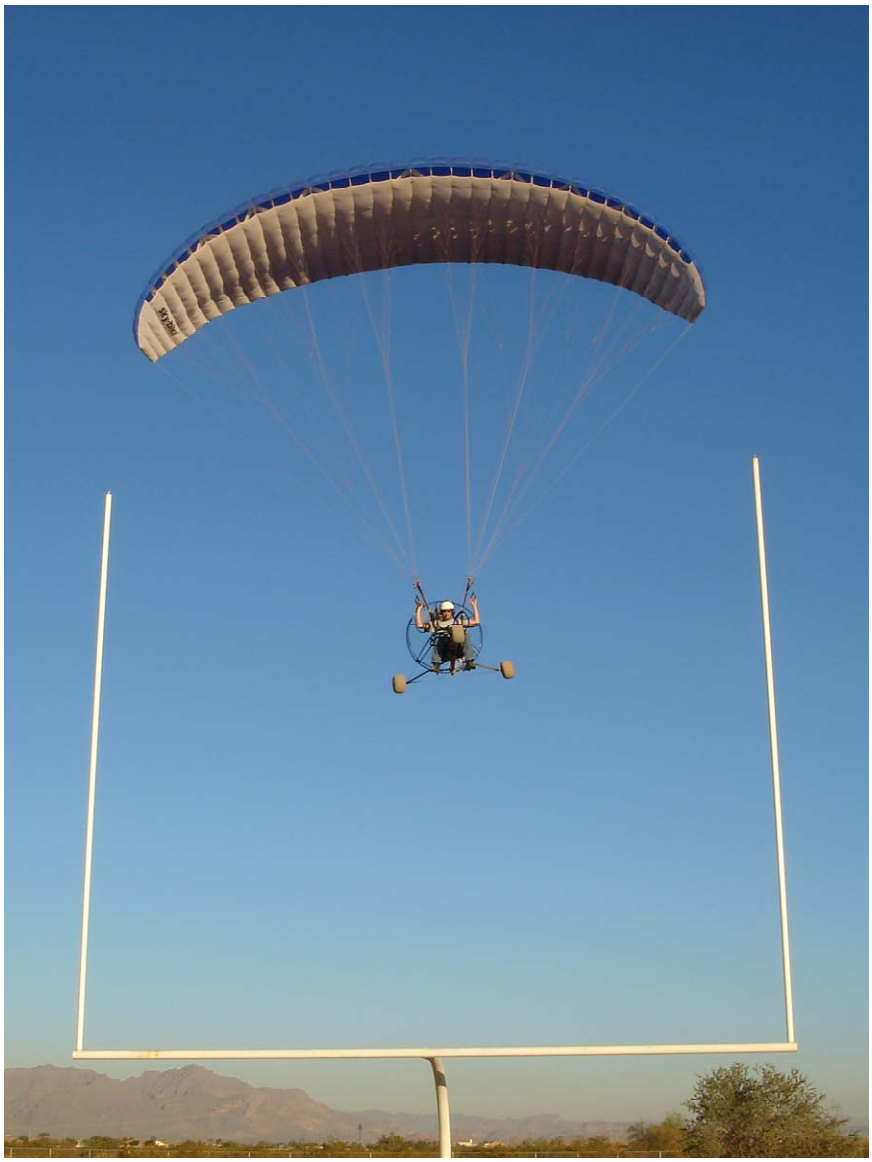
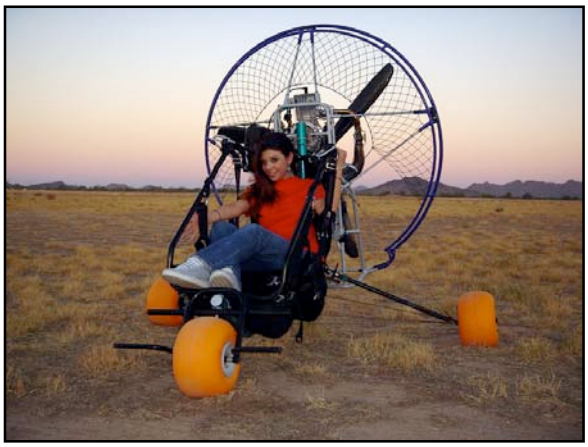
Airparamo
GRAZ*hopper* Trike
Owners Manual



Version 1.3

Index

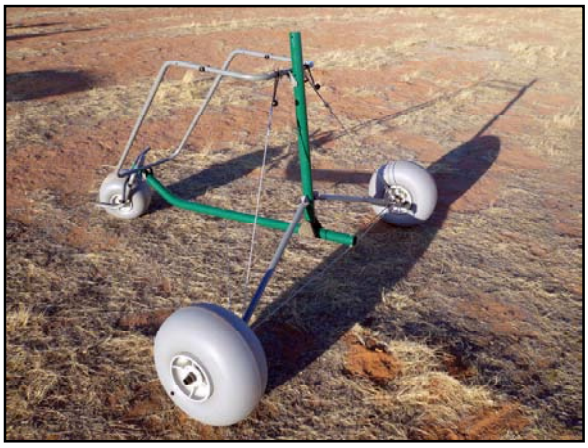


1. Introduction & General Information

1.1. Safety First

All forms of aviation have inherent risks which can be hazardous to your physical well being or your life. It is always a good idea to get qualified and proper training on the use of any gear that will get you off the ground and into the air. The GRAZ*hopper* is no exception. Ultimately it is up to each individual pilot to make their own determinations of safety on whether or not to fly; selecting the flying conditions and site; choosing gear to fly; conducting proper maintenance and assembly; observing all applicable local, state and federal laws; checking the airspace restrictions; and conducting thorough pre and post flight checks. Given the complexity and variability of the numerous variables involved in each flight, **the pilot in command assumes ALL RESPONSIBILITY for known and unknown risks for their and others safety in the use of any flying related gear**, including the GRAZ*hopper* trike.

1.2. Commitment to Quality



Congratulations on purchasing the GRAZ*hopper*. Airparamo LLC has spent years in development, using the highest grade of aircraft and marine materials and hardware, and sound engineering and design principles, to deliver what we believe to be the best PPG trike available. Designed and flight tested for a number of years by numerous pilots in real world conditions, the GRAZ*hopper* has evolved over a series of prototype models to be recognized as the finest quality PPG trike available in the world. This Owners Manual will provide you with helpful information on the design details, operation, care and safety of this incredible trike as well as set up, storage, flying tips, maintenance, and other useful information to help you get the most of your GRAZ*hopper*.

1.3. Notation Used

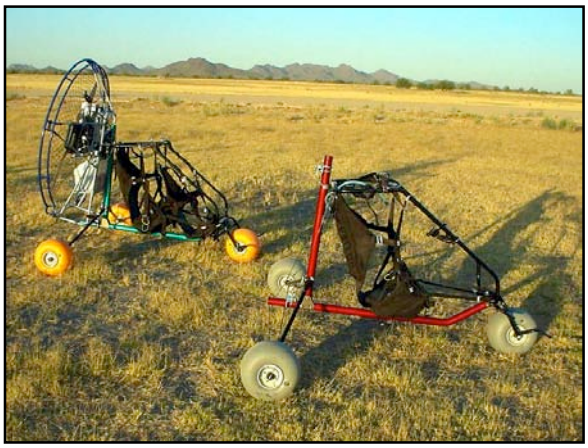
Certain special terms (***NOTE***, ***ATTENTION***, ***WARNING***) are used throughout this manual. Their usage is defined below.

A ***NOTE*** provides supplemental information to help clarify a point being made in the text. Generally, a ***NOTE*** is provided to help assembly, use, or maintenance of the product. Disregarding a ***NOTE*** could cause inconvenience, but would generally not cause damage or personal injury.

A ***ATTENTION*** provides supplemental information to help clarify an area where equipment damage could occur. Disregarding a ***ATTENTION*** could result in permanent and significant mechanical damage with a possibility of personal injury.

A ***WARNING*** provides supplemental information to help clarify an area where personal injury or even death could occur from negligence in ignoring the ***WARNING***. Disregarding a ***WARNING*** voids all product warranties.

1.4. Warranty



Airparamo LLC fully warranties the GRAZ*hopper* to be free of any workmanship or material defects for 1 full year from the date of purchase. Airparamo LLC will, at its discretion, repair or replace any damaged parts free of charge. This warranty does not cover misuse, neglect, abuse, unusually hard usage (such as aerobatics or hard landings), natural breakdown of materials, or normal wear and tear. The warranty specifically excludes tire or bearing damage, galled turnbuckles, cable damage due to untwisting, parts corroding, severe UV damage, or scratches to the finishes.
Additionally, the warranty excludes claims to any incidental or consequential loss to personal property and does not apply to accidental damage, misuse, mishandling, or permanent alterations. The user assumes all responsibility and liability in using this device.

1.5. Service & Parts

We at Airparamo LLC hope your GRAZ*hopper* brings you years of reliable fun in the air. In case you need service or parts for the GRAZ*hopper*, Airparamo LLC has a stock of ready parts that we can ship out to you immediately. Please contact your original dealer or Airparamo LLC directly to order replacement parts for your GRAZ*hopper*.

2. Overview of Features

The GRAZ*hopper* was designed and built from the ground up to be the pinnacle of PPG trikes. Here is a brief overview of some of the qualities and features that establish the GRAZ*hopper* as the best of the best in PPG trikes:

- **Tested, proven design.** Airparamo LLC pilots have logged thousands of flights on GRAZ*hopper* trikes in single and tandem, instructional flights. The GRAZ*hopper* has gone through several versions, each time refining and improving the strength, weight, shipping size, reliability, finish, build costs, and overall quality.
- Operation of the GRAZ*hopper* can be **single person or tandem**. The conversion is simple and quick.
- **Fully FAA legal** under Part 103 for single person operations.
  ***NOTE*:** For tandem operation, special FAA recognized instructor certification is required. Contact Airparamo LLC for details on this.

- **Strong design.** The design of the GRAZ*hopper* is basically a triangulated truss, where the cables act in unison with the rigid frame to form a strong, stable, lightweight structure. Additionally, all tubing on the GRAZ*hopper* is round, which is the strongest and most efficient shape for uneven loading. The GRAZ*hopper* has been thoroughly and rigorously field and flight tested with heavy single and tandem operations and has withstood many hard landings with usually no damage.
- **Stable.** The low center of gravity, wide wheel base, and the placement of the mass of the motor ahead of the rear wheels minimizes rollovers and turtling (where the trike tips backwards onto the prop).
- **Protection for pilot and passenger.** The main frame wraps around the pilot and passenger to protect the occupant(s) in the event of a crash or roll over. It is made of super-strong, thick walled, military grade 4130 Chrome Alloy tubing.

- **Light-weight.** The GRAZ*hopper* weighs only 32 lbs 6 ozs, without harnesses.
- **Quickly folds up** for transport or storage in less than 5 minutes with no tools.
- **Quickly disassembles** into a small footprint for easy shipping.
- A **universal motor mounting system** accepts just about any PPG motor frame available and connects or disconnects the motor to the trike frame in under a minute.
- A **unique rear wheel alignment system** makes it easy to keep the rear wheels tracking straight. This adjustment can be done in the field in 5 minutes or less with a pair of pliers or a wrench.
- Designed so that **motor thrust angle** points slightly upwards on takeoff and then slightly downwards in flight. This helps with inflations and take-offs since the motor does not disturb the layout of the wing on the initial motor run up. Additionally, the slight upwards thrust line helps to minimize dust and debris from getting airborne and consequently getting sucked into the prop or bothering bystanders.
- Designed and **built for years of trouble free operation**. For example, saddles, spacers, or inserts are placed in the most stressed places to absorb and distribute forces and keep the adjoining pieces moving freely as designed. As such, the GRAZ*hopper* is capable of absorbing repeated hard impacts with grace and ease.
- **Aircraft grade materials** used throughout: 6061-T6 Aluminum, 4130 Chrome Alloy, and AN hardware are examples of the quality materials used. These are the same materials and hardware used in certified aircraft. All AN hardware on the GRAZ*hopper* is sized, fitted, and fastened using certified aircraft standards. Any other hardware on the GRAZ*hopper* is aircraft or marine grade or is of the highest quality available.
- Designed and built using sound, tested, proven **aircraft construction principles and standards**. For example, structural welds are made by certified welders (there are only 6 welds on the entire trike, all on steel). Every other connection is mechanically fastened, which is the strongest method of joining aluminum parts (welding aluminum often significantly reduces the temper, and thus its strength).
- **Cables** are aircraft grade, coated with a UV resistant PVC.
- All machined parts are **finished with a tough powder coat or are anodized**.
- Designed to accommodate the **premium 12" (30cm) Rolleeze wheels** with standard with 1" nylon bearings on all wheels. These wheels are ideally suited for PPG trikes with low weight, suberb suspension capabilities, flexibility and robustness on all types of surfaces, puncture resistance, easy field repairs, and flat tread with low grip to help self-correct wing oscillations
- The **rear wheels can be upgraded** to 16" (42cm) or 19" (49cm) sizes for a greater ground clearance, higher weight tolerances, and better suspension capabilities.

- The standard nylon **bearings can be upgraded** to all steel bearings for improved wear and service life. Wheels and bearings can be quickly swapped out in minutes with basic hand tools.

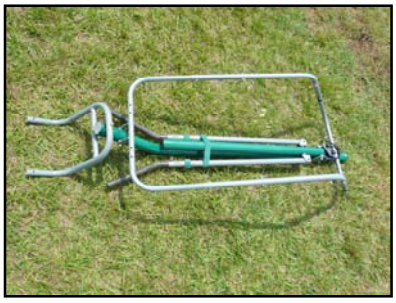
3. First Set-Up Assembly

The first time you assemble the GRAZ*hopper*, it is helpful to have a few tools handy: a rubber mallet; two wrenches in 1/2", and two wrenches in 7/16", or two adjustable wrenches to attach or tighten various bolts and nuts; and a flat head screwdriver. Estimate 1 to 2 hours to assemble and hang test your GRAZ*hopper* for the first time.

To begin assembly of the GRAZ*hopper*:

3.1 **Start by separating and checking the parts**: the main frame, the wheels, the front fork components, the roll bar components, all hardware, and the harness(es). The small footprint of the basic components makes for simplified and inexpensive shipping of the GRAZ*hopper*.

3.2 **Fill the Rolleeze wheels with the correct air pressure** as listed on the tire.
***ATTENTION*:** Do not over-inflate the Rolleeze wheels. This could damage them. Be careful to not leave the Rolleeze wheels in the sun on a warm summer day or in a hot vehicle. Also, be careful when traveling to high elevations. The tires could burst or be damaged due to over-inflation from high temperatures or drastic changes in altitude.

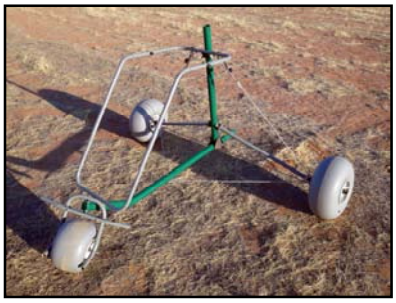


3.3 **Assemble the roll bar components with the supplied hardware.** See photos in this manual for specific details.

3.4 **Attach the front wheel onto the fork.** See photos in this manual for specific details.

3.5 **Attach the roll bar to the main frame.** See photos in this manual for specific details.

3.6 **Open up the GRAZ*hopper*.** Begin by vertically standing the trike up on the front wheel, facing and holding the underside of the trike. Next, undo the velcro strap that holds the trike and cables together. Next, with both hands, carefully balance the trike by holding the rear wheel axels, one in each hand. Next, lower the trike onto its wheels by pulling out and lowering the rear wheel axels to the ground. Next, release the quick release pin on the end of the roll bar. Next, undo the turn buckle and place the cable on the back of the main frame. Next, lift the center frame up and around the roll bar and between the tabs of the roll bar. Next, align the quick release pin to connect the roll bar to the lower hole of the main frame vertical support. Next evenly tighten the turnbuckles to the point where the cables have just a little slack and play. The cables should be a little loose, but the trike structure should be complete.



3.7 **Attach the rear wheels.** First check the clevis pin is in the correct hole (for standard 12" (30cm) wheels use the outer hole, for the 16" (42cm) or 19" (49cm) wheels use the inner hole). Next, insert the wheel bearings into the wheel axel with the stem facing outwards. If you encounter resistance with the wheel bearings going into the axels, use a rubber mallet to lightly tap the wheel into place. Next, secure the wheel with a clevis pin and ring in the outer hole.

3.8 **Align the rear wheels.** First, be sure the cables are loose. Next, loosen the thumb clamp on the wheel axels. Stand directly over the large main cable and visually follow

the angle to the wheel axels. If the wheels are towed in or out, simply move them into the right position. When the alignment is complete, retighten the clamps on the wheel axels.

***ATTENTION*:** Do not overtighten these wheel axel clamps. Use a wrench or pliers to gently tighten the thumb clamps.

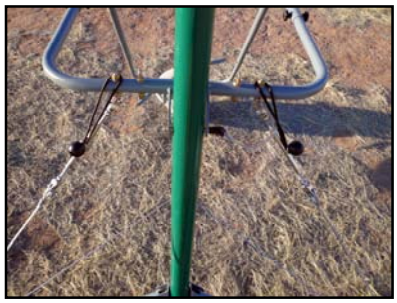
***ATTENTION*:** Wheel alignment is critical to maximize the ease of launch and longevity of the tires and bearings. Wheels that are not properly aligned create a huge drag resistance on the ground, which makes for longer and slower takeoffs. Also unaligned wheels put enormous lateral forces on the wheel bearings, which causes them to fail prematurely and quickly.

3.9 **Attach the harness(es).** The GRAZ*hopper* trike accepts a multitude of different harnesses. Use straps to pull the harness forward for better comfort and to adjust the flight nose wheel angle. See photos in this manual for details.

3.10 **Attach the wing hang point position.** Use the rear hole for single and the front hole for tandem positions.

***WARNING*:** Be sure to have the correct hang point arrangement for single or tandem configurations. Flying in the incorrect hang point position would cause the trike to be unbalanced (with the front wheel too high or too low) in the air and could be extremely dangerous or even lethal to fly and land.

3.11 **Attach the front foot bar as desired.** There are 8 user selectable positions depending on your comfort or leg length.



3.12 **Fully tighten the cable turnbuckles.**

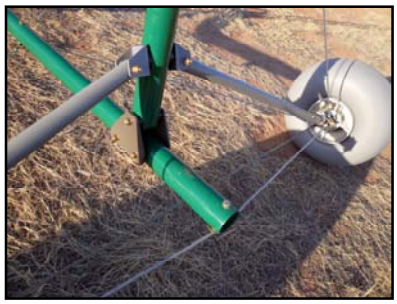
***ATTENTION*:** On turnbuckle tightening, special care must be taken when tightening or loosening the turnbuckles. DO NOT use any tools to loosen or tighten the turnbuckles (or nuts on the turnbuckles) or the threads will quickly gall and jam. Several users have found success with a stainless steel anti-galling lubricant on the threads of the turnbuckle, but this can become a messy ordeal with the lubricant sticking to anything it touches and attracting unnecessary dirt into the turnbuckle.

***ATTENTION*:** We also recommend our tested, proven approach to loosening and tightening the turnbuckles, which will insure you years of trouble free operation:

3.12.1 Pull the frame in such a way to release any cable tension on the turnbuckle you desire to tighten or loosen. It is helpful to use your foot to push on the lower main frame and one hand to pull the vertical main frame support towards you. This releases all cable tension on the turnbuckle you want to tighten.

3.12.2 With your other hand, use your pinkee to keep the lower cable from turning. Then use your thumb and other fingers to tighten or loosen the turn buckle.

3.12.3 Use the supplied bungie loop to go through the key ring on the turnbuckle and up to the bolts on the roll bar. See photos in this manual for details. This provides a secure system to insure that the turnbuckle will not turn loose in flight.



3.13 **Position rear cable into stay** under the rear portion the of main frame. It is ok if this rear cable is a little loose. See photos in this manual for details.

3.14 **Attach your motor unit**. Use the Universal Motor Clamping System on the GRAZ*hopper* to connect the bottom and upper frame tubes. Also, use the supplied doublesided Velcro to attach the motor unit to the GRAZ*hopper* wheel axels and as a safety backup for the top motor clamp.

***ATTENTION*:** With some motor units, the Universal Motor Clamping System may need to be modified to fit properly. Be sure that your Universal Motor Clamping System is securely holding the fame of your particular motor. If you have any doubts, do not hesitate to contact your product dealer or Airparamo LLC directly.

3.15 Do a thorough **flight check** of the GRAZ*hopper*, motor and attach points.
***WARNING*:** Always turn off the master switch on any PPG motor when conducting a preflight check.

3.16 **Warm up the motor.**
***WARNING*:** Always loudly announce "CLEAR PROP" before starting any PPG motor.
***WARNING*:** Do not attempt to start a PPG motor without instruction from a qualified instructor. There are dozens of instances of pilots and spectators who have been severely injured by coming in contact with a spinning propeller.

3.17 **Hang test** the GRAZ*hopper*. This helps to test your harness and hang point positions. To do this properly, set up a rigging arrangement where you can safely and securely hang the trike while you sit in it. It helps to have an observer, especially with a camera, to report or record the correct prop angles (between 2 to 5 degrees downwards while hanging in the air) and seating positions.

***WARNING*:** Do not attempt to fly a GRAZ*hopper* trike that has not been properly hang tested. It could be out of balance, resulting in an undesirable or dangerous flight attitude.
***WARNING*:** Be extremely cautious to run the motor on the trike while it is being hang tested. If you do want to run up the motor in the hang test rig, be sure to do this in a secure, sturdy hang test rig and with the assistance of an experienced instructor who is thoroughly familiar with motor runups in a hang tester.

3.18 **Test drive** the trike for a few minutes.
***WARNING*:** Be careful to not turn too sharply with any speed. This could initiate a rollover.
***ATTENTION*:** The GRAZ*hopper* has no brakes. When you need to slow down ground speed, use your feet to bring the GRAZ*hopper* to a halt.
***ATTENTION*:** The original bearings in the Rolleeze wheels are designed for walking pace speeds only. If you go faster than a walking pace for more than a few seconds, the bearings will heat up and potentially melt the housing.
***NOTE*:** A bearing upgrade is available to replace all the original nylon bearings to all steel bearings. Please contact your product dealer or Airparamo LLC for more information on this or other upgrades.

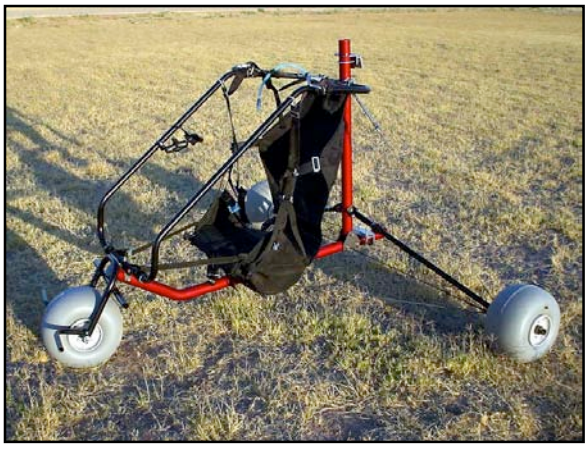
4. Set-Up & Breakdown

Once the trike is fully assembled, set up and break down can be accomplished in under 5 minutes. For the set up, refer to sections 3.6, 3.12, 3.13, 3.14, and 3.15 of this Owners Manual. For the break down, refer to sections 3.14, 3.13, 3.12, and 3.6 of this Owners Manual and detach and loosen parts.

5. Take-Off, Flight, & Landing

***WARNING*:** Do not attempt to operate or fly a GRAZ*hopper* trike without qualified flight instruction. The PPG trike is quite different from other types of PPG or PG flight and the subtleties of learning to fly a PPG trike can be unforgiving and dangerous. There are dozens of examples of PG and PPG pilots and complete newbees that have attempted to self-train on PPG trikes and ended up severely damaging themselves and their gear. Consider that the flight training is cheap compared to a broken arm or torn up wing and cage. Contact your PPG flight instructor or Airparamo LLC on recommendations for instruction.

***ATTENTION*:** The original bearings in the Rolleeze wheels are designed for walking pace speeds only. If you go faster than a walking pace for more than a few seconds, the bearings will heat up and potentially melt the housing.
***NOTE*:** A bearing upgrade is available to replace all the original nylon bearings to all steel bearings.



Here are a few tips to help you in flying a PPG trike:

- ***WARNING*:** Always **preflight** your gear prior to launch. As the famous saying goes, it's better to be down here wishing you were up there than up there wishing you were down here.
- ***ATTENTION*:** Airparamo LLC strongly recommends a **strong motor cage** for any PPG trike flying, preferably one with a double ring cage. A weak cage with a single ring cage is a recipe for expensive equipment damage.
- ***WARNING*:** Beginners should only **fly in calm conditions** with winds not exceeding 8 mph. Skilled and experienced trike pilots can push these limits as they progress within their capability as pilots.
- ***WARNING*:** Always loudly **announce "CLEAR PROP"** right before starting the motor.
- ***WARNING*:** Always **wear a helmet** when you fly the GRAZ*hopper* or any PPG trike.
- ***WARNING*:** Always take-off and land **into the wind**. Cross wind take-offs are to be done only by skilled and experienced pilots.
- ***ATTENTION*:** On the initial inflation, be careful to not **whiplash the lines** too hard with lots of thrust. This could flex even the strongest motor cage and cause the prop to come into contact cage or wing lines.
- ***WARNING*:** On the initial inflation if the **wing is oscillating**, reduce the thrust and either abort the launch sequence or attempt to get the wing under control. If the trike shows any hint of rolling, abort the launch and immediately shut off the engine.
- ***WARNING*: Assume your engine will quit any time** during the flight. In other words, always have at least one place to safely land.
- ***ATTENTION*: After landing**, shut the motor off as the wing falls behind you.
- ***WARNING*:** If **the wind picks up** past 12 mph while you are flying, on landing try to get the wing to come down straight behind you. If the wing falls to the side with winds exceeding 14 mph, there is a strong likelihood of rolling the trike, physical injury, and getting dragged.

- ***WARNING*:** The GRAZ*hopper* has a wide wheelbase and a low center of gravity. It is **difficult to roll over** the GRAZ*hopper*. However, if the trike begins to roll over, quickly bring your arms inside the roll bar. The roll bar may protect you from physical injury if you are dragged or rolled. However, if your arm gets caught under the roll bar as you are flipped upsidedown, it could cause immediate and painful injuries to your arm, including broken bones.
- ***WARNING*:** If you decide to use a **reserve parachute system** on the GRAZ*hopper*, have a knowledgeable rigger who is extremely familiar with reserve use and deployments install or do a safety review of the reserve mounting system. Also, if you

fly with a reserve, become knowledgeable about the operation parameters, risks and benefits, maintenance, care and exact use of owning and deploying a reserve. An excellent way to gain this knowledge is through a reserve clinic, which can offer much assistance in the set-up, use, and maintenance of reserves.

6. Care & Storage

The ideal place to store the GRAZ*hopper* is in a cool, dry, dark location, such as a garage. To clean your GRAZ*hopper*, use a mild cleaner and degreaser (such as Simple Green) and rinse thoroughly and generously with water. Be sure to dry any excess water on the GRAZ*hopper* after washing. You can also use finish protecting or polishing products to clean, seal, protect, and beautify the finish.

7. Upgrades

The GRAZ*hopper* has several upgrade and add-on kit options, as listed below. Please contact your product dealer or Airparamo LLC for more information on this or other upgrades.

- **Tandem upgrade**. The GRAZ*hopper* can be flown in single or tandem versions. Converting the GRAZ*hopper* to tandem involves adding a passenger harness. Tandem operations require a powerful motor with a strong cage and a tandem sized wing. ***NOTE*:** For tandem operation, special FAA recognized instructor certification is required. Contact Airparamo LLC for details on this.
- **Wheel upgrade.** The standard wheels are the 12" Rolleeze wheels. Upgrades can be done to the rear wheels only, by increasing the size to 16" or 19". The larger wheels offer better suspension over rough terrain and a higher ground clearance to better handle tall grass, brush, deep sand, or larger rocks.

- **Bearing upgrade.** The standard bearings on all wheels are 1" steel bearings on a nylon housing (some earlier models have ½" nylon shaft on the front wheel). These bearings can be upgraded to all steel bearings for much smoother rolling and extended service life.
- **Launce (A-line) Assists.** An upgrade kit that includes lines and hardware that connects to your A risers to the rollbar to help with inflations.
- **Pilot Stick Control.** An upgrade kit that allows the pilot to operate their paraglider much like a fixed wing aircraft is operated. The stick control is located between the pilots legs and controls the paraglider steering and flare control using a series of lines and pulleys.

8. Specifications

8.1. Dimensions & Weight

Length: 69” (176cm)
Width Assembled: 82.5” (210cm)
Width Unassembled: 22.5” or 57cm
Height Assembled: 46.5” (118cm)
Height Unassembled: 19” (48cm)
Weight w/ 12” wheels, w/o harnesses: 32 lbs 6 ozs or 14.75 kgs.

8.2. Main Parts List

Here is a listing of the main fabricated components of the GRAZ*hopper* trike:
1 x GHT-01A Front Fork
1 x GHT-01B Front Fork Support
1 x GHT-01C Pilot Foot Bar
1 x GHT-01D Passenger Foot bar
2 x GHT-01E Front Wheel Hub
1 x GHT-02A Main Frame Front
1 x GHT-02B Main Frame Rear
1 x GHT-02C Main Frame Vertical
2 x GHT-02D Main Frame Insert
2 x GHT-03A Rail Side
2 x GHT-03B Rail End
4 x GHT-03C Rail Insert
2 x GHT-03D Rail Bracket
2 x GHT-04A Frame Connect Plate
5 x GHT-04B Frame Motor Clamp
2 x GHT-05A Wheel Mount
2 x GHT-05B Wheel Strut
2 x GHT-05C Wheel Strut Insert
2 x GHT-05D Wheel Strut Bracket
2 x GHT-06A Launch Assist Tab

2 x GHT-C1 Front Cable
2 x GHT-C2 Upper Cable
1 x GHT-C3 Back Cable
1 x GHT-C4 Main Cable

1 x GHT-B1 Bungie Cord for Back Cable and Turnbuckles
1 x GHT-L1 Launch Assist Line Assenbly