maxon DC motors take to the air.

11,000 m above the ground, the atmosphere is much thinner. Contemporary pressurised cabins with environmental control systems (ECS) give modern commercial aircraft a pleasurable atmosphere. The new Boeing 787 Dreamliner contains unique air conditioning technology that advances passenger comfort even further. maxon brushless DC servo motor systems, reduction gearboxes and sensor systems guarantee an excellent climate at high altitudes.

The ECS of an aircraft contains three mechanisms: Temperature control, pressure control and air exchange. At high altitudes of 11km and higher, the provision of adequate oxygen and pressure is critical. The air conditioning systems in an aircraft need to be vastly different from standard air conditioning units, not just the design but the power source also, because aircraft air conditioners must have a much larger power source to meet stringent safety regulations. Inflight the system is most often powered by the main turbines and when grounded the system is powered by a compressed air system called the Auxiliary Power Unit (APU)

Commercial aircraft cabin pressure is maintained at the highest level possible however this can cause the aircraft fuselage to expand and impose stresses on the airframe. As the aircraft gains altitude the cabin pressure is reduced and the people onboard experience a pressure increase up to roughly 2.4km. The ECS must also be capable of adjusting the oxygen levels according to the number of passengers. However, a pleasant atmosphere is not given by just pressure and oxygen levels. Also critically important are the humidity and temperature. A contemporary ECU can regulate the cabin temp within 1°C taking into consideration that a single passenger can emit up to 100W also.

Long haul-comfort dramatically increased with Dreamliner system.
The Dreamliner is quite different from any other passenger aircraft having a fuselage constructed mostly from carbon fibre. This very strong medium enables greater control over pressure conditions giving a much nicer environment to the passenger.

The ground breaking carbon fibre fuselage, according to Boeing, is vastly stronger than the traditional aluminium shell. Correspondingly the cabin pressure can be maintained to an equivalent altitude of 1.8km giving a much more tolerable experience than the aforementioned 2.4km. Additionally, because the carbon fibre shell resists oxidisation the humidity can be controlled up to 15% a vast improvement on the traditional 4%. The other innovation on the 787 is the addition of powerful generators that are driven by the turbines. These generators in turn provide power to electric motors that then drive compressors drawing fresh air from the outside atmosphere. This gives a more pleasurable environment than drawing pressurised air directly from the engines.

Figure 1: maxon DC motors in the Dreamliner © - Boeing

The ECS on the 787 is supplied by US company Hamilton Sundstrand and has the equivalent power to heat or cool 25 average homes.

maxon DC servo motors give the ideal environment.
DC motors for aerospace applications are vastly different to standard motors. They must withstand larger temperature ranges and higher vibrations. Their life span must be greater and they must be extremely reliable. There are 48 DC motors from maxon motor on-board each Dreamliner. Custom modifications were carried out for the complex ECS. DC motors for cabin ventilation, motors for cooling electronics and motors for control of the air inlet on the skin of the aircraft. The DC motors are exposed to temperatures from -55°C to +85°C. 36 shut-off valves in the ECS are driven by maxon brushless 45mm flat motors. They are lightweight motors with a very small profile to fit the tight mounting arrangements.

The brushless flat motors can be controlled to 20,000 rpm, giving excellent heat dissipation via their open construction. The Hamilton Sundstrand ECS motors achieve a speed of 4,000 rpm. The brushless flat motors in the ECS have been customised for the application; the PCB has been fitted with low temperature hall sensors, it was given a special shape and the unit has conformal coating applied. Customised magnetic paths for the stator prevent unwanted movement when the motor is in an unpowered condition, further improving system efficiency. The linear actuators controlling the air inlets use customised 32mm motors which that are also fitted with low temperature hall sensors. In addition the output shaft of the motor has a fame arrestor, a unique vibration resistant mounting threads and brake modules operating with a cogging detent principal.

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Figure 2: The 787 ventilation system featuring custom DC motors. © Hamilton Sundstrand

Figure 3: The linear actuators with brushless 32mm motors. © Hamilton Sundstrand

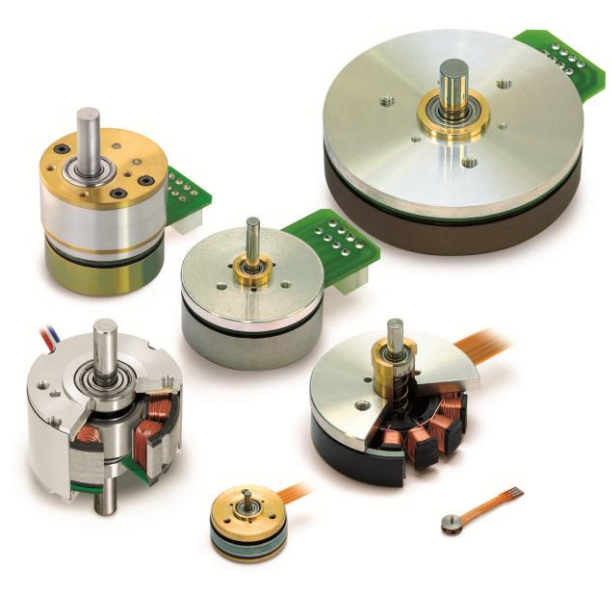

Figure 4: brushless DC flat motors by maxon motor. © maxon motor

For assistance selecting DC motors please contact our Sydney office:

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