

Dec.21 ,2016

## **MP Stunt Academy Report 1**

Both indoor planes fly well now but Wasp flies better than MPBee1.

It took seven weeks to trim the planes. By modifying only one thing at a time, I have fixed several problems noticed while flying the complete pattern. The work is not completely done yet as my Bee1 still requires some changes to the wings to fly like Wasp.

The photo below shows both planes RTF. Wasp is in the top right corner.

The Spiderwire lines length is 520 cm. and I use PFP reels to store the lines.



**Problem 1:** Wasp's wings were twisting in level flight.

**Solution 1:** 1.0 mm. diameter carbon composite rods were added underneath the wings to prevent twisting. Weight penalty: 3 grams.

Problem 2: on the top of the outside loops, Wasp had a tendency to roll and yaw in such a way that the plane wanted to slide towards me. The lines were going completely slack and I had to jump backwards to maintain the control of the plane.

Solution 2: the large air brakes were removed. They were mounted too close to the fuselage and the turbulent wake flow behind them strongly affected the tail surfaces.

As the plane is light and flies slowly, the inertia effects were small and the plane was sort of tossed around by turbulence when the speed decreased.

Wasp has many carbon composite and Depron stiffeners that provide enough air resistance for the plane in order not to fly too fast for me and the air brakes are simply not needed.

Comment: Igor Burger Bees have air brakes but they are mounted as far from the fuselage as possible. Also, Igor's Bees fly slower than my both planes so the turbulent effects are weaker. I will address the speed of level flight later.

Comment: initially, I started suspecting the gyroscopic moment effect but this effect is weak on top of the outside loops. I am addressing this issue below.

Problem 3: the most interesting part of the trimming process was "discovery" of the gyroscopic moment effect. It manifested itself as distinct buzzing sound when I started flying sharper corners, especially the third corner of the triangle. There was no adverse effect of this moment on the plane behavior, no excessive rolling or yawing only the sound. I did not know where this sound was coming from and suspected that something went loose. Then I crashed Wasp and, repairing it, discovered that the epoxy resin used to attach the carbon composite motor mount to the fuselage was cracked. The crack was so thin that to see it I had to use the magnifying glass. I will never know if the connection cracked in the crash or due to the gyroscopic moment but this is secondary.

I glued the cross-like motor mount using the epoxy mixed with glass balloons, increased its toughness and Wasp is flying again.

Solution 3: I have removed the prop saver style mount (see the photo below) and replaced it with the collet style prop adapter. After this change in both planes, the buzzing sound disappeared and is not present even if I jerk my hand really hard and fast.



Explanation: the rubber O-ring used to secure the prop was too flexible and, when the gyroscopic moment increased above certain value, allowed for the angular movement of the propeller's plane of rotation in the direction of the moment. In sharp corners, the gyroscopic moment acting on the propeller is always perpendicular to the motor shaft, causing rattling of the propeller on the ring of the mount when the corner was executed. I observed this behavior and heard the rattling sound while holding the plane, with the motor running at 4,700 RPM., in my hands and jerking it to simulate the corner.

When the prop. saver mount was replaced by stiffer collet style mount, the separation of the propeller and the mount disappeared but was replaced by bending of the blades.

APC 10x4.7 E slow flight propeller's blades are not very stiff compared to the "normal" E propeller blades but stiff enough in circumstances.

Collet mount causes more bending stress on the motor shaft and the motor carbon composite mount to the fuselage.

Both planes have the collet style propeller mount now but, anticipating the accumulation of the fatigue stress in epoxy, I have decided to modify this connection. Specifically, I will partially convert the tensile and compressive stress present now in the epoxy layer into shear stress. All glues work much better in shear and hopefully I will avoid the catastrophic fatigue failure that may and perhaps will happen after certain number of flights.

To be continued.