MICRO AIR VEHICLE OPERATIONS MANUAL

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Contents
Safety Overview........................................................................................................................................... 2
CAD Drawings.............................................................................................................................................. 3
Parts ......................................................................................................................................................... 5
Operation .................................................................................................................................................. 8
Engineering CAD Drawings....................................................................................................................... 10

Safety Overview
This is the operations and safety manual for the up scaled U13A micro air vehicle. This vehicle is capable of spinning rigid blades at speeds exceeding 5,000 RPM. Utmost care must be exercised to keep all body parts away from the blades when vehicle is in operation. It is the responsibility of the operator to ensure that the kill switch is turned on, the transmitter is off and all battery plugs are disconnected prior to working on or handling the vehicle. This vehicle is designed to operate outdoors with minimal wind. Do not use in wet environments. Do not use inside. Do not operate near occupied areas or around power lines.

Prior to operation the vehicle should be inspected for any loose nuts or screws, especially those holding the rotor assemblies together. All electronics should be inspected for loose, frayed or kinked wires that could cause a malfunction during the operation of the vehicle. Always ensure that the batteries are fully charged and the transmitter has fresh batteries.

Figure 1: Complete Prototype
CAD Drawings
In Figure 2 below the full prototype can be seen in an unexploded view. Figure 3 shows an exploded view of the prototype.

Figure 2: Unexploded Prototype CAD Drawing

Figure 3: Exploded View CAD Drawing

Figure 4 below shows the main body core with motors and gears. Also shown in Figures 5 & 6 are the main rotor assembly and the rear rotor assembly.
Figure 4: Main Body Core with Motors

Figure 5: Blade Assembly

Figure 6: Rear Rotor Assembly
Figure 7: Landing Gear

Shown above in Figure 7 is the landing gear.

**Parts**

Below is a list of parts included with the prototype:

- Hobbymate Brushless Motor: 5000 RPM / V
- T-Motor Brushless Motor: 1000 RPM / V
Hyperion CX G² Lithium-Polymer Battery:  
- Voltage: 7.4 V  
- 2 Cells  
- Capacity: 1600 mAh  
- Charging: 30 min – 2 hours (depends on charge rate)

FlyFun Electronic Speed Controller:  
- Maximum current: 30A  
- Maximum of 4S Battery

Exceed RC 6 Channel Transmitter/Receiver:  
- Maximum Range (no obstructions) 150+ yards  
- Frequency: 2.4 GHz
Operation

1. Ensure that vehicle is powered down and all batteries are disconnected (shown in Figure 8). As an added safety feature have kill switch turned on. Check vehicle for missing parts and loose fasteners. Check electronic for loose, frayed or kinked wires. Ensure that batteries for vehicle and transmitter are fully charged.

2. With the vehicle in safe operating condition, and the transmitter turned off, connect batteries to terminals and secure onto helicopter. At a safe distance and with the throttle at zero turn on transmitter (shown in Figure 9). Wait for warm up tone.

3. If it safe to do so, turn off the kill switch. Slowly push the throttle up until the vehicle barely lifts off. Use fine tuning knob to adjust bottom rotor if the vehicle is turning on its own. Bring vehicle to desired altitude by continuing to push up on the throttle.

4. At the desired altitude by pushing forward on the right stick the vehicle will move forward. If the stick is pushed to the rear the vehicle will travel backwards.
5. To rotate the vehicle the right stick can be pushed in the direction the vehicle needs to travel.

6. To land the vehicle, bring it to a hover a safe distance from which it can be observed. Taking note that there are no obstacles in the way slowly bring the throttle down until the vehicle has touched down. Once on the ground turn the kill switch on and bring the throttle to zero. Turn the transmitter off.

7. Once the rotors have finished spinning approach vehicle. Disconnect batteries from terminals.