

## **JOHN TAYLOR'S STATUS REPORT**

John Taylor enjoys the reputation of being probably the best Flight Analyst DAR in Canada. He prepared the following report for August 2011. It is a little dated because we have already made a good deal of the progress in September.

I would not be doing my job if I did not point out that all that remains is the last little bit of tweaking the aileron fence height and the final adjustment of the Stall Prevention System stick pusher computers.

The three weeks of effort and the cost of making the test parts for the uniform trailing edges were expensive. In this case, it was a resounding success. John's report confirms we are now on a smoother glide path and the end is clearly in sight.

## **SEAWIND CUSTOMER STATUS REPORT – AUGUST 2011**

### **By JOHN TAYLOR, FLIGHT ANALYST DAR**

The Seawind 300C has just completed a very eventful two months of testing over the summer holiday period. We have found and managed to resolve the issues discussed in the following paragraphs. It should be recognized that the Seawind has a very unconventional configuration and as a consequence, has at times been a very challenging configuration to make compliant with FAR Part 23 certification requirements.

#### **Adverse Yaw**

This is where the application of ailerons in a turn tends to yaw the aircraft out of the turn instead of into it. This has been resolved satisfactorily by changing the ratio of up aileron travel to down aileron travel, more commonly known as using greater differential aileron travel.

#### **Lateral Dihedral Stability**

Here we are looking for the airplane to lift the lower wing in a sideslip maneuver. At some flight conditions the aircraft did not meet this requirement. Certification requirements are such that we must consider the unlikely situation of the aileron circuit becoming disconnected in flight and ensure that it still is possible to control the aircraft in roll by the use of the rudder to create sideslip.

This was fixed by fitting fences to the upper surface of the ailerons at the inboard end of the aileron and by fitting aileron fences on the lower side of the aileron at the outboard end. We are further looking to see if we can refine this solution further.

However the airplane will now pick the wing up in sideslip at all speeds, center of gravity locations and power settings.

#### **Rudder Trim**

At very low levels of engine power such as 4-6 inches of manifold pressure, the propeller blades were not allowing enough air to flow over the vertical stabilizer, rudder and rudder trim tab as the propeller was in fine pitch. Consequently the rudder trim tab could not do its job. We have moved the flight idle stop such that it will always provide greater than about 8-10 inches of manifold pressure to the engine; this additional power increases the airflow through the propeller and enables the rudder trim tab to properly do its job.

There has to be a balance here between getting good trimability from the rudder but not providing an excess of power such that the aircraft can't taxi on the ground and water at a reasonable speed; it also should be capable of descending from altitude at a reasonable rate. Too higher power on landing can also cause the aircraft to "float" too much in ground effect, leading to long landing distances and imprecise touchdowns. Full idle on the ground or water will be achievable by releasing a throttle detent.

### Dynamic Stability

At high altitude where the air is thin and at extreme aft center of gravity positions the aircraft did not comply with the certification requirements in that both the pitch damping and the roll/yaw damping (Dutch Roll) were not compliant. When disturbed from trim, the aircraft oscillated too much and required constant pilot attention to trim out the oscillations. At these poor damping levels there was also a tendency for pilot-in-the-loop oscillations on takeoff and landing; not very desirable characteristics for an aircraft of any type.

These problems were solved by adding "T" strips, or little vertical strips about  $\frac{1}{4}$  high on either side of the rudder and elevator at the extreme trailing edge position: they look a bit like Gurney flaps seen on race cars but on both sides of the surface.

Their addition had a quite remarkable beneficial effect on the aircraft, and the aircraft is now a very stable and easy aircraft to fly in all configurations with oscillations damped out very quickly in less than one or two oscillations.

Whilst this was an effective solution it was rather crude. To give better aesthetics we have now given the rudder and elevator blunt bases and faired the airfoil section forward. The beneficial effects on dynamic stability have however been retained.

### High Rotation Forces on Takeoff

The production Seawind aircraft is unlike its kitplane predecessor in that its mainwheels are further aft. The gear is now mounted on the wing and is of the trailing link type. The trailing link gear makes landing much more pleasant than a vertical rigid oleo gear configuration. However, because of the more aft position of the mainwheels, it does shorten the tail or lever arm between the elevator and the gear and at heavyweight, full forward C.G. positions this can result in high stick forces to rotate the aircraft on takeoff. Also, in order to generate sufficient elevator force, the speed of the aircraft has to be increased and this results in much longer takeoff distances than desirable.

This problem has been alleviated by putting Vortex Generators on the fixed portion of the horizontal stabilizer in front of the elevator trim tab, top and bottom. The vortex generators inject high energy air into the airstream flowing over the trim tab, improving effectiveness and resulting in a reduced effort from the pilot to rotate the aircraft.

### Stall Prevention System

We are still waiting for the final components of the stick pusher clutch mechanism. These should be arriving in mid September and will allow us to fine tune the stick pusher and shaker. Whilst this can sometimes be an involved process, it is usually fairly straightforward, with time spent being the main risk as opposed to encountering technical risks.

## Flutter

Since we have changed some of the aerodynamic control surfaces, the addition of fences on the ailerons and blunt bases on the rudder and elevator for example, the flutter testing will have to be revisited. It is not anticipated that any issues will result, but we have to be sure by carrying out a few of the high speed tests again.

## What's Left?

Well, we need to get the final takeoff and landing distance numbers, get the airplane on water and ensure all is well there and generally make sure that we have explored all the combinations of aircraft weight, center of gravity and ambient conditions so that we can sign the certification off. Noise testing has to be done but in general is not a risk and is fairly straightforward to do. There are some outstanding system tests to be completed such as testing with hot fuel to make sure the venting system can cope with any expansion effects, but the Seawind is a very simple aircraft as far as systems design goes and system testing in flight should not spring any surprises.

Writing all of the certification reports takes time but is a necessary evil and requires the same effort on a small aircraft as it does on a large aircraft, but is not a risk as such.

So hopefully the end is in sight. Over the years I have always been surprised at what crops up just when you think you are finished. Usually it's a small detail that just needs resolving but that's certification flight testing.