



**HiFlyer
TRAINING MANUAL VOLUME 1**

**BASIC OPERATION AND MOORING PROCEDURES
FOR DAVID BROWN SPECIAL PROJECTS WINCH**

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Record of Amendments

No.	Date	Affected Pages	Incorporated By
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2	February 2002	ii, iii, 29, 32, 34	John Ackroyd

Amendments:-

This manual is kept up to date by amendments consisting of loose-leaf pages, required to add new information or amend existing information. The pages affected by an amendment and the effective dates are shown above. The pages themselves are identified by a change of the issue number at the bottom of each page. The number after the point in the issue number represents the amendment level of that page, e.g. a page marked Issue 1.4 is at Issue 1, modified by Amendment 4. The checklist of pages indicates the issue level of all pages included in this Training Manual. Amendments are issued to all relevant operators of the Lindstrand Technologies Ltd Hi Flyer System on a free of charge basis provided that the Inclusion Check Sheet is signed and returned to Lindstrand Technologies Ltd for each issued amendment.

Change of Ownership

If the ownership of this balloon changes, it is important for the new owners to contact Lindstrand Technologies Ltd to ensure that they receive Amendments and Supplements, as appropriate. This can be simply achieved by photocopying Page ii of this manual and writing your name and full correspondence address on the reverse side and sending to Lindstrand Technologies Ltd.

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1. Outline

The purpose of this training manual is to provide guidance to level 1 operators.

A level 1 operator should be proficient in:

- High mooring technique
- Low mooring technique
- Winch operation
- Basic Safety Procedures

This manual is to be used as an aid to training in conjunction with the HiFlyer Operations Manual.

All operators should aim to become familiar with the operations manual, as it is a comprehensive document covering all aspects of the HiFlyer system.

2. Description of the HiFlyer

The Lindstrand HiFlyer consists of three major sub-systems:

- A balloon and net, which provides the necessary lift to support all the equipment and passenger weights.
- A gondola, which provides a safe carrying structure for the occupants.
- A winch system which secures the balloon and controls the ascent and descent.

3. Mooring and Un-mooring

The mooring and un-mooring of the HiFlyer are two of the most important tasks to be undertaken by the operator.

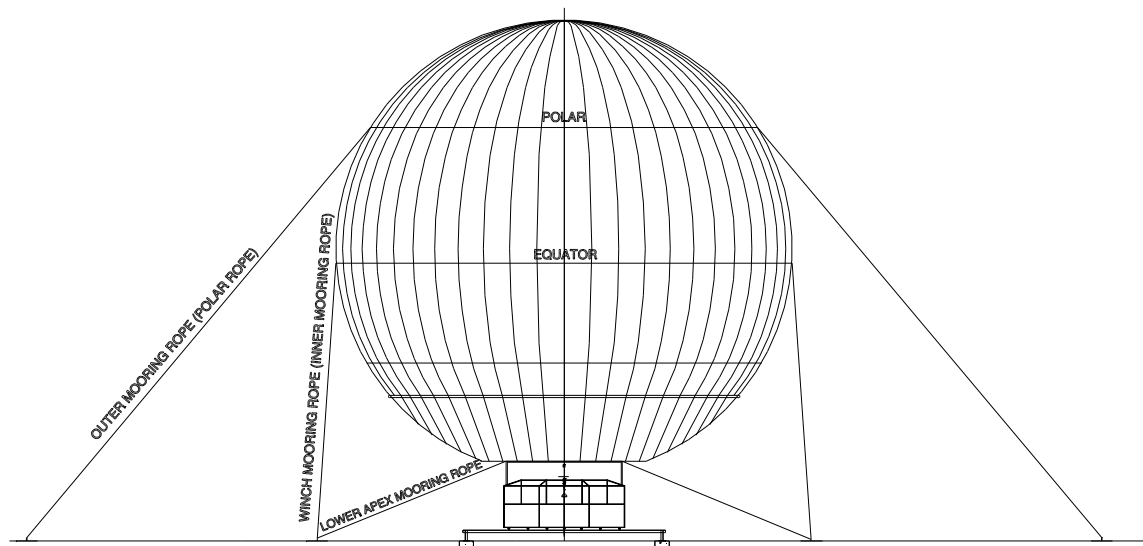
The envelope is over 22 metres in diameter, which means that a large surface area is exposed to the wind. This surface area combined with the large amount of lift generated by the Helium means that injury, damage and possibly envelope failure could occur if the HiFlyer is incorrectly moored.

The HiFlyer can be moored in two separate ways depending on wind speeds (the operations manual states the limits for different windspeeds).

- High moor for lighter winds
- Low moor for stronger winds and overnight.

There are three separate sets of mooring points:

Mooring point:	Description:	Attached to:
Equator Rope	The equator of the net has 16 winch mooring lines. These are fastened to the 16 mooring winches which are set around the main winch at a diameter of 23 metres. USED FOR BOTH HIGH and LOW MOOR	MOORING WINCH DRUM
Polar Rope	The upper section of the net has 16 tether lines. These are fastened to concrete hard points which are set around the main winch at a diameter of 50 metres USED FOR BOTH HIGH and LOW MOOR	2.5 TONNE RATCHET STRAP
Outer mooring winch option	Used for both High and Low Moor	MOORING WINCH DRUM
Lower apex mooring	The lower apex of the envelope has 8 load patches fixed to it. Straps are fastened to these load patches and anchored to hard points set into the concrete base supporting alternate mooring winches. LOW MOOR ONLY	2.5 TONNE RATCHET STRAP



The HiFlyer is able to rotate on a swivel connection, which is situated between the main winch cable and load ring assembly. This means that the mooring lines on the net and envelope cannot always be attached to the same mooring point.

Sections 3.4, 3.5 and 3.6 describe how to moor and un-moor the HiFlyer from the high and low positions

3.1 Outer Mooring



- (a) Open the ratchet handle out fully and pull the ratchet release lever up. Feed out the strap until there is only 300mm of the free end of the strap through the handle. Operate the ratchet mechanism a few times to secure the strap, then close the handle to lock the ratchet.



- (b) Using a karabiner, connect the looped end of the strap up to the highest loop of the mooring line that can be reached.



(c) The karabiner should be connected as shown.



(d) Open the ratchet handle out again and pull the loose end of the strap through to take up the slack. It is important to take up all of the slack, if too much slack is left when the ratchet is tightened the volume of strap wrapped around the spool will jam the mechanism.



- (e) Keep the strap under tension with one hand and operate the ratchet mechanism with the other until the strap and mooring line are fully tensioned. Make sure that the strap is not twisted or out of alignment, otherwise this will cause premature wear.



- (f) There should be no sag in the mooring line when correctly tensioned. Close the ratchet handle to finally lock the mechanism.



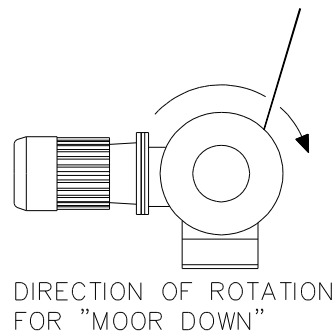
- (g) Route the free end of the strap back through the handle of the ratchet. Coil up the loose mooring line and tie it off to the strap to prevent it dragging on the ground.

3.2 Mooring winches

Remove the equatorial mooring line from its storage bag on the gondola. Make sure that it is not tangled or knotted. Set the mooring winch control pendant to **LOWER** and **MOOR ONE**.



(a) Pass the sewn-in loop back through itself to form a 'slipping loop'.



(b) Place the slipping loop around the mooring winch drum and pull it tight. Make sure that the sewn-in loop is positioned so that the free rope locks back around, to secure the rope onto the drum.



(c) Operate the winch from the local control panel and guide the mooring rope onto the drum.

SAFETY: Make sure that fingers, loose clothing, jewellery etc. cannot be snagged or trapped around moving parts of the winch



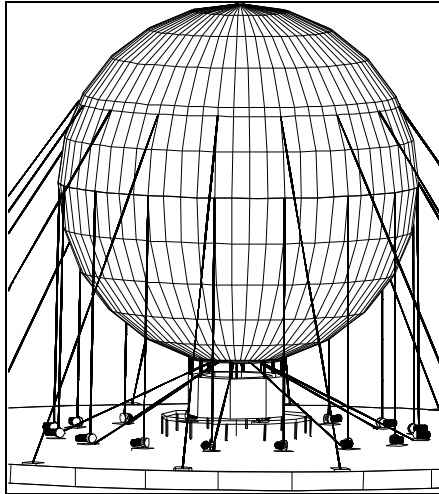
(d) Take up an equal amount of slack on each winch. If the rope is too tight the motor may back drive. It is best to one-person judge the tension for all 16 ropes before continuing.

LOW MOORING

Firstly ensure that all outer mooring ropes are attached to the ratchet straps, or if fitted with outer mooring winch system, with equal tension to all ropes. When all 32 mooring ropes have an equal amount of tension, change the mooring winch control pendant over to **MOOR ALL and LOWER**, and winch the envelope down to its low mooring position.

3.3 Lower Apex Mooring

This procedure is similar to section 3.1 Outer Mooring.



8 x 2.5 tonne ratchet straps are attached with karabiners directly to 8 extension straps on the load patches located on the bottom of the envelope. The technique for securing and tensioning the straps is the same as for outer mooring. The ratchet mechanism is secured to a hard point on the concrete mooring winch support block.

As there are only 8 lower apex mooring points, the ratchet mechanisms should be fixed to each alternate winch hard point situated on the winch motor.

NOTE: The strap and extension should be routed over the top of the gondola mooring ring - This is to ensure that the load applied to the patches on the envelope is aligned in tension, and will not cause a *peel* load

3.4 High Mooring from flying

OPERATIONS MANUAL REFERENCE:	SECTION 3.4.7 High Mooring System
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Procedure

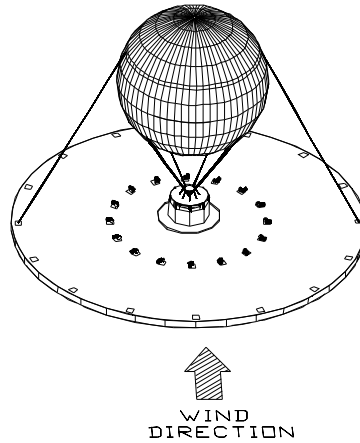
With little or no wind

When the gondola is on the platform, take the outer mooring ropes from their gondola mounted storage bags (or release them from the karabiners) pull them out towards the outer mooring hard points or winches (if fitted) and attach securely.

With moderate to strong winds

The movement of the balloon will cause the ropes to swing and possibly snag on the inner mooring winches. This could damage the balloon or cause injury to personnel. With this in mind it is best to

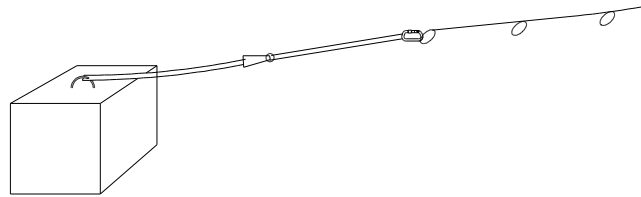
remove the outer mooring ropes individually and secure them to the ratchet straps or winches one at a time.



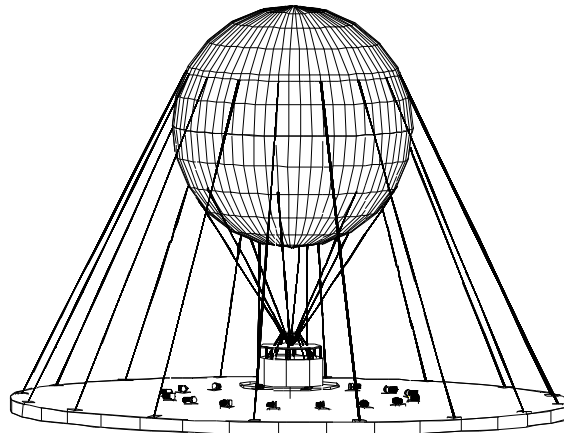
The up wind ropes will be subjected to a lot more load than the remaining ropes.

The first ropes to secure during mooring are those perpendicular to the wind direction (Fig 3). These will steady any sideways motion which should make it easier to connect the remaining ropes.

Place the karabiner through the first loop at the end of the outer mooring ropes.

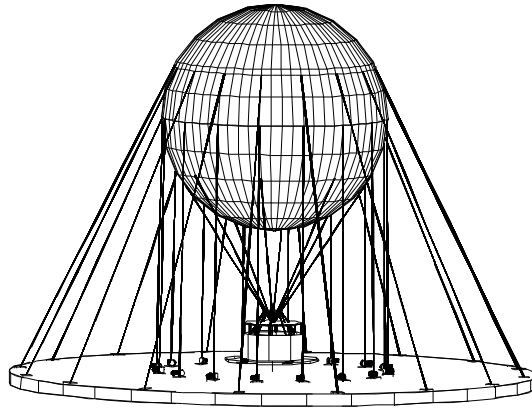


When all outer mooring lines are secured at the end loop, starting with the perpendicular, move the karabiners progressively up to the highest loop possible on each rope and tighten (Refer to Section 3.1).



The balloon should now be stable and movement should be minimal.

Ensuring that the mooring winch control pendant is set to **LOWER** and **moor one**, remove the inner mooring lines from their gondola mounted storage bags (or release them from the karabiners) and secure to the mooring winches (Refer to Section 3.2).



Ensure that all inner and outer mooring lines have equal tension. Where there is an outer mooring winch system, ensure the balloon has been secured in the high moored position first, then the outer mooring ropes may be attached to their respective winches and tensioned by use of the pendant control.

The balloon is now in the High Moored Position.

3.5 Low Mooring

OPERATIONS MANUAL REFERENCE:	SECTION 3.4.8 Low Mooring System
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In order to Low Moor, the balloon must be in the High Moored Position. At least two crew, preferably three are required for low mooring. One person is to be designated 'operator in charge'.

With the mooring winch control pendant, set to **MOOR ALL and LOWER**.

The operator in charge of Low Mooring should stand where the control panel in the gondola is visible.

The **HELIUM VALVE** switch on the control panel should be set to **MANUAL** to prevent pressure from opening the valve.

Other personnel should stand clear of the mooring winches, but in a position where as many of them are visible as possible.

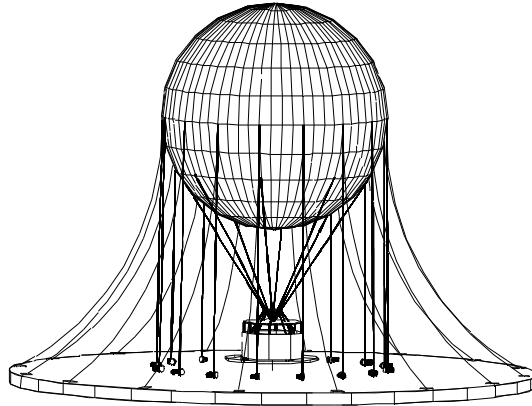
Before depressing the button to commence Low Mooring, the operator should indicate to other personnel that the winches are about to work by shouting "WINCHES". Other personnel should return this call to indicate that they are aware that the winches are about to be used. Once the operator is satisfied that all personnel are clear, the mooring button should be depressed.

Maintain equal tension on outer mooring winch ropes. It may be necessary to stop the inner winches whilst the outer winches 'catch-up', or vice-versa.

The operator should watch the load assembly as the balloon descends, making sure that there are no snags and that the load ring falls into the cradle horizontally.

The remaining ground crew should watch the winches for any sign of malfunction or problems.

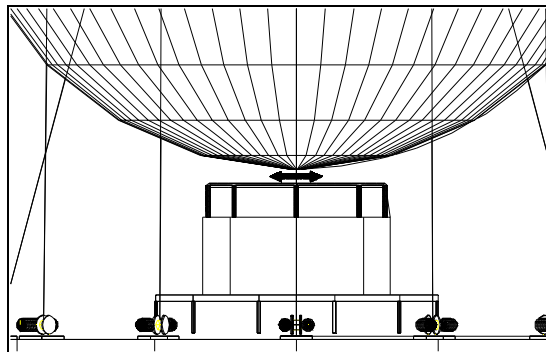
If anyone is not satisfied with the function of any of the mooring winches, they are to shout “STOP”. If the word “STOP” is heard, Low Mooring is to cease immediately and the reason made clear to all personnel.



As the mooring winches lower the envelope the outer mooring lines not attached to winches will slacken. If there is a moderate wind, the envelope will move around as the balloon is lowered. If movement becomes excessive, immediately cease the Low Mooring and re-tension all of the outer mooring lines to equal tension.

Bring the envelope down to within 500mm of the gondola-mooring ring.

The operator should be aiming to land the envelope onto the mooring ring as centrally as possible. The envelope may move around in the wind. Once the envelope is 500mm from the mooring ring re-fasten the outer mooring lines to take up the tension again on the outer mooring ropes.



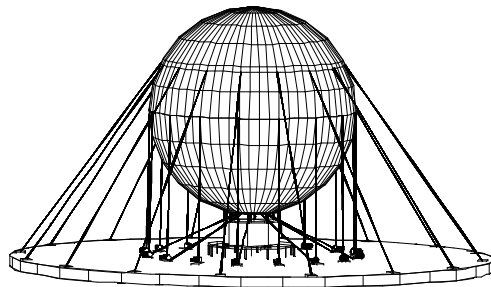
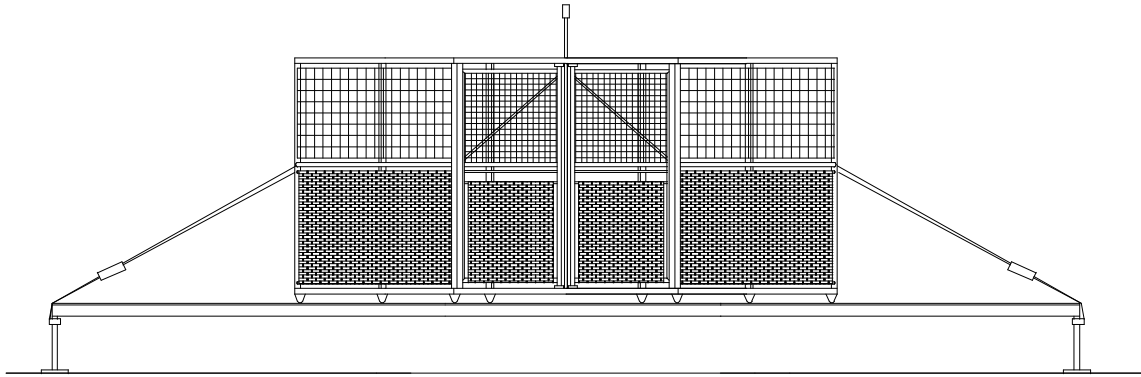
In moderate to strong winds, it may be prudent to attach the lower apex mooring lines whilst the balloon is in this position. This will prevent the envelope from straying towards the mooring ring and damaging the fan assembly at the bottom of the balloon.

The operator can now lower the envelope on to the mooring ring. It is important to monitor the helium and ballonnet pressures during this process. The balloon should be lowered until the mooring ring causes the lower apex of the balloon to indent by approximately 500mm.

As the balloon is being lowered, the helium and ballonnet pressure will rise rapidly. The operator is to ensure that the helium pressure does not exceed 38mm and the ballonnet pressure does not exceed 14mm.

Once in position, the outer mooring ropes should be re-tensioned and the 8 lower apex-mooring straps (if not already in place) should be attached and tensioned.

The gondola should now be secured to the decking using the ratchet straps (2.5T).



The balloon is now in the Low Moored Position.

3.5.1 Mooring Cushions

The mooring cushions may be attached to the gondola to provide extra contact area for the envelope when low moored during high winds.



These eight inflatable cushions are attached to the gondola corners using ratchet straps in the centre of each panel when the balloon is in the low moored position.



3.5.2 Ground Fan

The ground fan should be used during high winds and in case of ballonet fan failure. It can also be used to save battery power when the balloon is low moored overnight or if it is not operational for a long period.

It is essential to maintain pressure when the balloon is moored during windy conditions to prevent the envelope from indenting, and reduce wind drag and balloon movement.

To speed up pressure recovery in gusty conditions when ballonet air is blown out of the pressure relief valve, the ground fan has a higher performance than the ballonet mounted fan.

If the ground fan was operated continuously there is a danger that the balloon could be over-pressurised and helium vented. To prevent this the fan is linked into the pressure sensing system displayed in the instrument box which switches the fan in and out to limit pressure.

The ground fan is powered by mains or generator A C supply either 240 V or 110 V this means there is a continuous supply and no drain on the on board batteries, which can be charged.

The ground fan must be disconnected before the balloon is flown or raised to the high mooring position.

3.5.2.1 Ground Fan Installation

Locate fan on the platform outside the gondola.
Lead the duct over the top of the gondola and under the mooring ring.
Couple the duct up to the connection under the ballonet fan using the four 'over centre' catches.
Mains lead - plug in to mains (or generator) supply socket.

The connection of the ground fan controller lead to the control panel is the responsibility of the supervisor. He must also connect the battery charger to ensure overnight charging.

3.5.2.2 Emergency Operation

If there is a failure in the automatic system or in severe storm conditions the fan may be plugged directly into the mains supply and operated continuously.

In this case an operator should monitor the ballonet and helium pressure closely. If the ballonet pressure exceeds 14 mm WG, or He pressure exceeds 38 mm WG, the fan should be switched off until the pressure drops around 3 mm WG before switching on again.

If there is a mains power failure the ground fan can be connected and operated from the internal lighting generator.

3.5.2.3 Ballonet Fan Reconnection

Before the balloon is flown or raised from the low mooring position the ground fan must be disconnected.

3.6 High Mooring from Low Mooring Position

OPERATIONS MANUAL REFERENCE:	SECTION 3.4.8.2 Un-mooring Procedure
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The un-mooring procedure is largely the reverse of the low mooring procedure.

Remove the outer mooring lines from the ratchet straps and reconnect to the last loop. If outer mooring winch system is fitted, leave the ropes attached to the winch drums as these will automatically wind out.

Take two turns through the buckle, ready for re-mooring if necessary.

Remove the Lower Apex Mooring straps and the gondola securing straps.

Switch the Mooring Winch Control Pendant to **MOOR ALL** and **RAISE**. The operator should stand in a position where the control panel in the gondola is visible.

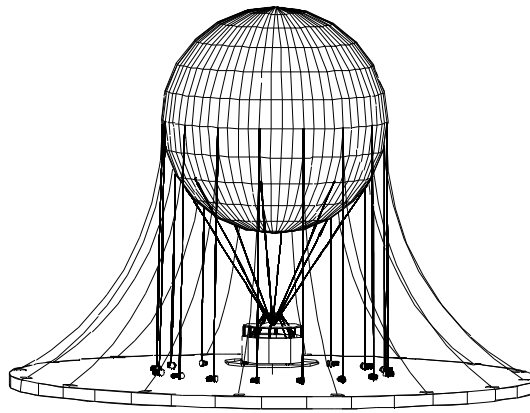
The **HELIUM VALVE** switch on the control panel should be set to **AUTOMATIC**. Other personnel should stand clear of the Mooring Winches, but in a position where as many of them are visible as possible.

Before depressing the button to commence High Mooring, the operator should indicate to other personnel that the winches are about to work by shouting “WINCHES”. Other personnel should return this call to indicate that they are aware that the winches are about to be used. Once the operator is satisfied that all personnel are clear, the mooring button should be depressed.

The operator should watch the load assembly as the balloon ascends, making sure that there are no snags and that the load ring leaves the cradle. The operator should also keep an eye on the cable to ensure it is located into the fleeting sheave correctly.

The remaining ground crew should watch the winches for any sign of malfunction or problems.

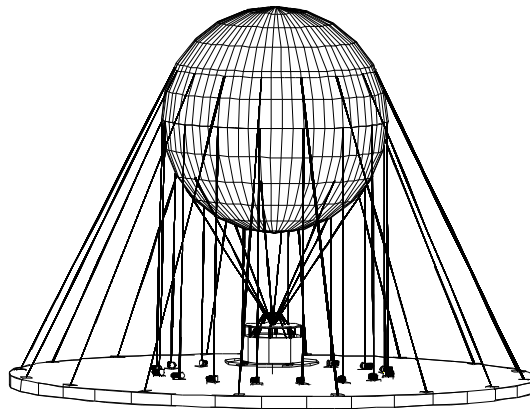
If anyone is not satisfied with the function of any of the mooring winches, they are to shout “STOP”. If the word “STOP” is heard, High Mooring is to cease immediately and the reason made clear to all personnel.



As the weight of the balloon comes onto the bridles and load assembly, the Free Lift will start to rise. As the free lift increases, stop raising the balloon.

The outer mooring ropes should be re-tensioned.

Switch the mooring winch control pendant to **LOWER** and **MOOR ONE**, and re-tension the inner mooring lines.



Ensure that all inner and outer mooring lines have equal tension. It may be necessary to tighten the outer mooring lines again.

The balloon is now in the High Moored Position.

3.7 Flying from High Mooring Position

OPERATIONS MANUAL REFERENCE: SECTION 3.4.8.2 Un-mooring Procedures

Ensure the mooring winch system is switched on.

Remove the outer mooring ropes from the ratchet straps and reconnect to the last loop. If outer mooring winch system is fitted, leave the ropes attached to the winch drums as these will automatically wind out. Lay out the ratchet straps with two turns through the buckle, ready for re-mooring.

Switch the mooring winch control pendant to **RAISE** and **MOOR ALL**.

Before depressing the button, the operator should indicate to other personnel that the winches are about to work by shouting "WINCHES". Other personnel should return this call to indicate that they are aware that the winches are about to be used. Once the operator is satisfied that all personnel are clear, the mooring button should be depressed.

The remaining ground crew should watch the winches for any sign of malfunction or problems.

If anyone is not satisfied with the function of any of the mooring winches, they are to shout "STOP". If the word "STOP" is heard, operations are to cease immediately and the reason made clear to all personnel.

The operator should watch the Free Lift as the tension comes off the inner mooring ropes. As the free lift ceases to rise, the inner mooring ropes will become slack. When the ropes are slack, cease operation.

Switch the mooring winch control pendant to **RAISE** and **MOOR ONE**.

Remove the inner mooring ropes and stow in the bags provided on the gondola (or attach to the karabiners).

Stow outer mooring ropes in the bags provided on the gondola (or attach to the karabiners).

Switch the mooring winch control pendant to **LOWER** and **MOOR ONE**.

The balloon is now in the flying position – record un-laden (grounded) freelifft, helium pressure, ballonnet pressure, helium temperature, and ambient temperature.

4.2 Winch Controls

OPERATIONS MANUAL REFERENCE: SECTION 1.4.2.8 Winch Controls

The main winch can be controlled from either a radio link in the gondola or an auxiliary control panel mounted on the edge of the landing platform.

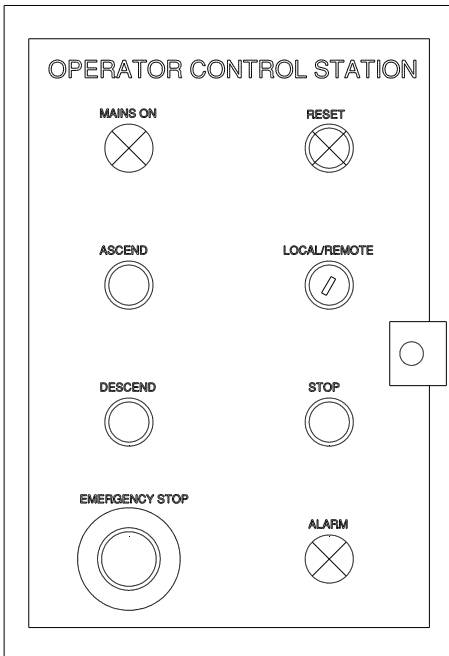
4.2.1 Gondola Remote Control Unit

OPERATIONS MANUAL REFERENCE: SECTION 1.4.2.8.1 Remote Control unit

The remote control is incorporated in the gondola control panel.

4.2.2 Auxiliary Control Panel

OPERATIONS MANUAL REFERENCE: SECTION 1.4.2.8.2 Auxiliary Control panel



The platform mounted operator control station can override the remote control unit in the balloon gondola - the key switch must be changed from remote to local.

Lights indicate mains on, alarm and reset conditions.

The operations manual lists alarm conditions, possible causes and remedies.

5. Normal Procedures

OPERATIONS MANUAL REFERENCE:	SECTION 3 Normal Procedures
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5.1 Pre-flight

There are several procedures to carry out each day prior to commencement of passenger carrying rides.

The senior supervisor is responsible for carrying out the following

- Structural inspection and completion of technical log of the full balloon system
- An operating plan with regard to forecast weather conditions
- A daily test ride to full ride height

Any Level 1 or 2 operators should report any observations regarding faulty/damaged equipment, changes in weather, etc. to the senior supervisor. **Safety is the responsibility of everyone.**

5.1.1 Structural inspection

A full inspection of the HiFlyer and winch system must be carried out each day, prior to commencement of passenger rides. Once completed, the relevant section in the technical log is filled in. Only when all the sections in the technical log have been completed, the test flight carried out and the log signed off by the senior supervisor, can passenger operations for the shift commence.

The daily inspection should highlight any components, which require maintenance or repair. The balloon should not be allowed to operate until faults have been repaired.

The Master Minimum Equipment List (MMEL) in Appendix 1, identifies certain types of faults on some parts and sub-systems where operations are allowed to continue. Procedures must be followed to repair the fault within the specified time.

A section of the Tech Log provides a record of inspection and maintenance.

Rides must not commence until the HiFlyer has been inspected and the technical log completed and signed off.

5.1.2 Weather

It is the responsibility of all operators to be fully aware of the predicted weather conditions and it's effect on the operation of the HiFlyer.

A basic course in meteorology is strongly recommended for all operators.

It must be noted that a weather forecast is only a scientific prediction. All operators should have a basic knowledge of meteorology and be able to spot changing weather patterns and make amendments to the flight plan. Forecasts are by nature not always accurate and it is important that any conditions encountered that do not match the predicted pattern are reported immediately to the supervisor.

5.2 Test flight

It is the responsibility of the supervisor to ensure that the Daily Test Ride is carried out to prove the system and sub-systems are safe for passenger flying.

5.2.1 Technical Log

The supervisor in charge of each shift must fill out a new technical log sheet at the start of his/her shift.

The test pilot is to ensure that all the relevant information is filled in before the test flight can commence. i.e.

- Weather forecast
- Balloon status
- Ride Data
- Inspection and maintenance
- Un-laden freelif
- Windspeed

When the balloon is at ride height, the test pilot fills in the remaining data i.e.

Elevated Freelif
Helium Temperature
Measured windspeed and direction
Helium Pressure
Ballonet Pressure
Battery condition

The Operations Manual specifies minimum free lift requirements at various wind speeds up to the max. operating windspeed.

Freelif and windspeed govern how many passengers may be carried per ride.

Freelif and helium temperature/pressure data can be used to estimate the volume/purity of helium. This should be monitored carefully as it will highlight any increased helium loss through valve leakage, envelope damage etc.

The battery voltage must be between the limits specified in the Operations Manual

5.2.2 Monitoring

During the test flight, the pilot should be monitoring the control panel, the gondola, netting and envelope for any abnormalities or defects.

The control panel may provide the first indication to the pilot that there may be a problem. It is vital that all pilots are fully conversant with the control panel and it's relevant sub-systems and the consequences of their failure.

If any at any point during the test flight the pilot notices any abnormality or defects, the test ride is to be terminated immediately and the balloon descended.

5.3 Passenger Rides

On completion of a successful test flight, the supervisor will calculate the maximum number of passengers permitted per flight and sign the technical log.

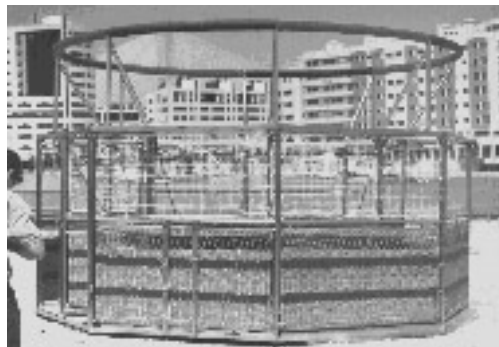
Passenger flying may now commence.

Embarkation is normally achieved through one door of the gondola to simplify counting of passengers. Once all passengers are embarked the doors must be closed and observe the 'closed' light on the control panel.

NOTE: The operator must be familiar with the two-way radios, which are used for communication between the on board and ground controllers.

OPERATIONS MANUAL REFERENCE:	SECTION 3.4.2.2 Radio procedures
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5.3.1 The Gondola



The gondola is the passenger-carrying component of the HiFlyer. A full description is contained in the operations manual.

5.3.2 The Gondola door mechanism

The gondola operator is positioned in the triangle area formed between the two open doors, in front of the control panel.



a.
The doors are held open by partially sliding the locking bolt into a locating hole situated below the control panel



b.
When all the passengers are aboard, the operator can close the doors.



c.)
The locking lever slides across horizontally until the bolt is fully into its locating hole.



d.)
It is then pushed down to lock it into position.



e.)
Both doors are to be fully locked.



f.)
When both independent door locks are in position, the central over-lock can be rotated into position.



g.)
When all three locks are in position
The control panel indicator light should be off.

5.4 Balloon Operation

OPERATIONS MANUAL REFERENCE:	SECTION 3.4.1 to 3.4.4
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This covers:

Passenger briefing

Balloon operations

 Balloon ascent

 Balloon monitoring

 Balloon Descent

Ride stop

Emergency stop

6. Safety

6.1 Rope Safety

There are 32 ropes and 24 ratchet straps used on the HiFlyer, and therefore, there will be times during operation when ropes and straps are hanging and swinging freely.

For this reason, extra care should be taken when working with or around them.

In breezy conditions, the HiFlyer will tend to sway and this will make the ropes swing around. Do not try to stop them, as they are attached to the envelope and this creates large amounts of force more than any person or people can control by hand.

When working with the ropes, leather gloves are advisable, as they will offer protection against rope burn. Never allow your feet to leave the ground when holding on to a rope. If you feel this may happen, let go.

Be aware that there will also be ropes on the ground and this has the potential to wrap around feet. Never wrap the ropes around any part of the body.

When the ropes are being taken from their storage bags, it is important to ensure that they are not left in a tangle, as this can cause injury if they swing around.

When the first ropes are being attached to the winch drum, there is a risk of crushing a hand as there is still movement in the envelope and this adds and removes tension on the mooring rope until the rest of the lines are attached and stabilise the envelope.

Also be aware that when the outer mooring lines are being loosened at the ratchet straps, these straps are under a lot of tension and as the tension is released, there is a tendency for the rope to shoot forward toward the HiFlyer so be aware of feet being caught in the ropes.

Be careful not to catch fingers in the karabiners and ratchets when attaching or detaching the ropes.

6.2 High Pressure Gases

This section refers specifically to the use of helium, not any other gases, although some of the characteristics may be the same.

Helium has no smell, is non-toxic and is much lighter than air. It is inert and will not burn or support combustion. There is a risk of asphyxiation in high concentrations and under no circumstances must it be inhaled.

To be of any practical use, cylinders need to contain a significant quantity of gas compressed to as high a pressure as possible. By simple laws of physics, the higher the pressure, the smaller the volume occupied by the gas, hence the smaller and more manageable the cylinder can be made.

There is a great deal of stored energy inside the thick walls of the gas cylinder. Energy that can be useful to the user, but needs to be controlled to prevent it from causing harm. In particular, gases released from a cylinder, whether by controlled opening of the valve, or due to a leak, can have a very high velocity. It is possible that dust particles, or debris from the working area, may become entrained in the gas flow and cause injury to the eyes, face or other parts of the body.

The volume of the gas stored under pressure within a cylinder will occupy much larger volumes when expanded to atmospheric pressure. It is important to realise the potential this volume of gas might have for displacing breathable air at the work place. The majority of gas companies fill cylinders to 200-300 bar. The gas contained in a 50 litre cylinder, when compressed to 200 bar will fill a space 8.5m^3 in volume if it is released to atmosphere.

Gas under pressure in a small volume expands very rapidly to a lower pressure. It takes heat energy from the surroundings. It can lead to serious problems to the unwary user, since the heat drawn from the metal in valves and regulators can cause them to freeze and frost up. If these metal parts are touched they can cause frostbite or cold burns which are very painful and difficult to treat. It is advisable to wear gloves when dealing with helium cylinders. This sort of situation can occur if a valve is left cracked open or a valve failure develops.

6.2.1 Storage of Cylinders

When the helium top up cylinders are delivered, they will usually be single cylinders as opposed to the way the helium arrives for the inflation. Sometimes however, the helium will be delivered as a titan (ie. 16 cylinders together).

These will be left on site until they are used and are ready for return. Whilst the cylinders are on site, they should be stored on a flat, level, solid and well-drained surface. The storage area should be secure to prevent unauthorised access. It should be segregated from car parks and areas where people congregate.

Wherever possible the storage should be outside in the open air where leaks will dissipate quickly. If it is necessary to store the cylinders indoors, then there should be adequate low and high level ventilation. Measures should be taken to ensure that the cylinders do not fall over or are not knocked over. If the cylinders have to be stored against a building, then avoid proximity to doors and gangways and also windows and other openings above the cylinders. Good housekeeping is important. Separate full cylinders from empty, and avoid the accumulation of rubbish etc., especially combustible materials.

6.2.2 Handling Cylinders

Wherever possible, cylinders should be moved using a purpose designed cylinder trolley, particularly on uneven ground and by inexperienced operators. If a trolley is not available, then cylinders can be churned short distances, one at a time, with one hand steadying the cylinder at the valve guard, and the other hand rotating the body of the cylinder. Always check that the valve guard is securely attached before moving a cylinder. When handling cylinders, suitable gloves and protective footwear

should always be worn. When cylinders are being connected or disconnected, eye protection should be worn.

If during the course of handling or moving cylinders, one or more of them should start to fall over, stand well back and allow them to fall. Do not attempt to catch them, or serious back injury may result.

Cylinders in the horizontal position should be righted carefully. Crouch at the valve end of the cylinder, check that the valve is closed and that the valve guard is securely attached, then keeping a straight back lift that end of the cylinder whilst walking forward. Ensure that the cylinder is secure before walking away.

Cylinders should never be dropped or hit sharply, and all due care taken to avoid knocking them over.

Cylinders should never be subjected to direct heating or allowed to come into contact with electrical supplies.

6.2.3 Leaking Cylinder

If a cylinder is found to be leaking and the cylinder is stored inside then it must be removed from the building and allowed to vent off to atmosphere. However, because the helium is an asphyxiate, under no circumstances must any person enter the room that the cylinder is in unless wearing a self contained breathing apparatus.

If it is possible to open the doors to allow the gas to escape outside then this is best done. It is important to ensure the safety of all other persons likely to be affected by the leaking gas and is therefore best to evacuate the people concerned until all of the helium has dissipated. If the cylinder cannot be removed to outside and nobody is able to enter the room, then contact the fire brigade who have the correct equipment. Do not allow anybody to re-enter the evacuated area until it is safe to do so.

6.3 Fire

If there is a fire the gas in the cylinder will not burn. However there is a risk of the cylinder exploding. As the cylinder gets hotter, the gas inside expands, and will eventually reach a point where the walls of the cylinder cannot hold the pressure any longer, causing an explosion. If at all possible, remove the cylinders from the fire to a safe position well away from the heat, as it is the heat that causes the expansion. If it is not possible to remove the cylinders then the cylinders must be kept cool by using a hose to pour water on the cylinders until the fire brigade arrive where they will take over. Remove all unnecessary staff to a safe distance and keep the public away.

6.4 Site Safety

The site should be kept clean and tidy. Members of the public should not be allowed to wander around freely.

All ropes and ratchet straps should be tidied away when not in use.

Systems and procedures should be in place for maintenance and repairs.

- Electrical equipment must be isolated and locked off with the key held by the person working on the equipment.
- All personnel must be informed of any work being carried out

7. Emergency Procedures

In the event of an emergency, crew should not panic and follow instructions from the shift supervisor. Passengers should be kept calm and re-assured.

The shift supervisor should carry out regular practice drills to make sure that crew are familiar with emergency procedures.

The winch emergency recovery procedure, as shown in this manual, should be copied, laminated and displayed on the front of the winch control cabinet.

Winch Emergency Recovery Procedures – sheet 1

P.L.C. DISABLED - SCREEN DOWN

1. 'E' STOP IN
2. OPERATION MODE TO "EMERGENCY"
3. MAINS - LEAVE ON MAINS
4. 'E' STOP OUT
5. RESET
6. EMERGENCY RECOVERY KEY TO "EMERGENCY" HOLD KEY ON UNTIL ALUM DISC DESCENDS TO NORMAL CUT OUT LEVEL *
7. 'E' STOP IN
8. RESET "EAR" TRIGGERS TO ZERO SYSTEM

MAIN MOTOR DISABLED

1. 'E' STOP IN
2. ENGAGE AUX MOTOR COUPLING
3. OPERATION MODE TO EMERGENCY
4. 'E' STOP OUT
5. RESET
6. COUPLING ENGAGED LIGHT ON
7. AUX MOTOR LIGHT ON (CLEAR TO RUN)
8. AUX MOTOR START
9. STOP WHEN DISC DESCENDS TO NORMAL CUT OUT LEVEL *
10. 'E' STOP IN
11. DISENGAGE COUPLING
12. RESET "EAR" TRIGGERS TO ZERO RIDE HEIGHT

MAINS POWER LOST (GENERATOR RECOVERY)

1. 'E' STOP IN
2. SWITCH OFF MAINS ISOLATOR
3. COUPLING ENGAGED
4. START GENERATOR
 - POWER OFF
 - PRIME
 - START
 - POWER ON
5. OPS MODE TO EMERGENCY
6. MAINS TO GENERATOR
7. 'E' STOP OUT
8. RESET
9. COUPLING LIGHT ON
10. AUX MOTOR CLEAR TO RUN ON
11. AUX MOTOR START
12. AUX MOTOR STOP WHEN DISC REACHES NORMAL CUT OUT LEVEL
13. 'E' STOP
14. GENERATOR - POWER OFF, STOP
15. DISENGAGE – COUPLING
16. SWITCH ON MAINS ISOLATOR
17. RESET "EAR" TRIGGERS TO ZERO SYSTEM

- - If disc is inadvertently winched down onto 'ear' triggers – release procedure is given on sheet 2.

Winch Emergency Recovery Procedures – sheet 2

Cable disc winched down onto 'ear' trigger switches

INDICATIONS

1. CABLE DISC CONTACTING TRIGGER SWITCHES.
2. WINCH 'NOT ENABLED' ON DISPLAY
3. WINCH WILL NOT 'RESET'

RELEASE PROCEDURE

1. MARK POSITION OF DISC ON CABLE WITH TAPE OR 'WHITE OUT'
2. UNSCREW DISC CLAMPING SCREWS
3. SLIDE DISC UP CABLE TO CLEAR TRIGGER SWITCHES
4. RESET WINCH
5. WINCH CABLE UP APPROX ONE METER (3 FEET)
6. 'E' STOP
7. SLIDE DISC DOWN CABLE TO MARKED POSITION
8. RECLAMP DISC
9. RESET WINCH
10. MAKE UNMANNED TEST RIDE

NOTE! DO NOT ATTEMPT TO LIFT DISC OFF TRIGGER SWITCHES BY RELEASING WINCH BRAKES.

Winch Emergency Recovery Procedures – sheet 3

MANUAL RECOVERY

Circumstances:

1. Mains and Generator Power failure
2. Winch auxiliary and main motor failure

Note! This is a very unlikely combination of events. Get a 'second opinion' and help to get the system working **before** attempting a manual recovery.

OPERATORS

A MINIMUM CREW OF THREE WILL BE REQUIRED:

- ONE TO OPERATE HYDRAULIC BRAKE
- ONE TO OPERATE MOTOR BRAKE
- ONE TO CRANK WINCH HANDLE

The crew should take turns at operations without releasing handle or crank during changeover.

RECOVERY PROCEDURE

1. WINCH MAINS 'OFF'
2. ENGAGE AUX. MOTOR COUPLING
3. FIT HAND CRANK LEVER AND **HOLD SECURELY**
4. TURN HYDRAULIC SELECTOR TO 'HAND' PUMP
5. RELEASE DISC BRAKE WITH HAND PUMP UNTIL IT JUST CLEARS DISC
6. EASE MOTOR BRAKE 'OFF' WITH HANDLE
7. TAKE STRAIN ON HAND CRANK LEVER

Note! If cable starts to pay out (balloon ascends)

- Release brake handle immediately, to apply motor brake
- Open hydraulic vent immediately to apply disc brake

8. HAND CRANK DOWN BALLOON UNTIL GONDOLA IS LANDED
9. OPEN HYDRAULIC VENT – APPLY DISC BRAKE
10. RELEASE MOTOR BRAKE HANDLE – BRAKE ON
11. ENSURE LOAD IS OFF CRANK HANDLE, THEN RELEASE
12. DISEMBARK PASSENGERS
13. MOOR BALLOON

Helium Venting Procedures – Sheet 1

Helium Overfill Indications:

- low ballonnet
- high freelif
- high helium temperature
- high helium pressure

Before venting

Measure ballonnet height and record (with balloon in low moored position)

Unmoor balloon in calm conditions

Connect battery charger to maintain power

Record unladen freelif, temperatures and pressures

Turn panel key to 'UNLOCK'

Ballonnet fan switch to 'AUTO'

Manual Helium Valve Operation

OBSERVER TO COUNTDOWN 'OPEN' TIME AND MONITOR FREELIFT

OPERATOR TO CONTROL HELIUM VALVE SWITCHES

PRESS TO TEST HELIUM VALVE INDICATOR LIGHTS

L.H. HELIUM SWITCH UP TO 'MANUAL'

R.H. HELIUM SWITCH UP TO 'OPEN'

RED INDICATOR LIGHT 'ON'

COUNTDOWN – 6 SECONDS

R.H. HELIUM SWITCH DOWN TO 'CLOSE'

RED INDICATOR 'OFF' AFTER 4 SECONDS TRAVEL TIME*

L.H. HELIUM SWITCH TO 'AUTO'

Helium Venting Procedures – Sheet 2

RECORD OPEN TIME (INDICATOR 'ON' TO 'OFF') IN SECONDS

RECORD NEW (REDUCED) FREELIFT

WAIT FOR FAN TO FILL BALLONET

REPEAT VENTING PROCEDURE UNTIL TARGET FREELIFT ACHIEVED

LOW MOOR BALLOON

MEASURE (INCREASED) BALLONET HEIGHT AND RECORD

*** EMERGENCY VALVE CLOSURE**

IF VALVE DOES NOT CLOSE:

RED INDICATOR REMAINS 'ON'

ARM EMERGENCY BOX ON TOP OF CONTROL BOX

SWITCH ARMING SWITCH UP TO 'ON'

PUSH RED CLOSE BUTTON

This bypasses the control box systems.

CONFIRM RED VALVE OPEN INDICATOR 'OFF'

Envelope Minor Repair Procedure

Patch Application

Patch – cut from envelope fabric of PU coated PVC

Cut patch with 2 inch (50 mm) margin around fault and radius corners

Adhesive – Bostik 3206

Hardener – Bostikure D. 200

Mixture – 4% hardener

Application

Clean area with alcohol wipes.

Brush on 1 coat to both surfaces

Wait until tack dry

Brush on second coat to both SURFACES

Wait until tack dry

Apply patch with hand pressure working out from centre

Allow at least 10 minutes for curing

Sealing cover – cut from self adhesives vinyl sheet

Allow 3/8” (10mm) overlap around patch

Peel off backing and apply over patch