers, two, 24/64 ID vinyl tubing.

02. Emergency Releases

`A. Carabiners

Two.

`B. Emergency Release

As Primary Release (below) with the following variations.

`a. Foundation Loop

Analogous to Keel Attachment Loop.

`b. Foundation Loop Retainer

32-24/64 x 1 vinyl tubing.

`c. Lanyard

05/64 leechline, ends secured to each half of Emergency Release Trigger Pin eye with Double Overhand Noose, middle safetied over end of Pin with Double Figure 8 Loop

`d. Lanyard Sleeve

12-08/64 x 45 mm vinyl tubing.

`C. Recovery Release

Identical to Emergency Release.

03. Bridle Assembly

`A. Lift Line Recovery Safety Assembly

`a. Core

1 inch diameter plastic 16/64 halyard ball, white, RWO 1992.

`b. Body

8 mm Edelrid perlon tied in triple Monkey's Fist, ends connected with Fisherman's Knot.

`c. Weak Link

05/64 leechline, secured with Double Overhand Nooses to Body (Noose triple looped) and either Bridle Eye Splice (Noose double looped).

`B. Bridle

Material and splices as in Lift Line (below), 248 inch finished length.

04. Lift Line Assembly

`A. Carabiner

Modified D. Note: Carabiner's maximum width capacity must not allow Lift Line Recovery Safety to pull through.

`B. Carabiner Stabilizer

One, rubber band.

`C. Swivel Link

12/64 Sta-Set Polyester Double Braid, triple looped between Carabiner and Swivel, ends secured with Fisherman's Knot.

`D. Swivel Link Retainer

Rubber band, looped around Link between Carabiner and Fisherman's Knot.

`E. Swivel

Ronstan RF78A.

`F. Lift Line

24/64 Sta-Set X Polyester Parallel Core, 7 Eye Splices at both ends cross stitched and whipped, 360 inch finished length.

`G. Eye Splice Collar

48-40/64 x 1 vinyl tubing, snugged against Lift Carabiner base.

`H. Stop Assembly

`a. Seizing

08/64 leechline Plain Whipped (coiled securely) around Lift Line about 66 inches from lower end.

`b. Collar

48-40/64 x 1 vinyl tubing, installed over Seizing.

`I. Anti-Fouling Tube

57-48/64 x 5' PVC water pipe with coupling fittings installed on both ends.

`J. Thimble

24/64 Nylon, RFPNP78A.

`K. Anti-Fouling Tube Stowage Tie

Releasable electrical tie.

05. Primary Release

Three ring principle, four string construction.

`A. Keel Attachment

`b. Keel Attachment Loop

8 mm perlon, secured with Fisherman's Knot.

`c. Keel Attachment Loop Retainers - Proximal and Distal

32-24/64 x 1 inch vinyl tubing.

`B. Trigger Tab

`a. Base

6 inch length of 1 inch flat nylon webbing, doubled and stitched along its length save for enough length at the doubled end to allow Loop installation.

`b. Pin Retainer - Upper

32/64 x 1 inch flat nylon webbing stitched laterally to the port side of the base flush with the top end and such that the Pin, when inserted between the two components, is held with moderate friction.

`c. Grommet

Aquabatten No. 0 Toothed Nickel-Plated Brass Grommet installed through the middle of the Base such that its top edge is flush with the bottom edge of the Upper Retainer.

`d. Pin Retainer - Lower

As with the Upper Retainer but with it's top edge flush with the bottom edge of the Grommet.

`C. Trigger Pin

`a. Base

06/64 x 150 mm, clear plastic coated stainless steel 7x19 flexible control cable, 85 mm stripped for thimble and nico swaging.

`b. Thimble

06/64 stainless steel.

`c. Nico

06/64.

`d. Protector

16/64 x 020 mm heat shrinkable tubing installed over Nico.

`e. Keeper

05/64 leechline, ends secured with Double Overhand Nooses to Trigger Tab and Pin eye.

`D. Four-String

`a. Loops

Specifications in Components section. Closed with Fisherman's Knots and installed sequentially on Keel Attachment Loop with Lark's Heads.

`b. Four-String Retainer

40-32/64 x 1 vinyl tubing. Installed over Four-Strings base bundle.

`E. Lanyard Assembly

`a. Body

05/64 leechline, secured to eye of Trigger Pin with Double Sheet Bend.

`b. Marker

05/64 leechline, tied around Lanyard with a Triple Overhand Knot

`c. Marker End Sleeves

Two, 12-08/64 vinyl tubing.

`F. Safety

`a. Body

08/64 leechline, secured through bottom end of Trigger Tab with Double Overhand Noose.

`b. Pin

08/64 cotter pin, stitched to end of leechline with 2.5 inch overlap.

`c. Sleeve

24-16/64 vinyl tubing.

06. Tether Assembly

`A. Line

10/64 leechline, secured to Grip with Clove Hitch and Two Half Hitches.

`B. Grip

1 inch wooden dowel.

`C. Link

Quick link, steel, 16/64.

`D. Link Interface Line

12/64 Sta-Set Polyester Double Braid, secured to Link and balloon load point with Double Overhand Nooses.

`E. Reel

Extension cord reel.

07. Balloon Launch Kit Zipper Bag

13 x 8 x 7, Granite Gear Zipp Sack, Medium, Blue.

08. 2 Meter FM Radio

Two tuned to Amateur or one of the five USHGA allocated frequencies, call sign WPRY420, 151.505, 151.625, 151.925, 151.955, and 158.400 MHz or, preferably, an Amateur frequency for communications between gondola and glider. Transmission power should be selected at lowest possible settings. In absence of radios, vocal communications are possible with burners idling. Radio may be secured with releasable electrical ties to upright padded with Radio Mount Padding, split 1.25-1.00 vinyl tubing.

09. Knots and Splices

A Figure 8 Bend is formed by tying a Figure 8 Knot in one end of a line then following back through the knot with another free end.

Bridle and Lift Line are spliced in accordance with manufacturer's instructions.

`05. Installation - From Storage Configuration

#1. Interface Lines

Interface Lines are unclipped from Release Carabiners and may be secured to any opposite sets of points to which tether lines may be properly attached. In the absence of tether blocks attachments are made prior to connection of envelope. When Interface Lines are used in Long Configuration, Bridle Releases should fully clear the top edge of the basket when loaded - check and adjust Interface Line to shorten if necessary. The following are recommendations for popular suspension designs.

`A. Two Point Suspension, Tether Blocks:

`a. Available

Short Configuration coils are hitched with a Lark's Head to each tether block.

`b. Unavailable

Short Configuration coils are hitched with a Lark's Head around the load tubing such that each of the two interface blocks is encompassed.

`B. Three Point Suspension

A Long Configuration Interface Line is secured at two of the suspension points while the other in Short Configuration is secured to the third. Interface Links are used as described for the following configurations.

`C. Four Point Carabiner Suspension

Interface Links are used to connect ends of both Interface Lines in Long Configuration to pairs of lower carabiners on opposite sides across the narrow dimension of the rectangular gondola (so as to reduce the separation of Bridle halves). (If the rectangle is equilateral (square), arbitrarily designate opposing "narrow" faces.)

`a. Carabiners Configuration

Configure load frame carabiners such that their gates face each other above the narrow faces of the basket.

`b. Interface Line Installation

Span the two carabiners above a wide face by installing onto their spines the Interface Links through the eyes formed by the Protector.

`E. Fuel Lines

For all installations ensure that fuel lines are routed clear of Interface Lines.

02. Bridle Assembly

The Bridle Assembly is stored fully intact with essentially mirror image components sequencing being:

Release Carabiner
Emergency Release
Bridle
Lift Line Recovery Safety
Recovery Release
Release Carabiner

The Release engaging the same Bridle eye as the Recovery Safety is designated the Recovery Release. The other, engaging the free eye, remains the Emergency Release.

To install the intact Bridle Assembly simply clip the Release Carabiners in to the opposite sides Interface Lines, gates outboard.

03. Lift Line Assembly

`A. Thimble Removal

The Thimble is removed from the lower eye of the Lift Line by working the line off of a side.

`B. Threader

The Primary Release Lanyard (or any six foot length of string) is fed through the Anti-Fouling Tube from its bottom end. (It may be necessary to weight the string.)

`C. Anti-Fouling Tube Installation

The free end of the Primary Release Lanyard is tied to the lower eye of the Lift Line which is then drawn through the Anti-Fouling Tube after which the Primary Release Lanyard is separated and made back up.

`D. Thimble Reinstallation

The Thimble is reinstalled in the lower eye.

`E. Anti-Fouling Tube Seating

The Anti-Fouling Tube is seated against the lower eye by pulling down snugly the Upper Stop into the top coupler of the Anti-Fouling Tube.

04. Primary Release Installation

`A. Clearance Adjustment

The Distal Retainer is repositioned proximally to allow clearance of end fittings and the Assembly is laid out straight.

`B. Orientation

From below the wing, position the Release Assembly below and perpendicular to the keel, immediately aft of the kingpost, with the Release Mechanism to starboard, Keel Attachment Loop's Fisherman's Knot aft, and distal end of the Keel Attachment Loop port.

`C. Hang Loop Routing

If keel mounted suspension webbing - main or backup - is present immediately aft of the kingpost and forward enough to create an interference problem, feed the hanging loop of this installation between the fore and aft strands of the Keel Attachment Loop and between its Proximal and Distal Retainers.

`D. Insertion

Feed the ends of the Assembly on their respective sides of the keel up through the opening and lay them out on the sail.

`E. Lark's Head Formation

From above the wing, feed the Release Mechanism and Safety through the distal end of the Keel Attachment Loop. (The resulting Lark's Head is, essentially, an upside down hang loop.)

`F. Safety Routing

Feed the free end of the Primary Release Safety back down through the kingpost opening on the port side of the keel.

`G. Seating

Pull up tightly on the Release Mechanism to tension the Keel Attachment Loop. The Fisherman's Knot of the Keel Attachment Loop should be positioned on the starboard side of the keel to avoid interference with the Lanyard, Safety, and suspension webbing. If adjustment is necessary slide Retainers back from ends and adjust the two bending points of the Keel Attachment Loop to reposition the knot. Slide Retainers snug towards the ends.

`H. Safety Engagement

Route the Safety aft of the Lanyard, engage but do not seat overly tightly, and check for proper upper Lanyard section slack.

`I. Kingpost Opening Boot

A kingpost opening boot, if removable, is best taken out of the equation. Otherwise, it should be pushed down to minimize the distortion it will be subjected to as a result of the loaded Keel Attachment Loop.

05. Glider Connection

The lower (Anti-Fouling Tube) end of the Lift Line is routed to the Primary Release over the trailing edge of the glider's sail on the port side of the rear ground wire and below and inboard of any reflex bridle lines or cables, if present, and attached as described in the following section.

`06. Installation - Storage Configuration Details

01. Four-String Engagement

The four-string Release Mechanism employed in all Releases is engaged with its respective eye in the following manner. Orientation assumes engagement of Primary Release. All loop insertions are from starboard.

With the Trigger Pin pulled and the Release Mechanism opened, the eye is passed through by the #4 (6 mm) loop of the four string mechanism, which is passed through by the #3 (4 mm) loop, which is passed through by the #2 (3 mm) loop, which is passed through by the #1 (05/64 inch) loop. The #1 loop is inserted through the grommet in the Trigger Tab and the Trigger Pin is reinstalled up under the Lower Retainer of the Tab, through the end of the #1 loop, and under the Upper Retainer and pushed as far up as it will go.

The Lanyard of a Bridle release is safetied by inserting through its end loop the protruding end of the Pin.

Save for the suspension recovery operation, each Bridle Release and its Carabiner remain assembled as a unit, the Release being held firm at the bottom of the Carabiner by the Retainer. The Carabiner's gate and Release's Pin face the same direction.

02. Lift Carabiner Stabilizer

The Lift Carabiner Stabilizer (rubber band) holds Lift Carabiner bottom in the top of the top Swivel Link. A Figure 8 pattern is formed crossing the Eye Splice inside the Carabiner twice.

03. Primary Release Safety

The Primary Release Safety's length is adjusted so that, when cinched tight on the Trigger Tab, its mechanism protrudes a short distance - about 70 mm - below the keel when the Primary Release is under a lifting tension. Its Sleeve is cleared up from the free end of the Pin and the Lanyard is tied with a Clove Hitch around the base of the Pin such that slack will remain in the upper Lanyard section thus formed when tension is applied to the lower section with the Assembly under load. The Pin is then folded back against the Safety Body, and the Sleeve is pulled back down over the distal end of the Body and Pin. The Lanyard Marker is positioned (slid) immediately above the Clove Hitch (Pin) to facilitate future Safety engagements.

`07. Equipment Care

The three greatest threats to the integrity of the equipment are soil, abrasion, and ultraviolet radiation.

The assembly sequencing outlined below is designed, in part, to minimize the possibility of components being ground into the dirt by the gondola or underfoot. The Lift Line and Bridle Assemblies should be properly stowed as soon as possible after release to protect them from being trodden upon. (Obvious safety considerations obligate having components inboard well before landing but having a line between a plowed field and a sliding gondola would present another obvious concern.)

Abrasion should not be a problem when components are properly installed and handled.

Components should be stored in the zipper bag, which itself should be kept out of direct sunlight, save for the few minutes of use required for flight operations.

`08. Preflight - Day Minus One

01. Lines

All lines of all components should be checked for general condition.

02. Fisherman's Knots

Fisherman's Knots comprise the critical fastenings of the Releases (5 per unit) and the Swivel Link. All have been pre-tensioned to field loads or greater and are quite secure, especially those in the smaller diameter cordage. Check, however, to ensure that one pair of ends protrude a safe distance from each knot.

03. Bridle Releases

Check Bridle Releases for proper installation and Lanyard/Trigger Pin safetying.

04. Lift Carabiner Stabilizer

Check Lift Carabiner Stabilizer (rubber band) for deterioration.

05. Swivel

Swivel Pin threaded ends should protrude 1.0 millimeters representing a torque applied through an eighth of a turn.

06. Primary Release Safety

The Primary Release Lanyard Marker's adjustment position can be determined without mounting the Assembly on a glider. Ensure but minimize slack in the Lanyard's upper length.

07. Gloves

Check that any gloves to be worn for flight will allow enough dexterity to unbundle and arm the Lanyard.

08. Preparations

To minimize required field installation procedures, installations and assemblies involving the glider mounted components and Lift Line may be performed prior to the day of flight. Primary Release Assembly installation will be facilitated by setting up the glider to the point of tensioning. The Lift Line, with Anti-Fouling Tube installed, may be connected to the Primary Release and folded up with the glider. Installation and adjustment times may be further shaved if access to the gondola is convenient.

`09. Field Procedures

Instructions in this and the following sections assume significant wind and use of tether. In light conditions references to such use may be disregarded.

01. Field Size

A field large enough to accommodate an emergency glider landing is selected.

02. Gondola

The basket's interior, in which the suspension assembly will be recovered, and side areas, which will contact the Bridle, are brushed clean.

03. Glider

Glider is assembled and preflighted as balloon is prepared.

04. Interface Lines

Interface Lines are installed on the gondola.

05. Anti-Fouling Tube Stowage Tie

The Anti-Fouling Tube Stowage Tie is loosely zipped onto a non-fuel upright.

06. Radio

A radio transceiver may also be mounted on a non-fuel upright.

07. Tether

The Tether Link is secured to an appropriate interface location on the gondola. The Tether Line is doubled, clipped in at its midpoint, and laid out directly upwind of the balloon.

08. Lift Line Loading

With the Glider Pilot immobilizing the glider a heavy strain is put on the Lift Line to seat the Release Assembly components and a check of adjustments is made, with particular attention being given to the Primary Release Lanyard and Safety routing and adjustment and Release Pin protrusion.

09. Glider Positioning

The Glider is positioned facing away from and, to stay out of the path of a drifting gondola and free from interference from the Tether Line, about 30 degrees off of upwind.

10. Inflation

Balloon is inflated to near buoyancy. Interface Line connections are checked.

11. Zipper Bag

The Zipper Bag is stowed on board the gondola.

12. Bridle Installation

Twists are allowed to turn out of the end of the Bridle Assembly, Release Carabiners are clipped in to Interface Lines, gates facing outboard, the Bridle being routed up- and crosswind outboard and clear of the gondola.

13. Tether Crewperson

A Tether Crewperson acquires a hold on the Tether Line Grip. The Line's free end is wound five times around the Grip and held fast under thumb pressure.

14. Hook-In

Glider Pilot clips in and performs radio check.

15. Glider Readyng

Glider Pilot lifts glider to normal foot launch position and maintains glider level and with a neutral pitch attitude. Positions with respect to the wind are checked and, if necessary, adjusted.

16. Connection

The Lift Line Carabiner is clipped onto the Bridle. Note that if the rear end of the keel contacts the ground while the glider is being pulled backwards an overturned glider will be the likely result.

10. Flight Procedure

01. Lift Line

The Glider Crewperson holds the Lift Line to prevent slack to the Primary Release and snags on the keel, wing and batten tips, and any miscellaneous hardware and checks the Release Pin for Protrusion.

02. Weigh Off

The Balloon Pilot weighs off and the Tether Crewperson holds tension to limit drift.

03. Glider Positioning

The Glider Crewperson releases the Lift Line when it pulls up and away and directs the Glider Pilot to position the glider directly underneath balloon.

04. Glider Lift-Off

The Glider Pilot maintains neutral pitch and moves backwards in the direction of the pull until swept aloft.

05. Tether Disengagement

The Tether Crewperson releases pressure from the free end coils, thus allowing the line to pull through the Tether Link and drop clear upwind of the glider.

06. Initial Climb

The Balloon Pilot initially climbs as rapidly as temperature considerations allow to clear the glider from obstructions (trees, power lines) and to reach safe stall recovery altitude, avoiding interference with the Bridle Releases. Ground crew personnel should clear astern of the glider as it is lifted.

07. Ascent

The Glider Pilot avoids contacting the Primary Release Lanyard and Safety until exceeding stall recovery altitude. The Pilot may remain vertical and stand with a foot on each end of the basetube. The glider will likely pitch down but is easily levered to any desirable attitude. Note that premature release may be harmful or fatal to the Glider Pilot as well as to ground crew personnel and spectators in the immediate vicinity. The Glider and Balloon Pilots ensure that

the Tether Line has cleared and remained on the ground. Otherwise the Balloon Pilot (or crew member) must recover the Line fully into the basket, being careful not to cause a fouling with the glider.

08. Lanyard Clearing

Above stall recovery altitude the Primary Release Lanyard may be unbundled.

09. Arming

Upon completion of the ascent the Glider Pilot grasps the end of the Primary Release Safety by its sides (avoiding contact with the Pin and Lanyard) and holds it high (with slack in the Body) and stationary while pulling the Sleeve clear of the Pin, then carefully slides the Clove Hitch up off of the Pin without applying tension to the Lanyard.

10. Proning Out

The Glider Pilot assumes prone flying position without interfering with the Lanyard.

11. Descent

The Balloon Pilot establishes a descent rate of at least 300-500 fpm and clears Glider Pilot for release. Note that the sudden release of the approximate 300 lb. weight of the glider package will result in a sudden positive change in the balloon's vertical speed. This may introduce severe aerodynamic and internal pressure forces on the envelope unless a sufficient descent rate has been previously established.

12. Release

The Glider Pilot pulls the basetube in to stomach position, rolls the glider slightly to the right (lowers right wing) to clear the Lift Line away from the glider's rear ground wire, raises head, places the Primary Release Lanyard in teeth, and rotates head and upper body down until release is effected. Approximately 5 to 8 pounds of tension is required.

13. Stall Recovery

The Glider Pilot holds bar position for speed and against weightlessness until glider recovers from the stall.

14. Mid-Air Avoidance

The Pilots should remain aware of each other's presence during descent (the glider sinks in the neighborhood of 200 fpm and the balloon can easily quadruple that rate).

`11. Suspension Recovery

01. Bridle and Lift Line

The suspension assembly is brought on board by, with the Lift Line Recovery Safety in hand, pulling the Trigger Pin of and disengaging the Recovery Release, passing that free end of the Bridle around to the opposite side outboard of the gondola assembly, and hauling the lines in. If this end is accidentally dropped when thus disengaged, no metal accelerates towards metal and the assembly may still be recovered from the opposite side. (If the Emergency Release is disengaged there is a danger of losing the Lift Line Assembly.)

02. Emergency Release

After the suspension assembly is safely inboard the Emergency Release Carabiner is unclipped from its Interface Line and that end of the Bridle Assembly is added to the pile.

03. Anti-Fouling Tube

The Anti-Fouling Tube end of the Lift Line Assembly is stowed by zipping it, upside down, in the Anti-Fouling Tube Stowage Tie mounted on the upright.

04. Stowage

The pile of suspension components is stuffed into the Zipper Bag.

05. Recovery Release

The Recovery Release Carabiner is unclipped from its Interface Line and stowed in the Zipper Bag.

`12. Relaunch Procedures

01. Cleaning

The areas of the basket in contact the Bridle is brushed clean of any mud which may have been acquired at landing.

02. Emergency Release

With the balloon buoyant, the Emergency Release Carabiner is clipped into the upwind Interface Line and the Lift Carabiner is unclipped from the Bridle.

03. Recovery Release

The Recovery Release Carabiner is clipped into the opposite Interface Line.

04. Lift Line

The Anti-Fouling Tube is released from its stowage and the Lift Line is carried (not dragged) to the glider.

05. Bridle

The Bridle Assembly is paid out straight away upwind from the balloon and routed around to the Recovery Release where that mechanism is engaged and safetied.

06. Primary Release Lanyard

The Primary Release Lanyard is safetied and made up.

07. Glider Connection

The Lift Line is connected to the Primary Release and relaunch is sequenced as before.

`13. Emergency Procedures

01. Emergency Glider Separation

The Primary Release may be activated on the ground by pulling on the portion of the Lanyard above its tie-in with the Safety provided the lift line is exerting several pounds of tension.

02. Lift Line Jettison

The Lift Line Assembly may be jettisoned using the Emergency Release.

`A. Arming and Releasing

The Emergency Release Lanyard is pulled out to clear the end of the pin and up to execute.

`B. Minimum Required Load

Note that a load force of 30 lbs. is required for the Release to disengage. If no significant load exists a manual load may be applied or the Release can be manually separated.

`C. Weak Link

If the Recovery Release is activated out of sequence with a Lift Line load of approximately 200 lbs. or more, the Lift Line Recovery Safety will be lost after its Weak Link breaks and the Lift Line will clear as it would if the Emergency Release were activated.

`D. Bridle Wrap

The Recovery Release may be used in the event of a Bridle wrap after the Emergency Release pull.

03. Landing With Glider

In the event the balloon must land with the glider still attached, the Glider Pilot should remain attached after touchdown unless conditions are such that his or her safety will be jeopardized. Assistance should be rendered to the Balloon Pilot as directed. When the Lift Line slackens and the balloon begins to descend the final 40', the Balloon Pilot should direct the Glider Pilot to pull the release, move the glider clear upwind, unclip, and assist with the landing.

`14. Components

01. Interface

Link
quick link, steel
16/64

Link Protector
Dacron leechline
04/64 x 032 inch

Line
Sta-Set Polyester Double Braid
16/64 x 128 inch

Line Retainer
tubing, vinyl
32-24/64 x 025 mm

02. Emergency Releases

Carabiner
aluminum

Foundation Loop
Edelrid perlon
8 mm x 017 inch

Foundation Loop Retainer
tubing, vinyl
32-24/64 x 025 mm

Lanyard
Dacron leechline
05/64 x 360 mm

Lanyard Sleeve
tubing, vinyl
12-08/64 x 045 mm

03. Bridle Assembly

`A. Lift Line Recovery Safety Assembly

Core
halyard ball
RWO 1992
1-16/64
white

Body
Edelrid perlon
8 mm x 057 inch

Weak Link
Dacron leechline
05/64 x 250 mm

`B. Bridle

Bridle
Sta-Set X Polyester Parallel Core

24/64 x 374 inch (248 finished)

04. Lift Line Assembly

Carabiner
aluminum
Carabiner Stabilizer
rubber band
Swivel Link
Sta-Set Polyester Double Braid
12/64 x 575 mm
Swivel Link Retainer
rubber band
Swivel
Ronstan RF78A
Lift Line
Sta-Set X Polyester Parallel Core
24/64 x 262 inch
Eye Splice Collar
tubing, vinyl
56-40/64 x 2 inch
Stop Collar Seizing
Dacron leechline
08/64 x 018 inch
Stop Collar
tubing, vinyl
56-40/64 x 1 inch
Anti-Fouling Tube
PVC pipe, couplings at both ends
57-48/64 x 5 ft

05. Primary Release

`A. Keel Attachment

Loop
Edelrid perlon
8 mm x 033 inch
Loop Retainers - Proximal and Distal
tubing, vinyl
32-24/64 x 025 mm

`B. Trigger Tab

Base
nylon flat webbing
1 x 6 inch
Pin Retainer - Upper
nylon flat webbing
32/64 x 1 inch
Grommet
Aquabatten No. 0 Toothed Nickel-Plated Brass Grommet
20/64 inch ID
Pin Retainer - Lower
nylon flat webbing
32/64 x 1 inch

`C. Trigger Pin

Base
7x19 flexible control cable
06/64 x 150 mm
clear plastic coated stainless steel
85 mm stripped for thimble and nico swaging
Thimble
06/64 stainless steel thimble
Nico
06/64 x 150 mm
Protector
16/64 x 020 mm
heat shrinkable tubing
Keeper
Dacron leechline
05/64 x 190 mm

`D. Four-String

`a. Loops

1
Dacron leechline
05/64 x 245 mm
2
Edelrid perlon
3 mm x 350 mm
3
Edelrid perlon
4 mm x 530 mm
4
Edelrid perlon
6 mm x 740 mm

`b. Retainer

Retainer
tubing, vinyl

40-32/64
015 mm

`E. Lanyard Assembly

Body
Dacron leechline
05/64 x 7 ft
Marker
Dacron leechline
05/64 x 100 mm
Marker End Sleeves
tubing, vinyl
12-08/64 x 013 mm, 2

`F. Safety

Body
Dacron leechline
08/64 x 018 inch
Pin
cotter pin, stainless steel
08/64 x 047 mm
Sleeve
tubing, vinyl
24-16/64 x 1.5 inch

06. Tether Assembly

Line
Dacron leechline
10/64 x 200 ft
Grip
wooden dowel
1 x 1 ft
Link
quick link, steel
16/64
Link Interface Line
Sta-Set Polyester Double Braid
12/64 x 400 mm
Reel
extension cord reel

`15. Materials

All forces are given in pounds.

01. Line Strengths

Breaking Strength - Diameter

Edelrid Perlon Accessory Cord
millimeters

0506 - 3
0792 - 4
1166 - 5
1606 - 6
2640 - 7
3366 - 8

Mammut Perlon Accessory Cord
millimeters

0396 - 3
0705 - 4
1100 - 5
1760 - 6
2200 - 7
3300 - 8

Howe & Bainbridge Aquabatten Dacron Leechline
inches

0050 - 04/64
0205 - 05/64
0505 - 08/64
0767 - 10/64

New England Sta-Set Polyester Double Braid

1200 - 12/64
2000 - 16/64

New England Sta-Set X Polyester Parallel Core
inches

4400 - 20/64
5500 - 24/64

(Manufacturer advises that full line strength is retained by Eye Splices.)

02. Quick Link

NATIONAL MANUFACTURING COMPANY

STERLING IL 61081
 N223-024
 3150
 0 38613 17160 2
 16/64
 Zinc Plated
 .235 inch diameter
 axes clearances:
 15 mm - short
 46 mm - long

0880 - Safe Working Load

03. Carabiners, Aluminum, Self-Locking - Minimum Strengths

5170.4 - Closed
 1573.6 - Open

04. Ronstan RF78A Swivel

3740 - break load
 80 - grams weight
 .25-28 threaded pins.

05. Release Strength

Each loop component of the release is subjected to half of the loading of the adjacent larger loop (i.e., if the #4 loop is supporting the entire 300 lb. payload then the #3 loop is loaded to 150 lbs.).

The following table indicates the maximum payload weight or force at which the various release component materials will fail at each step removal from the final loop of the system. Assumed is a 50% line strength reduction due to the knots. This half strength figure is quadrupled in accordance with the distribution of the stress over the four strands of the folded loop.

It should be noted, however, that loads in the upper approximate two thirds of the release's capacity will cause extreme tension on and some distortion of the Trigger Pin, thus making release difficult or impossible until loading is reduced.

LINE STRENGTHS,
 KNOT WEAKENING ALLOWANCES,
 RELEASE COMPONENT LOOP STRENGTHS AND MULTIPLES

IN POUNDS

Material	Breaking Strength	50%	4 x 50% Step: 0	8 x 50% 1	16 x 50% 2	32 x 50% 3
05/64 Leechline Aquabatten	205	102.5	410	820	1640	3280
08/64 Leechline Aquabatten	505	252.5	1010	2020	4040	8080
10/64 Leechline Aquabatten	767	383.5	1534	3068	6136	12272
12/64 Polyester New England	1200	600	2400	4800	9600	19200
16/64 Polyester New England	2000	1000	4000	8000	16000	32000
20/64 Polyester New England	3000	1500	6000	12000	24000	48000
3 mm Perlon Mammut	396	198	792	1584	3168	6336
3 mm Perlon Edelrid	506	253	1012	2024	4048	8096
4 mm Perlon Edelrid	792	396	1584	3168	6336	12672
6 mm Perlon Edelrid	1606	803	3212	6424	12848	25696
6 mm Perlon Mammut	1760	880	3520	7040	14080	28160
7 mm Perlon Edelrid	2640	1320	5280	10560	21120	42240
8 mm Perlon Edelrid	3366	1683	6732	13464	26928	53856

Tad Eareckson
 TadErcksn
 at
 aoldotcom

2007/01/15