HUMIDIFICATION IMPROVE WORK ENVIRONMENT FOR PILOTS AND CABIN CREW

News / Airlines

A healthy, well-rested and alert flight crew is a safe crew, yet a cockpit in flight is probably one of the driest places on earth. It is similar for the cabin crew at the front of the aircraft as Relative Humidity (RH) levels are very similar, around 3%. That is drier than the Sahara Desert or the Arctic and Death Valley.

This is because typical cruise altitudes are above most, if not all, of the water vapor in the atmosphere, thus no humidity enters the cabin as the air is refreshed. The RH is dependent on the number of passengers on board (each exhaling around 70g/hour of water vapor) and the rate of air recirculation

How does dry air affect people and their wellbeing and health?

The human body is not designed to function in a dry environment with less than 20% RH and so it is adversely affected when exposed to extremely low RH levels.

During a long-haul flight, dry cabin air gradually dehydrates the mucous membranes in the nose and throat. These are part of our first line of defense against bacteria and viruses, as they contain

antibodies that physically catch and destroy pathogens. This is exacerbated by the dry air itself, as droplets become smaller and diffuse more slowly. The bottom-line is that a weakened immune system not only increases risks during flight but also, perhaps more importantly, upon arrival at the destination.

Another common and unwanted side-effect of dehydrated mucous membranes is nasal congestion and sinus pressure, while dry eyes may require the removal of contact lenses and there may also be problems with dry skin and allergies.

Even crew meals are affected, as low RH levels change the taste in the mouth, alter the viscosity of saliva, modify the ability to vaporize into the nose, dehydrate the nasal cavity affecting the sense of smell (innervation olfactory nerve) and decrease the volatility of odour molecules.

Finally, dry air has a negative impact on sleep as dehydration will be extreme.

The answer is to install the Humidifier Onboard system from CTT Systems, which will provide RH levels of 17% in the cockpit and 22% in crew rest compartments.

In the cockpit, more than 90% of Boeing 787s are now equipped with Humidifier Onboard, along with an increasing number of Airbus A350s. The system is also available as an option on the Boeing 777X. That enables the flight crew to feel better, which is critical as they have the safety of the entire aircraft as their responsibility.

As airlines focus on the quality of their service, it is often overlooked that cabin crew are highly trained professionals whose real job is to take care of passengers if there is an emergency. Humidifier Onboard is now very common in flight and cabin crew rest compartments on the Boeing 787 and an option on the Airbus A350 and Boeing 777X.

So how does it work?

The Humidifier Onboard System is installed directly into the ECS supply duct.

The Humidifier Onboard system is simple and reliable. Water from the potable water tank is sprayed over the top of an evaporation pad for about two seconds every minute. The evaporation pad, a honeycomb structure made of fiberglass and heat treated with charcoal, absorbs the water. The airstream in the ECS supply duct then evaporates the water and the now moistened air is

directed into the cabin. As the evaporation process produces pure water vapour, there is no risk of viruses or bacteria being transmitted.

The Humidifier Onboard system is only in operation during cruise and so is normally activated when reaching 30,000ft and deactivated at the same level at top of descent. This ensures that, when the aircraft lands, the evaporation pad is dry, further preventing bacterial growth.

Another hazard faced by pilots is the presence of Volatile Organic Compounds (VOCs). These substances, such as acetone, benzene and toluene, can be found from various sources inside the aircraft as well as from the ingestion of exhaust fumes or deicing fluid into the aircraft's environmental control system from outside. Oil leaks caused by engine bearing seal leaks are another source of VOCs. These produce similar symptoms to dry air but high levels can cause performance impairment or, in rare cases, incapacitation. In addition, VOCs can react with oxygen (O2) in flight to produce ozone (O3), which is also an irritant to mucous and respiratory tissues.

CTT Systems has teamed with two Swedish specialists in air filtration to produce an enhanced Humidifier Onboard to counter the problem. The current pad, made by Munters, has a newly developed active carbon filter solution from Camfil at the upstream end that will reduce ozone by 70- 75% and VOC by up 80%. The filter will also reduce and remove fume events during fuelling and taxi to runway. The new pad also has a service life of 4,000 flight hours, the same as the humidifier, so it can be simply replaced with no special tools or routines required. The team has produced a conceptual design for the Boeing 777.

Freighters are no exception

A new operational requirement for cockpit humidification has come about as the number of widebody freighters is set to grow after the COVID-19 pandemic and the subsequent increase in air cargo. These aircraft will be operating on similar sector lengths to their passenger counterparts and so the crew (and reserve crew) will be subject to the same low RH Levels, as no moisture will come from the freight. A possible further consideration is that many freight flights are operated overnight, including the time when the human Circadian rhythm is at its lowest point (around 0500).

Airbus has already specified the Humidifier Onboard System as an option for the A350F for the cockpit and crew rest compartment.

Research may be required into RH levels when supernumerary crew are carried. Their

compartment is located between the cockpit and the bulkhead at the front of the cargo compartment, so they could experience RH levels similar to cabin crew in in the forward galley, around 3%.

The 2022-2041 Airbus Global Market Forecast estimates that the world freighter fleet in service will reach 3,070 aircraft by 2041, with a demand for 2,440 new-build or converted freighters in that period. over 2022-2041. These will consist of 860 mid-size widebodies (40-80 tonnes) and 560 large widebodies (> 80 tonnes). Narrowbodies (10–40 tonnes) will account for a further 990 aircraft.

Some of these narrowbodies, such as the Airbus A321 and Boeing 737-800, are likely to operate with the cargo compartment full but with a total weight well within the maximum payload. This can translate into more fuel carried and range extended, so humidification is a consideration here as well.

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