

# Boeing 727-200 Aircraft Hydraulic Blower Positive Pressure Ventilation Tests Conducted at Ontario International Airport

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## Test Objectives

On June 22, 2006, positive pressure ventilation (PPV) tests were conducted at Ontario International Airport. The scope of the test was two fold. First was to test two new Tempest hydraulic blowers for operation and performance. One is a 24" standard shroud and the other is a 27" with an extended 27" shroud. The test was conducted using an Accessair Stair Truck to provide a platform for the blowers.

Aircraft Rescue Fire Fighting (ARFF) personnel are working to adapt currently produced stair trucks into aircraft interior access vehicles (AIAV) for ARFF operations. Aircraft are getting bigger and carry more passengers than ever. Airport firefighters need to have the ability to



Ontario International Airport Stair 150

rapidly access the aircraft cabin interior to rescue incapacitated passengers/crew, and to perform timely fire suppression. Due to the size of existing aircraft like the B747 and new airplanes like the A380, airport firefighters are severely challenged in order to minimize casualties in the event of an interior cabin fire.

## Ventilation to Save Lives

The idea is to mount a hydraulic blower on top of the aircraft interior access vehicle (AIAV) to provide PPV for the firefighters without blocking the work area or ingress/egress to/from the cabin. Secondly, the test was to determine what the characteristics of PPV smoke removal in an aircraft would be like with all the doors and hatches opened at once. The concern was that the more openings that were used, the less removal of smoke and heat would take place versus having fewer openings in the fuselage. The only way to understand this smoke behavior was to actually smoke up an aircraft cabin interior and run a series of tests. Michael Allomong and Danny Pierce have been working on this project along with Dexter Coffman for over a year trying to obtain an aircraft to conduct tests with. Ontario Airport received a B727 donated by a Hollywood film company after the cancellation of a TV series and the airport was willing to allow us to use it for our testing. test was video taped. One video camera was positioned in



The 27-Inch Extended Shroud Blower

front of the nose of the aircraft at 12:00 oriented towards the tail so we could see an exterior view of the smoke exiting from any and all openings. The other video camera was set up in the doorway to the cockpit looking down the aircraft aisle to the rear galley to record the movement of the smoke as it exited. The rear exit to the stairway was closed. The first smoke test was done only opening the rear side doors (R2 and L2) to get a bench mark of time and PPV performance. All newer commercial passenger aircraft only have side fuselage doors and over wing hatches. Aircraft are no longer being produced with stairs at the rear of aircraft. There were two smoke machines used; one at the front of the aircraft and one at the rear. Captain Allomong wore an SCBA to avoid the smoke and would open the rear doors (L2 and R2) once he saw that the smoke totally obscured visibility. John Thompson and Luis Cadena would enter the cabin and open the over wing hatches upon Danny's signal. The elapsed time for the first test was 1:26 minutes to ventilate the entire aircraft using the standard 24" Blower. When the test was conducted with the 27" extended shroud, the time was 1:22 minutes. Some smoke is being pushed through the rear of the plane though the stairway door. It is almost closed to the cabin to allow for the extension cord that is connected to the smoke generator. Once we had established the bench mark, we then ran tests alternating the blowers while opening two over wing hatches and four doors. On the 24" model with the standard shroud it took 1:15 minutes and on the 27" extended shroud it was 1:12 minutes for smoke removal. We also ran a test of opening a combination of two over wing hatches and four doors and let the prevailing wind ventilate the plane. After over three 3:40 we concluded that the prevailing wind had little effect on ventilation and used the blower to clear the aircraft for more tests.



**Normal view from flight deck to rear of aircraft**



**Cabin filled with artificial smoke.**

environment for the firefighter as well as improving the interior environment of the aircraft. In moving the stair truck back away from the door, we were able to ventilate the aircraft in 53 seconds with two over wing hatches and four doors opened. This was important to both ARFF and passengers/crew for enhancing the environment prior to firefighters entering the aircraft plus aiding the potentially incapacitated victims.

### **Testing a Simulated Slide Extension**

On the final test we wanted to see what effect of moving the stair truck back from the aircraft would have with the 27" extended shroud blower. John Thompson felt that we would get more entrainment of air and do quicker ventilation than being closer to the door. ASO Pierce and Captain Allomong explained that in actual aircraft firefighting the inflatable escape slide has to be deflated or released from the door before a stair truck can be parked at the aircraft door. In order to do this, a ladder must be placed on the escape chute and a fire fighter has to climb up to get into the doorway, then turn around and cut the slide away or release it. If the blower worked, this would enhance the

**Conclusions:**

The hydraulic blower performed better than the gas blower while producing no carbon monoxide emissions and more air movement. The hydraulic blower is lighter than a gasoline powered model and can be mounted in numerous ways while being powered by a power take-off (PTO) from the trucks engine. Tempest will endeavor to provide a blower design that is acceptable to the ARFF industry with input from ARFF departments and others.



**Smoke ejected with PPV**



**AIAV backed away from aircraft to simulate a slide deployment.**

For videos of these tests please contact ASO Dan Pierce at

[DPierce@lawa.org](mailto:DPierce@lawa.org).

These Positive Pressure Ventilation (PPV) tests were conducted with the assistance of Captain Michael L. Allomong & Airport Safety Officer Dan Pierce C.M.F. of Los Angeles World Airports Ontario International Airport Safety Division/ARFF, and senior managers at Tempest Technology Corporation.