MotOpinion - Super Cub with Speed 480 Motor

Sea Level, 29.92inHg, 59°F

Motor: Graupner Speed 480 BB Race 7.2V #6327; 3893rpm/V; 1.6A no-load; 0.165 Ohms.
Battery: Elite 1500; 8 cells; 1500mAh @ 1.2V; 0.0035 Ohms/cell.
Speed Control: Super Cub ESC; 0.003 Ohms; High rate.
Drive System: Super Cub Gear Box; 10x8 (Pconst=1.31; Tconst=0.95) geared 3:1 (Eff=80%).
Airframe: Super Cub; 320sq.in; 26.3oz RTF; 11.8oz/sq.ft; Cd=0.047; Cl=0.47; Clopt=0.61; Clmax=1.07.
Stats: 97 W/lb in; 30 W/lb out; 17mph stall; 23mph opt @ 43% (30:05, 93°F); 26mph level @ 47% (25:48, 98°F); 510ft/min @ 14.9°; -183ft/min @ -5.3°.

Possible Power System Problems:

- **The full-throttle steady-state motor temperature (334°F) is extremely high, which will likely damage the motor unless full-throttle is used sparingly and cooling is good (even then, damage is possible). [More like damage is assured. This was the warning I failed to pay attention to. – DM]**
- Current can be decreased by using fewer cells, a smaller diameter or lower pitched propeller, a higher gear ratio, or some combination of these methods.

Power System Notes:

- At full-throttle and the best lift-to-drag ratio airspeed, the motor is operating approximately between its maximum efficiency current (9.4A) and its current at theoretical maximum output (28.2A). However, it is operating at only 40% efficiency, which is significantly less than its theoretical maximum efficiency (69%). Efficiency may improve at reduced throttle settings.

Possible Aerodynamic Problems:

- The static pitch speed (37mph) is less than 2.5 times the stall speed (17mph), which may result in reduced performance at typical flying speeds and a low maximum speed. This situation is usually acceptable for an electric sailplane or other slow-flying model.
- Pitch speed can be increased by using a higher pitched and/or smaller diameter propeller, a lower gear ratio, a higher cell count, or some combination of these methods.
- The diameter (10.0in) to pitch (8.0in) ratio is less than 1.5:1, which will result in reduced propeller efficiency at low speeds (the propeller is stalled). Although this is not likely to affect flying characteristics, it may make take-off or hand launching difficult.

Aerodynamic Notes:

- With a wing loading of 11.8oz/sq.ft, a model of this size will have trainer-like flying characteristics. It would make an ideal trainer, for use in calm to light wind conditions.
- The static thrust (13oz) to weight (26.3oz) ratio is 0.5:1, which will result in medium length take-off runs, and no difficulty taking off from grass surfaces (assuming sufficiently large wheels).
- At the best lift-to-drag ratio airspeed, the excess-thrust (6.9oz) to weight (26.3oz) ratio is 0.26:1, which will give strong climbs and rapid acceleration. This model will most likely readily loop from level flight, and have sufficient in-flight thrust for many aerobatic maneuvers.

General Notes:

- This analysis is based on calculations that take motor heating effects into account.
- These calculations are based on mathematical models that may not account for all limitations of the components used. Always consult the power system component manufacturers to ensure that no limits (current, rpm, etc.) are being exceeded.