



Innotech-ExECAire

Global Paint Facility

Innotech-ExECAire, which is located in Montreal, is a large Maintenance, Repair and Overhaul provider and completions center for all large corporate aircraft. They operate a business jet repair facility in Montreal that does heavy maintenance, structural repair, avionics and interior furnishings and green aircraft completions for Challenger and Global Express series aircraft. The only thing they lacked for a complete one-stop facility was an exterior paint shop. They opted to build a new facility near their current property at Pierre Trudeau International Airport (Innotech-ExECAire) that would be used solely for exterior painting.

This facility is designed to be a world class painting facility and it uses the latest Gen-5 paint booth technology for aircraft painting hangars. The market area Innotech Aviation serves is North America, as well as a worldwide clientele, which establishes Innotech as a global paint facility. The fact that it is designed to paint Global Express aircraft just underscores the international nature of the business.

The paint facility is equipped with two bays. One bay is used as a prep bay where masking, sanding, stripping and detail work are performed. The other bay is used as a paint facility where paint is applied with a spray gun. It can also be used for masking and striping of aircraft.

The facility was sized for a Bombardier Global Express BD-700 aircraft. The dimensions of the aircraft are 94'-0" wingspan, 99'-5" length and 24'-10" height at the tail. The usable dimensions of the paint facility are 118' wide x 114' deep and 28 ft high. This gives ample room around the wingtips and nose and tail to move stands around for painter access. The paint bay has a penthouse over the empennage that adds some headroom for the painters.

Mr. Marc Savoie was hired to be the manager of the paint shop. He had previously been supervisor at Bombardier. He has a crew of 16 painters and helpers to perform the work.



Currently, this is a one shift operation that can complete about 30-35 paint jobs in a year's time. This can vary depending on the complexity of the scope of work. Innotech Aviation will do simple striping and full paint jobs. There are plans to increase to 2 shifts of operation and to run a seven day schedule to cycle 2-3 times the number of paint jobs. This future plan envisions the workforce at 50 employees.

DESIGN

From the start of design, the building was designed around the paint booth and prep booth, so it was decided to make the booth an "integrated" facility. This means that the paint booth ceiling was hung from the building truss-work by rods. Turnbuckles were used to make the ceiling perfectly level. The sidewalls were engineered to be very close to the building exterior walls and were supported by their own structural steel columns. The other method of constructing a facility is as an insert, where the booth is completely self-supporting.



The walls and ceiling of the booth are made of 18 gauge galvanized steel panels factory painted with a baked-on white enamel finish. This finish gives good reflectivity and, as a result, lighting levels are excellent. The design was for 1000 lux at one meter above the floor. With a white epoxy floor this design level was greatly exceeded.



The sidewalls of the paint booth are kept clear of conduits and piping and other dust catching devices by use of utility niches. These are sidewall boxes that are used to introduce water, air and electrical power into the booth and they work by keeping all piping and conduit on the outside of the booth walls. Notice the uncluttered appearance of the sidewalls.

Mr. Savoie says that his painters believe that the booth has the best airflow control of any paint booth they have worked in and it has excellent overspray control so they can always see the surfaces they are painting. Mr. Savoie says, "This booth has surpassed our expectations and will only get better as time goes on. Customer service is very good and responsive."

PAINT BAY EQUIPMENT

The paint booth operates by moving a lot of air. If you have never seen an aircraft paint booth it is hard to imagine the amount of air that must be moved. This facility moves 262,000 cfm of air during painting operations. Supply air

is handled by (5) Weather-Rite indirect fired gas heaters with steam injection grids to introduce humidity to the air.

Fresh air is filtered at the rooftop air replacement unit and once again at the bottom rolling pneumatically powered filter doors at the front of the paint booth. This air is introduced into a plenum space between this filter door and a building door that is a sectional overhead door. The fans are 40 HP each and the heaters are rated for 6 million BTUs per hour each.

It is important to add moisture to control the relative humidity in the booth at about 40% RH at 70°F (21C). It is necessary to generate 9500 lb/hour of steam to take care of the demand for humidity during paint mode. But during cure mode the temperature in the booth is raised to 120°F (49C) and even more steam must be added to boost the moisture in the booth air to 26% RH. This requires an additional 2750 lb/hour of steam to be generated. There are two heaters in the units. The first stage unit runs during most modes of operation. The second stage unit is only used for curing mode of operation.

During the curing mode, three of the 5 exhaust fans are re-directed to discharge their air back into the booth to reduce energy consumption by 50%. Mr. Savoie says the ramp-up time for the system to get from room temperature to cure temperature is very fast. Because of the moist curing of the aircraft paint, they are able to cut by one third the amount of time to move an aircraft.

The exhaust system is a state-of-the-art environmentally controlled facility.



The air in the paint booth is removed through three stages of high efficiency filtration media in accordance with Canada's strict environmental laws. The filter efficiency is 99.97% efficient on 2 micron particles. This is excellent removal efficiency and represents maximum control technology. But this facility went one step further and installed a bank of granular activated carbon filters. The carbon granules adsorb the VOCs from the exhaust stream emitting pollution-free air into the Montreal environment. Together with the particulate filters, this is Maximum Available Control Technology (MACT).

The exhaust air is handled by (3) exhaust fans, each rated at 75 HP, and (2) fans rated at 60 HP each. The exhaust fans are booth supported so that even though they are very heavy no load is imposed on the building structure. This paint bay has four modes of operation.

Unoccupied Mode: In this mode of operation, the booth uses 100% outside air at a greatly reduced velocity but maintains 60°F (16C) while planes are being stored or the area is unused. This is an energy conservation measure and also reduces costs while the booth is not being used. The rooftop units run only at times when building heating is needed. Only one stage of heating is used.

Masking Mode: Air velocity is reduced to 40 fpm. This mode is used when areas of the aircraft are being masked and painting is not active. Temperature is held at 70°F (21C) and is heated by only the first stage heater.

Paint/Sand Mode: Air velocity is at its full rated design of 100 fpm average. The temperature is maintained at 70°F (21C). Relative humidity is maintained at 40% RH. All five units are running and only the first stage of heating is operational.

Cure Mode: Air velocity is at its full rated design of 100 fpm average. The temperature is maintained at 120°F (49C). Relative humidity is maintained at 26% RH. All five units

are running and both stages of heating are operational. When cure is timed out, the system returns to unoccupied mode. Three of the five exhaust fans (50%) recirculate their air to the front of the booth during this mode for energy conservation.

The paint booth is a forced draft system and the room pressure is controlled so that the airflow is a constant whether the exhaust filters are new or fully loaded. This feature is sensitive to doors that are ajar and the system will shut down if doors stand open too long. Mandors are placed on a timer, but the product door produces a booth shutdown and disables painting when the door starts to open.

PREP BAY EQUIPMENT

The prep bay operates with similar equipment as described for the paint bay. The intake plenum is mounted above the outer doors and is 110 ft wide and 14 ft deep. The plenum is located with 28'-6" clear height above the floor. It discharges air at 176,000 cfm which is about 60 fpm on average.

The air replacement units are rooftop mounted. There are two units rated for 88,000 cfm each with 10 million BTU heaters, both direct fired natural gas. The supply fans are rated at 75 HP each. There are filters in the unit as well as in the intake overhead plenum.

The exhaust system uses 2-stage filters. The two exhaust chambers are



located at the corners of the room. There are two exhaust fans in each chamber rated at 25 HP each.

The bay is lighted using pendant hung HID lighting fixtures suspended from the room's trusses.

This room has two modes of operation and they are supervised by a PLC controller. In Prep mode, the booth operates at full airflow and controls air temperature to 70°F (21C). In Unoccupied mode, only one rooftop unit operates as required to maintain 60°F (16C). This operation is for energy conservation.

OPERATION

The Innotech Aviation facility has two operational bays for handling full sized aircraft and a parts paint booth. The first bay is a prep bay and is used for prepping the aircraft for painting. The aircraft is cleaned in this bay and water is available. The aircraft can also be sanded, filled and, if necessary, stripped. Dust collection is available while sanding.



Prep Bay Operation

The Prep bay has full bay exhaust, like the paint bay. The filtration of the exhaust is 2-stage as it handles only sanding dust. No other particulates are handled in this facility. Fresh air is introduced by rooftop units with heaters and filters dumping air into an overhead fresh air plenum that has another stage of filtration.

Masking an aircraft is a significant activity that requires lots of skill and labor. For a multi-color finish, several masking operations are required to make all the color coats separate and distinct.

Surface preparation is the most critical aspect of any painting operation. This includes body filling which is applied by roller or spray gun, followed by sanding. It also includes touch up of primers where necessary.

Paint Bay Operation

The Paint bay has a higher air velocity than the prep bay. It operates at about 100 fpm. It is used for painting and sanding and must have that velocity to capture the overspray and to keep the room safe for the operators. When adding stripes to the aircraft, it is sometimes necessary to first mask the lines and then to paint. For this reason, there is a separate mode for doing light work such as masking and this mode operates at a reduced air flow velocity of 40 fpm.

Painting is accomplished at full air velocity (100 fpm) and at 40% RH. The moisture in the air aids the polyurethane paint in drying and is very effective. When in painting mode, the



spray guns are enabled so painting can be accomplished. The booth has fall protection so painters can walk on the upper surfaces of the aircraft. Sanding is also accomplished in this mode, but sanding is a minor operation used mostly for re-work. When stripes are added to the aircraft, this mode is used.

Curing is accomplished at 120°F (49C) and at 26% RH. The high humidity in drying is a big aid in increasing productivity of the facility. Some 60% of the air is recycled to the front of the booth during this mode for energy conservation reasons. Airflow is held to full flow (100 fpm) to reduce the tendency of the air to stagnate in a room with 28 ft high ceilings.

When the booth is unoccupied, the space is maintained at 60°F (16C) at a considerably reduced air velocity.

CONCLUSION

This global aircraft painting facility was designed for a global market place and serves both business aviation and an OEM customer who makes Global Express business jets. The paint

booth was integrated into the building structure by the paint booth contractor, Global Finishing Solutions in such a way that the economies are fully optimized. These paint systems are fully qualified fifth generation paint facilities (Gen-5 paint booths™) and by their nature, are complex engineering projects. It would not have been possible without full cooperation of the project architect's and structural engineer's design input.

Much of the system economy was derived by allowing some building components to serve as paint booth components and letting some paint booth components serve as building elements. Innovative techniques such as this are what make a global player like Innotech Aviation the leader in their class.

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