Airmaster
High Performance Propeller Systems

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COMPARISON OF FIXED AND CS PROPELLER PERFORMANCE

During April 2013 a series of flight performance tests were carried out in Wanaka New Zealand, to compare the characteristics of a fixed pitch wooden propeller against a variety of composite propeller types mounted in Airmaster constant speed mechanisms. The intent was to investigate the relative benefit of different blade designs, compared to the benefit of the CS mechanism.

Caution: Although a great deal of care was taken to ensure accuracy and consistency in the testing procedure, it should be noted however, that the tests were not thorough enough to completely eliminate the variability of pilot, wind and air density. The results are provided for interest and should not be taken as a definitive performance test of the various blade products.

Procedure

Test Aircraft

- A Tecnam P92 with Rotax 912S was used on all the tests.
- Each propeller was mounted in turn and balanced
- The testing period was over three days with the weather being calm but cool over the entire period.

Static Thrust

- Static thrust was measured by tying the aircraft down with at load cell.
- The load cell transmited the strain information into the aircraft cab where it was recorded.
- The aircraft was operated at full power at full rpm

Recording Data

- Take Off times, Climb rates and Cruise speeds are recorded manually (on test cards) based on standard cockpit instruments.
- Where possible, data is cross substantiated by alternative method, ie observed climb rate vs calculated time to climb 3000ft
- Cruise speed recorded average of 3 triangulated flight paths.

Testing

Item	Blades #	Blade Type	Description
1	2	GT 68in VRR	Fixed pitch wooden, type VRR as supplied on aircraft
2	3	Warpdrive 68in T	Fixed pitch composite tapered profile
3	3	Warpdrive 68in T	Constant speed composite tapered profile
4	3	Warpdrive 68in N	Constant speed composite wide profile
5	3	Whirlwind 70in W	Constant speed composite W profile
6	3	Sensenich 68in C	Constant speed composite C profile
7	2	Sensenich 70in E	Constant speed composite E profile
8	3	Bolly 68in	Constant speed composite std profile

1. GT 68in VRR

- The propeller supplied by the factory for the Tecnam was the GT68 VRR. This propeller performance was used as the base line performance that the CS propellers were compared against.
- Static thrust 139kg
- Take Off 20sec (time to 50ft)
- Climb 705fpm (ave)
- Cruise 97kts (3000ft)
- Noise was moderate and smoothness moderate

2. WD R68T GA

- Warpdrive 68in tapered set up as a fixed pitch
- Static rpm on takeoff set to 5000rpm
- Static thrust 180kg +29%
- Take off 20sec (time to 50ft) 3%
- Climb 780fmp
- Cruise 95kts
- Noise was low and smoothness good

3. WD R68T CS

- Warpdrive 68in tapered profile Constant Speed
- Static thrust 212kg +53%
- Take off 15sec (time to 50ft) 25%
- Climb 826fmp +17%
- Cruise 104kts +7%
- Noise was low and smoothness good

4. WD R68N CS

- Warpdrive 68in wide profile CS
- Static Thrust 220kg +58%
- Take off 13sec (time to 50ft) 35%
- Climb 847fmp 20%
- Cruise 101kts +3%
- Noise was low and smoothness good

5. WW R70W CS

- Whirlwind 70in W profile CS
- Static thrust 220kg +58%
- Take off 13sec (time to 50ft) 35%
- Climb 810fmp +15%
- Cruise 105kts +8%
- Noise was low and smoothness good

6. SN R68C CS

- Sensenich 68in C profile CS
- Static thrust 221kg +59%
- Take off 13sec (time to 50ft) 35%
- Climb 820fmp +16%
- Cruise 104kts +7%
- Noise was low and smoothness good

7. SN R70E CS

- Sensenich 70in E profile CS
- Static thrust 219kg +58%
- Take off 14sec (time to 50ft) 30%
- Climb 867fmp +23%
- Cruise 105kts +8%
- Noise was moderate and smoothness moderate

8. BY R68 CS

- Bolly 68in std profile CS
- Static thrust 214kg +54%
- Take off 15sec (time to 50ft) 25%
- Climb 816fmp 16% ?
- Cruise 103kts +6%
- Noise was low and smoothness good

Summary Comments

a. All constant speed propellers showed a significant improvement in performance compared to the fixed pitch.

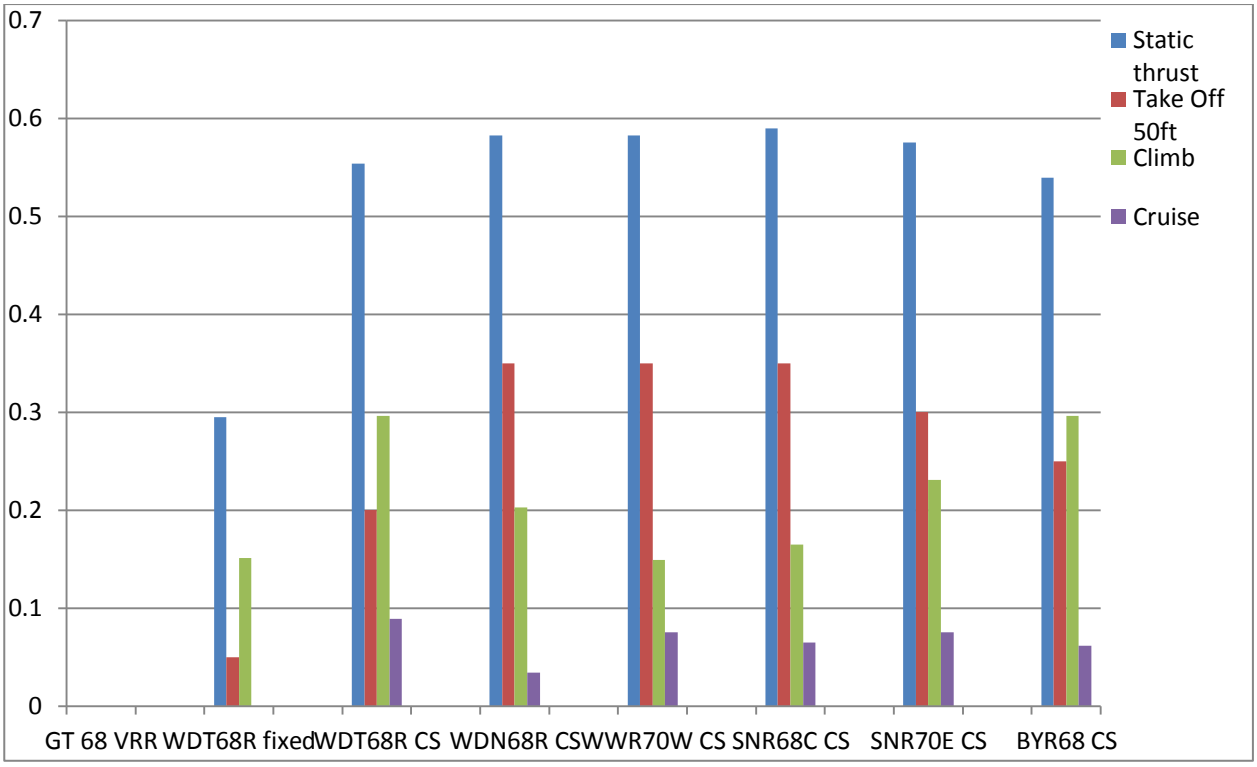
b. The GT propeller was a cruise propeller so the CS propellers showed more improvement in take off and climb, than in cruise.

c. The aircraft had a fairly slow cruise speed (95kts), so the CS propellers did not show as high an improvement in the cruise speed as would be expected from a faster aircraft type, still 10kts were picked up (8%).

d. Overall the two blade CS propeller performed very well but was not as smooth as the three blade propellers.

e. Three blade propellers showed higher braking effects during landing

Increase in performance of CS propeller compared to fixed type (0.5 = 50%)



Conclusion

Although it is often requested as to which propeller is “best”, we did not see a clear leader in our testing. Each propeller type had a slight edge in some area but no clear leader overall.

Regardless of which blade type is chosen however, it is clear that adding the CS functionality greatly increases the performance of the aircraft overall.