



# Humidification for Crew Rest Compartment

Understanding the dry reality of crew rest compartments unveils a critical aspect of aviation that directly impacts the well-being and performance of flight crews. Extended periods in dry air mean a gradual dehydration of mucous membranes and a big impact on crew members' immune systems.

But there is a solution.

# WHITE PAPER

CTT Systems  
Optimizing humidity in aircraft

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[www.ctt.se](http://www.ctt.se)

## Introduction

# Humidifier Onboard

**This white paper delves into the pivotal aspect of crew well-being during flights, with a specific emphasis on the challenges posed by low humidity levels in crew rest compartments. It provides an in-depth exploration of the innovative solution offered by CTT Systems – the Humidifier Onboard.**

The Humidifier Onboard installed in crew rest compartments, not only addresses health concerns but also enhances the overall performance and alertness of flight crews.

## Introduction

# The dry reality

Crew rest compartments play an indispensable role in ensuring that flight crews can recharge during long-haul flights, maintaining the alertness and responsiveness required for their demanding responsibilities. However, the often-neglected challenge lies in the environment within these compartments, specifically the pervasive dryness that can have profound implications for crew well-being.

At cruising altitudes, crew rest compartments face an unparalleled environment, with Relative Humidity (RH) levels plummeting to as low as 3%. This level of dryness surpasses that of renowned arid landscapes like the Sahara Desert or Death Valley. The implications of such low RH extend beyond discomfort, affecting the physiological and psychological well-being of crew members.

# Understanding the need for humidification

## Health implications

Extended periods in dry air mean a gradual dehydration of mucous membranes and a big impact on crew members' immune systems. This underlines the importance of maintaining optimal humidity levels in the crew rest compartment to mitigate these health risks.

### **A weakened immune system**

During a long-haul flight, dry cabin and rest compartment 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.

### **Dry eyes and skin**

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.

### **Decreased taste**

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

### **Negative impact on sleep**

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

## The role of humidity

# Crew performance

Beyond health concerns, the dry environment adversely affects crew performance. Changes in taste, viscosity of saliva, and alterations in the sense of smell create an uncomfortable and suboptimal working environment. Moreover, the extreme dehydration induced by dry air negatively impacts sleep, a critical factor in maintaining crew alertness and responsiveness.

Humidifier Onboard are now very common in flight and cabin crew rest compartments on the Boeing 787 and an option on the Airbus A350 and Boeing 777X. This enables the crew to feel better and be more alert, which is critical as they have the safety of the entire aircraft as their responsibility.

## Humidifier Onboard

# Tailored solution

CTT Systems introduced the Humidifier Onboard as a tailored solution designed to address the unique challenges faced by crew members in rest compartments. By seamlessly integrating into Aircraft Environmental Control Systems (ECS), this system aims to optimize humidity levels, ensuring a more comfortable and health-conscious environment for the invaluable resting periods of flight crews.

Past research that studied both pilots and cabin crew has found nearly 82% of participants have operated flights under the duress of fatigue.<sup>6</sup>

## Humidifier Onboard

# Operational mechanism

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 vapor, there is no risk of viruses or bacteria being transmitted. The Humidifier Onboard system is only in operation during the cruise and so is normally activated when reaching 30,000 feet and deactivated at the same level at the top of the descent. This ensures that when the aircraft lands, the evaporation pad is dry, further preventing bacterial growth.

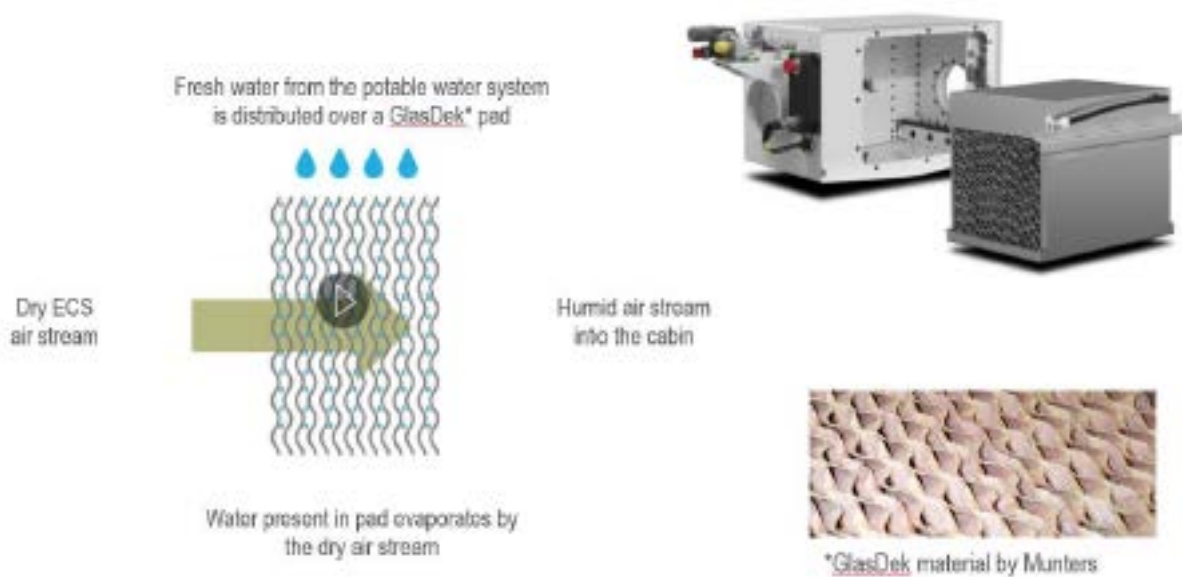


Illustration of CTT Systems Humidifier Onboard

## Combat VOCs

# Improve air quality

Another hazard faced by the crew 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 (O<sub>2</sub>) in flight to produce ozone (O<sub>3</sub>), which is also an irritant to mucous and respiratory tissues.

## Collaboration

# Air filtration specialists

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 to 80%.

The filter will also reduce and remove fume events during fuelling and taxi to the 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.

# Beyond passenger flights

## Freighter pilots

### New operational requirement

A new operational requirement for flight crew rest 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 so the pilots (and reserve pilots) 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 (04:00 to 07:00).

### Already option for Airbus A350F

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

Research may be required into RH levels when supernumerary crew are carried. Their compartment is located between the flight deck and the bulkhead at the front of the cargo compartment, so they could experience RH levels similar to cabin crew in the forward galley, around 3%

71% of cabin crew believe their fatigue affected their safety-related performance, and 60% felt their roles in looking after passengers were compromised, both in service and safety.<sup>6</sup>

## Market trends and forecast

# Future of flight deck comfort

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 tons) and 560 large widebodies (>80 tons). Narrowbodies (10-40 tons) 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.

The most common symptoms among airline crew were fatigue (21%), nasal symptoms (15%), eye irritation (11%), dry or flushed facial skin (12%), and dry/itchy skin on hands (12%). The most common complaint was dry air (53%).<sup>5</sup>



# Elevating crew comfort and safety

## Conclusion

In summary, understanding the dry reality of crew rest compartments unveils a critical aspect of aviation that directly impacts the well-being and performance of flight crews.

In the dynamic world of aviation, where every detail counts, addressing the challenges within crew rest compartments is not just a necessity but an opportunity for transformative enhancement. As we conclude our exploration into the dry reality of these crucial spaces, optimism abounds in the form of CTT Systems' revolutionary solution – the Humidifier Onboard for Crew Rest Compartments.

### Humidifier Onboard Crew Rest Compartment

– efficient relaxation and sleep

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# Thank you for taking the time to read

We hope you found it informative and helpful.

If you have any questions or would like to discuss your specific needs, please don't hesitate to contact us. We are here to help you optimize the humidity in your aircraft.

We look forward to hearing from you!

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