
User Manual (Outdoor remote control Airship)

飞艇介绍：无人驾驶飞艇结构由气囊、吊舱、推进装置、尾翼、控制系统，地面设备组成。

Introduction – unmanned, remote-control airship system consists of the “sausage balloon”, the gondola, propulsion system, fin system (for pitch and turn control) and the ground remote control console.

气囊为旋成流线体，如果是大型飞艇头部设有头锥用于地面系留；吊舱位于气囊中部下方，起落架、推进装置和任务载荷都安装在吊舱上，如果有机载导航仪也安装在吊舱内；尾翼安装在气囊后部，用来控制和保持姿态。

The sausage balloon has an aero-dynamic contour. Large size balloons have a cone structure in its nose for anchoring on the ground. The gondola hangs in the mid-section at the belly of the balloon, inside which houses the propulsion system, landing gear, and the receiver for the fin control. It also provides space to house the optional autopilot system as well as the payload. 4 fins are attached to the tail of the balloon for directional and pitch up and pitch down control.

一、气囊

1. Blimp (Sausage Balloon)

飞艇的艇囊也称气囊，使飞艇能做浮空飞行的浮力源，也是最能反映飞艇特点的主体结构之一。

气囊的形状对于飞艇的整体性能有很大影响，理想的形状是常规的椭圆形或橄榄型。飞艇对气囊的主要要求是：流线型外形，以减小空气阻力和提高飞艇的操纵性能；能承受飞行中的空气净力、动力和推进装置产生的载荷。

The balloon is the main structure of the blimp, it stores helium to provide the lift to bring the blimp up into the air. Its ideal shape is elliptical, or olive like. The requirement for such shape is to be aero-dynamic with a minimum drag; to be mechanically strong to provide stable maneuverability in the air; to have sufficient lift to float the total load, including the gondola and payload.

气囊材料是决定飞艇性能的另一个重要因素。目前气囊材料在单位面积重量、强度、氦气渗透率和耐候性方面具有良好的表现，这种材料在高强度聚酯织物上贴合光稳定聚亚胺酯及 Tedlar 抗紫外线涂层，氦气渗透指标小于 1 升/平米·24 小时。

This blimp is made from material consisting of a core woven rip-stop nylon fabric with laminated coating of urethane. The woven core fabric provides superior strength and the material is excellent for helium retention. The helium leak rate is less than 1 litres per square meter surface area per 24 hours. Tedlar® coating is used as surface protection because of the weather resistance, UV-resistance and easy-to-clean properties.

有些型号飞艇主气囊内有一个副气囊，可装配电控排气阀门和增压系统，根据飞行高度及环境温度变化对气囊内部压力进行调节，同时起到不同载荷状态下为飞艇配平作用。

There is an optional secondary air chamber built into the blimp. It is controlled with a pressure regulator system by pumping air into, or releasing air from this chamber to regulate the overall pressure of the blimp to a preset value.

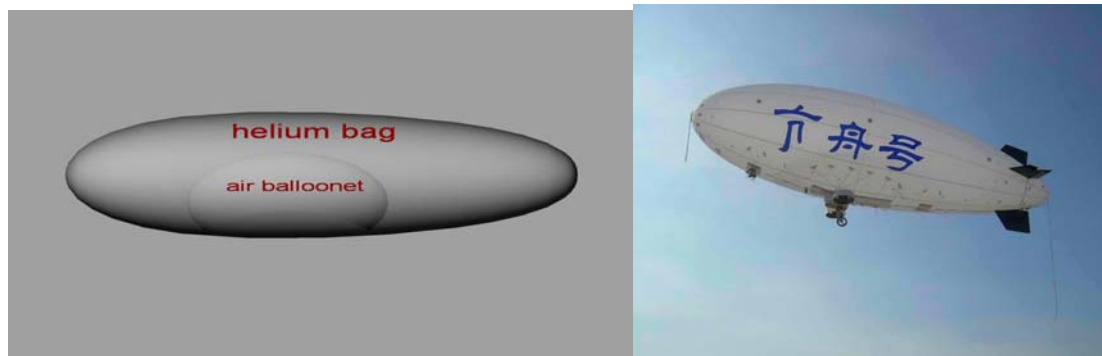
气囊前部设有头锥或者撑条，用于抵抗高速飞行时气囊头部正压，维持流线外形，另外方便地面系留。

For large blimps, a metal cone is fixed to its nose, thus enabling the proper streamline of the blimp shape

during flight. It also serves as the anchoring point while tying down the blimp on the ground.

气囊内部可装有夜间照明系统，以适应夜航要求。

An optional night lighting system can be added to the blimp.



二、吊舱，动力及控制装置

2. Gondola / Engine / RC system

飞艇吊舱也称吊篮，是飞艇载荷的主要承力结构。

The Gondola is the main structure to house the engine and the RC receiver system for the maneuvering of the blimp in the air.

飞艇吊舱是由空气动力外形的硬式容器结构，在原理上与低速飞机机身相似，一般为船形。使用内张线或外张线悬挂在艇囊上。

The gondola is streamlined in shape, just like the airframe of the aircraft, to reduce drag. It is attached to the belly of the blimp via anchoring points.

吊舱外壳采用模具成型玻璃钢材料制造，内部为框架结构。

The body of the gondola is molded fabric glass with reinforcing steel frame.

吊舱内的倾转系统、防静电油箱和矢量舵机可控制发动机推力方向，给左右发动机供油和调节艇囊压力。水平和垂直尾翼分别用来控制飞艇的升降和方向。

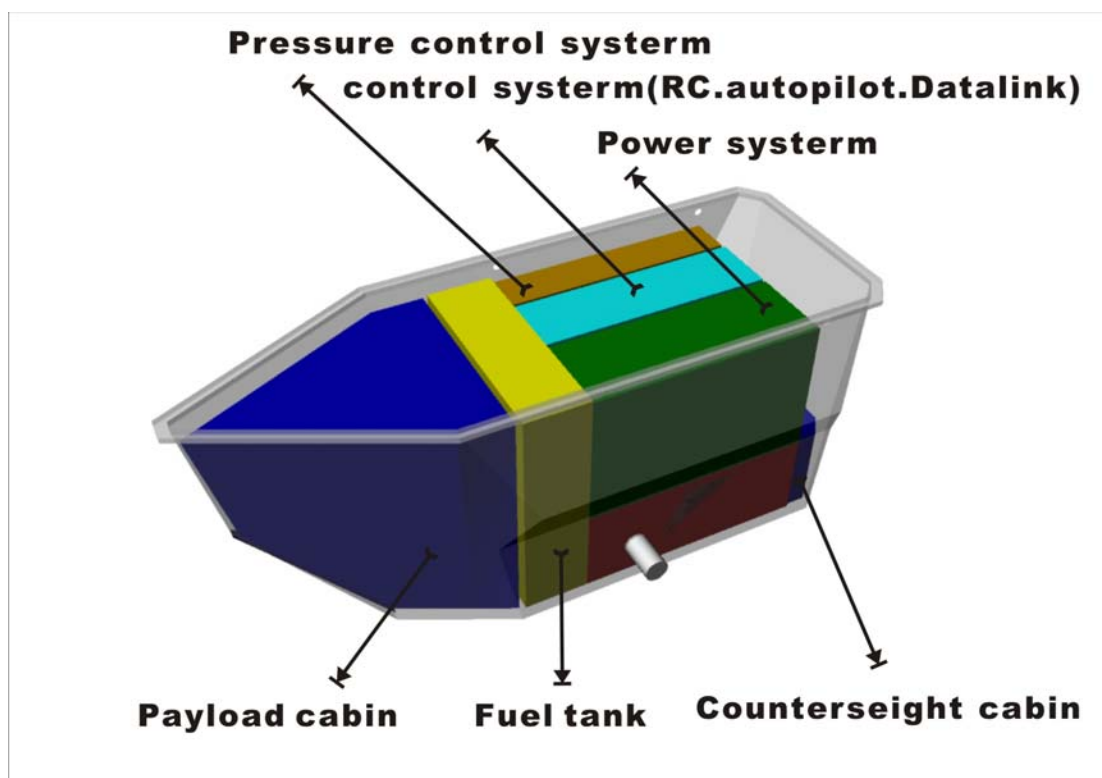
Inside the gondola, it houses the anti-static fuel tank, the engine-tilt control mechanism, the engine power control servo and engine cutoff control. It has a special compartment to install the optional Blimp pressure regulator system. The RC receiver for the fin control is also installed inside the gondola.

控制系统安装在飞艇上，可包括导航飞行导航控制系统、飞行参数采集及压力控制系统、遥控接收机、数传电台、电源系统等。控制系统也可实现GPS导航自主飞行、艇囊压力控制、飞行参数的采集和下传、人工遥控指令及应急控制指令的接收和执行、空中实时监控图像的摄制和下传、任务机的控制等功能。

Electronic flight control system provides pre-planned route control, flight data collection and blimp parameter collection for downloading to the ground control console for both historical analysis and real-time performance monitoring. The flight control system uses GPS and the pre-planned flight routes to maneuver the blimp to fly a preset path, defined by the route. The flight control system will receive command from the ground console to take over the flight control in autopilot mode. In case of emergency, the ground control console can override the autopilot to regain manual control to maneuver the blimp.



下图为吊舱内部空间布局：The gondola, see below for its internal layout.



吊舱前部是配重舱，向后依次为电源舱、燃油舱、动力倾转控制舱和尾舱。

At the front of the gondola is the ballast compartment, followed by the battery compartment, fuel tank compartment, engine compartment with engine tilt control and the tail compartment.

两台活塞式航空发动机安装在发动机舱外的涵道内，直接驱动螺旋桨产生拉力。螺旋桨及涵道可以绕传动轴做 360 度旋转，用于在起飞、着陆和悬停时提供矢量推力。

Two 2-stroke piston model aircraft engines are mounted on the engine-tilt axis extended out of the gondola body. The propellers are enclosed in two fabric glass cowlings. The engines can be rotated 360 degrees to be positioned to provide vectored thrust in take-off, cruising and landing controls.

单柱式起落架安装在吊舱中后部下方，如果是大型遥控飞艇安装单柱式起落架，起落架上安装有自由轮可以实现 360 度自由转向。

The landing gear is a mechanism located directly below the gondola, for large blimps the mechanism includes a single wheel for free moving while on the ground.

三、尾翼

1.the Fin system

飞艇尾部一般安装一组固定式尾翼，由三片或四片尾翼组成，呈十字、X 型或 Y 型布局。

The fin system provides stabilization of the blimp by using 3 or 4 fin systems. It can be installed either in a "Cross", "X" or "Y" configuration.

尾翼有安定面和可操纵的舵面组成，从原理上说，飞艇尾翼类似于飞机的尾翼，从结构上看可采用复合材料或构架蒙皮式。

Each fin consists of a fixed part to provide flight stabilization and a smaller movable tab for either directional control or up and down control. It can be constructed using balsa wood frame mounted with surface material. It can also be constructed of composite material.

飞艇飞行时通过操纵舵面实施对飞艇姿态的控制，尾翼舵面采用机械或电传操作，最大舵偏角 $\pm 45^\circ$ 。In a "cross" fin installation, the control of the vertical fin sets creates directional control of the blimp; and the control of the horizontal fin sets creates up or down control of the blimp. The max angle movement of the tab is + or - 45 degrees. The tab control is servo driven with command signal from the ground control console.

尾翼面可用张线固定在与艇囊连接。

The fins are attached to the blimp body via velcro tape and tie-down ropes.



四、地面设备包括系塔、吊舱车、充气系统等，主要用于飞艇日常的使用维护。

4. The ground support system: includes the anchoring post, gondola trolley, helium filling tool and some common hand tools for routine maintenance.

室外双引擎（带引擎转动控制）汽油机飞艇安装及飞行步骤

PART I

Twin Gasoline Engine with Engine-tilt control RC Blimp Set Up Procedure (outdoor airship)

1 艇囊充气

1. Filling with helium

如果夜间飞行请先在气球内部安装灯具，并将灯具的电源线引出至吊仓内。如果飞艇气囊有空气附属气囊，请先将空气副囊通过鼓风机充空气，充气后的副囊体积小于设计容积。然后在主气囊内充氦气，注意气囊是否有多个充气口（个别大型飞艇具有多个充气口），将多余的充气口用绳索系紧避免漏气。将气球充分充满，没有明显的褶皱，将细绳将充气口系紧避免漏气，并用绳索将艇囊固定避免漂浮起来。注意飞行期间室外温度的变化情况，如果飞行期间温差比较大，注意气体体积会随温度的变化略有变化，在气温高的时候不适合充气过饱。

If need to install the internal light, inside the envelope, have a small air balloonet, first to fill a few air into the air balloonet, then put the light into the balloonet and connect the battery.

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If the blimp comes with the secondary air chamber, fill it up with air partially. Then start the helium filling. For larger blimps there are filling tubes in the front, center and at the end of the blimp. Simultaneous filling can shorten the filling time.

Fill the blimp body with helium until it looks full without any crease or wrinkle. After filling, tie the filling tube tightly using rope. Tie the body down at both ends to ensure the body does not fly away freely.

Monitor the outside temperature during the day of the blimp operation. If the temperature varies greatly during the day, be sure the blimp pressure is not too high when the temperature is at its highest. Use the air chamber, if equipped, to regulate the blimp pressure.

如果进行广告飞行，将广告横幅先挂载在气囊球体上

For aerial advertising, tie the banners to the blimp body after filling.

2 安装尾翼

2. Install the fin system

注意尾翼的方向需要垂直于艇囊表面，按照尾翼标签固定好上，下，左，右四个尾翼。并将尾翼的控制线按照先上，后两侧，再下的顺序接好。

The fins are marked with their installation position – UP, Down, Left and Right. All fins must be tied down correctly so they are at right-angles to each other on the blimp body. Always start installing the top (Up)

fin first, rotate the blimp body so the top fin can be installed while you are standing on the ground. Then, followed by installing the two side fins and finally the bottom (Down) fin.

3 检查遥控器，油门舵机及尾翼是否工作正确和稳定

3. Check for proper control and function

将 12V 电池安放在吊仓内并连接电源（如果是 17 米及以上型号的飞艇需多组电池），检查各控制通道是否插入遥控器接收盒的对应通道，注意接收盒天线是否已经放置在吊仓外固定，将尾翼控制总线接入吊仓外壁上的插座。接通电源，将遥控设备电源打开，检查尾翼控制方向，速度控制舵机，熄火开关以及引擎转动控制和刹车装置是否都工作正常

Install the 12V battery in the gondola and connect it. For blimps larger than 17 meters, multiple 12V batteries are needed. Check and confirm that the RC receiver connections are correct. Ensure the receiver antenna is attached to the blimp body external of the gondola. Connect the fin system cable to the gondola receptacle.

Switch on the power, turn on the Ground RC unit and check for proper control of the fins, engine throttle control, engine cut-off control and the correct operation of the engine tilt control and its braking system.

4 安装吊仓及航拍云台或者其他任务机构

4. Attach the gondola to the blimp belly / Install the the Camera mount / Other mission mount

如果进行航拍操作，先将航拍云台挂载在气囊腹部，吊仓前方，并挂载好照相机（摄像机）、电池、无线电发射和接受装置。如果是其他任务机构（例如传单发送装置，或者降落装置），请将任务机构挂载在气囊腹部，吊仓后方（避免任务机构洒落的装置影响螺旋桨的安全）

If your mission is for aerial photography, install the Camera mount in its designated location, in front of the gondola. For other mission, install the specific mount either in front or at the back of the blimp body at the designated mounting points. If brochures are to be discharged from the blimp while it is in the air, be sure to mount this discharge fixture only at the back of the gondola, thus preventing the discharged material from hitting the propellers, or being sucked into the engine intake manifold.

在飞艇的重力中心点安装吊仓，如果安装吊仓后飞艇的浮力仍然大于重力，需要在气囊两侧配重待或者吊仓内放置适当的配重，使整个飞艇重力略大于浮力，在无动力状态下飞艇能够缓慢自然下降。如果重力过大可减少飞艇上不必要的重量（如果有空气副囊，可放出部分空气增加氦气量）

Mount the gondola handles to the velco taped flaps of the blimp to attach it securely. Tie ropes from the blimp body attach points (for gondola only) to the handles to further hold the gondola to the blimp belly.

After attaching the gondola, check for the blimp balance. Fit ballasts to the front and rear ballast bags as well as in the gondola to balance the blimp in a level position. The net weight of the blimp should be that you can lift the whole blimp up easily and upon releasing the lifting force, the blimp should settle down on the ground easily and smoothly.

Instead of using ballast, try increase air in the air chamber, and reduce the fill of helium. This is a good way to increase the net weight of the blimp. To increase the total lift, remove air from the air chamber and

add more helium to the blimp.

为避免引擎熄火，将油门推杆的微调调整在最小速度以上，油门主推杆放置最下端，熄火开关调整到不熄火状态，并需要检查设置是否正确。1 引擎矢量转向 2 通道控制升降，4 通道控制方向，3 通道控制速度，7 控制矢量刹车，8 通道控制熄火，

To prevent the engine from flame-out, preset the throttle fine-control to just above the minimum speed, position the main throttle control at idle position. Set the engine-off control to "on" position. Channel 1 is the engine tilt control ,Channel 2 is for the Up/Down control; Channel 4 is for directional control; Channel 3 is for engine power control; Channel 7 the engine lock switch, Channel 8 is the Engine off (shut down) control.

如果飞艇是带有 GPS 自动驾驶仪的，其通道设置如下：

If the airship have the GPS autopilot, below is the channel setting:

1 矢量转向 2 通道控制升降，4 通道控制方向，3 通道控制速度，5 通道控制自主与手持遥控切换，7 控制矢量刹车，8 通道控制熄火，

Channel 1 is the engine tilt control ,Channel 2 is for the Up/Down control; Channel 4 is for directional control; Channel 3 is for engine power control; channel 5 is manual control or autopilot control changer. Channel 7 the engine lock switch, Channel 8 is the Engine off (shut down) control.



解开所有束缚飞艇的绳索，注意观察安装完毕后在无风状态下飞艇是否前后平衡如果不平衡可通过气囊两端的配重袋调节飞艇平衡。

After balancing, untie all blimp tie-down ropes. The blimp should be level and sitting freely on the ground, during no wind condition. Adjust the ballast in the front and at the end to maintain a level blimp position.

加装燃料（燃料加装的数量取决与将要飞行的时间，建议加装燃料的数量因多于理论飞行能够消耗燃料的50%），引擎需要的燃料是混合燃料（普通汽油与二冲程机油的混合燃料），汽油和机油的比例是 50：1（夏天）， 30：1（冬天）；如果是 100cc 以上排量的引擎，汽油和机油的比例是 80：1（夏天）， 50：1（冬天）

Add fuel (The amount of fuel to be added is determined by the mission and the duration of the flight. We recommend another 50% margin of fuel to be added for safety reason). The engine is 2-stroke engine,

therefore a mix of gasoline and 2-stroke engine oil is required. The mixing ratio is: 50:1 (Summer) and 30:1 (Winter). For engines of above 100 cc capacity, the mixing ratio is: 80:1 (Summer) and 50:1 (Winter).

5 起飞

5. Pre-flight and Takeoff

起飞前操作人员打开遥控器和电源开关，将油门推杆放置在最高端，将发动机风门关闭，手动拨动螺旋桨，连续拨动螺旋桨 4—5 次，使发动机进油，然后打开风门，将油门推杆放置在最低端，启动发动机，通过遥控旋钮开关遥控引擎方向至起飞状态（螺旋桨与地面处于水平位置），飞艇放飞人员在遥控人员的命令下放飞艇。飞艇放飞时将速度提高，使螺旋桨的推力有足够的能使飞艇提升，爬升至安全高度后压起上升舵面并将 6 通道遥控旋钮开关遥控引擎至飞行状态（螺旋桨与地面处于垂直位置）。飞艇起飞的方向为逆风起飞。

Turn on all powers to the blimp systems and the Ground RC unit. Put the main throttle control to max power position, and close the choke, manually spin the propeller 4 to 5 times to prime the engine with fuel. Then open the choke, set the throttle to low and start the engine. Use the engine-tilt control to position the engines in take-off position, i.e., the propellers are pushing air to the ground. The person in-charge of the Ground RC unit must signal the other members of the working team to let go of the ropes that hold down the blimp. Increase the throttle smoothly until the blimp begins to lift off the ground. Once the blimp lifts up to a safe altitude (sufficient clearance from any ground obstacles), use the engine tilt control to tilt the engines to a forward thrust position (cruising position) and at the same time select a pitch up position of the horizontal fins to take the blimp forward and up. Always fly the blimp towards the wind (head-wind position) during take off.

6 飞行

6. Flying

飞艇起飞后，先保持在安全高度，再通过调整速度控制手柄来调整飞艇的飞行速度并保持该油门。建议速度控制推杆拉到最小，速度只需要通过速度推杆微调来调节就可以了，如果室外风力实在非常大，再通过速度推杆来调整速度。建议飞行速度只需要在逆风的状态下缓慢前进就可以了（这样在顺风的时候速度也不会太快），速度调节到自己满意后，只需要通过 2, 4 遥控通道来控制飞艇的自由升降和方向就可以了。注意：飞艇起飞后切记将引擎矢量开关关闭，使矢量机构处于锁定状态，尤其在使用 GPS 自动驾驶仪的时候。

Once the blimp gets into cruising altitude, use the the throttle trim turn knob to maintain a constant speed while moving the main throttle control to idle position. Use the throttle trim knob for fine speed adjustment. The engine speed should be such that the blimp moves slowly forward in head-wind, and not too fast when flying with a tail-wind. Once experienced the correct engine speed for that particular wind condition, then use only the fin controls, i.e., pitch up or down and left or right turn to control the blimp. after take-off make must be close the engine vector, the vector mechanism is in the locking state (channel 7). Especially when using the GPS autopilot.

如果需要空中悬停或者紧急上升和下降，可通过 1 遥控通道控制引擎转动来调整螺旋桨的推力方向就可以实现飞艇的垂直起降和空中悬停。

To maintain the blimp in a hovering position, use the engine tilt control (open the engine lock, then by the channel 1 to control the engine) .

7 降落

7. Landing

下降方向为逆风降落，控制飞艇走直线缓慢飞行至接收人员上方，注意控制飞艇的方向，保持逆风直线飞行并降低高度，当降落至安全高度，通过 1 通道遥控旋钮开关控制引擎转动至降落状态（螺旋桨与地面水平），或者使螺旋桨处于一定的矢量分量位置，抵抗风对飞艇方向的影响和重力的影响缓慢降落，或者直接熄火，同时控制飞艇的姿态和方向以方便接收人员接收飞艇。

Always land in a head-wind position. Circle the blimp to fly down slowly over a close range of the Ground RC controller, once the blimp comes to a safe altitude, use the engine tilt control to position the engine to landing position, adjust the engine tilt to counteract the effect of the wind and bring the blimp down vertically smoothly and slowly. Cut off the engine if necessary to allow the blimp to free fall by its net weight (the total equipment weight is larger than the total lift of the helium volume in the blimp).

8 降落后检查电池电量以及燃料变化，为下一航次的飞行做参考，建议重新更换电池以及添加燃料。

8. After landing check – Check battery capacity and fuel level, replace the battery with fully charged ones and fill up the tank as necessary. Check if helium needs to be replenished. Check the gondola and other mounting fixtures are still firmly attached to the blimp body.

如果采用了智能化 GPS 自动飞行导航系统，地面遥控增程及自动驾驶飞行系统互为备份，控制精度高、距离远，系统可靠性高。

The blimp can be installed with an optional GPS Smart Pilot system that will provide a precision predefined flight path tracking with blimp parameter monitoring functions.

飞行技巧及注意事项：

Control skill and observations:

1 飞艇在起飞前，在地面就进行飞行模拟操作，并要求启动发动机，以次可以再次确认所有的控制部件是否工作正常（方向舵，升降舵，熄火，发动机转速控制，引擎驱动控制），可检查并排除飞行中可能出现的电气及机械故障

1. Pre-take-off check – Perform a visual check that all components (fins, gondola, cables and connections) are properly attached to the blimp body. Start the engines, check for free and correct operations of all flight control surfaces. Check for correct throttle control and the engine-shutdown function. Check for correct engine-tilt control.

2 起飞和降落都需要逆风，起飞时可加强空气对尾翼的上升升力并避免飞艇在失速状态下保持姿态的稳定；在降落的时候可以减缓飞艇飞行速度，减缓飞艇对地面的冲击力，方便降落操作。

2. Always takeoff and land with head wind. During takeoff, the head wind will assist the effectiveness of the pitch up control and ensures the blimp is stable without stall. During landing, the head wind helps to slow down the blimp speed to enable a smooth landing.

3 飞行过程中尽量逆风飞行，飞行速度不适合太快，控制在逆风的时候缓慢前进，这样在顺风的时候飞艇速度也可以最大限度的减缓，无需额外的控制发动机转速去干预飞行速度。

3. Always try to fly the blimp into the wind and control the engine to maintain a smooth flight. Then, when

the blimp turns into a tail wind situation, the blimp speed will not become too fast. The key is to maintain a fixed engine power (RPM) during the whole flight operation.

4 飞行过程中，尽量避免眼睛，飞艇和太阳成一直线，这样无法辨别飞艇的方向和姿态。

4. The ground RC controller must always position himself to avoid direct sunlight into his eyes, so he can see the direction of the blimp's flight and its attitude.

5 起飞前汽油发动机的加油量要大于实际飞行时间所消耗的理论耗油量 50%，避免因消耗完毕燃料后造成发动机熄火，吊仓内电池最好是在 2 小时就进行更换保证电量的充足。如果是电动飞艇，要及时降落更换电池，尤其是在室外，避免电池耗尽后飞艇在风力下造成损坏。

5. Always fill the fuel tank up with 50% more fuel than that required for the mission. This ensures there is always fuel supplying the engine, thus avoiding the chance for air to get into the fuel line and starve the engine (engine frame out). Always replace batteries with freshly charged ones for every two hours of flight operation.

6 飞行过程中要时刻注意遥控器电量的变化情况，避免因电池耗尽造成飞艇失控。

6. Always monitor the battery level of the RC unit to avoid failure to control the blimp.

7 室外汽油马达的飞艇切忌不要在风力大于 5 级以及雨天（风速 9 米/秒）的天气条件下飞行，电动飞艇切忌不要在风力大于 3 级以及雨天（风速 5 米/秒）的天气条件下飞行。

7. Do not fly the gas-engine powered blimp in situations where the wind speed exceeds 9 meters per second. Do not fly electric-engine powered blimp in situations where the wind speed exceeds 5 meters per second. Do not fly the blimp in rain.

8 安装飞艇过程中注意电源的正负极性，避免插头插反造成电气损坏。

8. When installing the batteries, ensure the correct polarity of the connections to avoid damaging the system.

9 时常检查各个零件安装的牢固程度，时常检查并紧固各连接部分的牢固程度，长时间使用后，应大方的更换必要的零件。

9. Always check the parts inside the gondola for proper installation after the flight. Check all bolts and nuts for proper tightness.

10 人员配备及起降场地要求：正常情况下为 4--7 人(操作员 1-2 名，地勤人员 3-5 名)，不小于 50m×50m, 周围无高层建筑和高大树木。

10. Under normal conditions, a crew of 4 to 7 persons, depending on the size of the blimp, are required to prepare the blimp for flight. Take off the blimp in a clear area without obstructions of about 50 Meters by 50 Meters area.

11 飞行器无小事，小到一根针线都有可能造成意想不到的重大损失，所以切忌谨慎小心对待飞艇。

11. There is no such thing as "unimportant", the slightest mistake or an overlook can cost you dearly. Carry out the proper preflight check every time before takeoff.



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