

## RESEARCH NEWS

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### Improved aircraft comfort

#### **No more dry mucous membranes when flying**

**Hovering at around 20 percent, the relative humidity in aircraft is kept very low to keep condensation from building up in the cabin. The downside for passengers and the crew is that this dries out the mucous membranes. Now a vortex ring generator will direct humidified air to passengers, increasing the humidity of the air they breathe without causing the overall relative humidity to skyrocket.**

Your throat is dry, and taking a drink of water offers only brief respite: that is because the air humidity in aircraft is sometimes not even 20 percent. This has to do with the flight altitude and the low outside temperatures encountered at this height: not only does the air contain very little moisture, it also cools the aircraft fuselage. If the inside air were more humid, additional water would condense on the shell. All the same, the dry climate is unpleasant for passengers.

#### **Vortex rings to supply humidified air**

Now a new technology from the Fraunhofer Institute for Building Physics IBP in Valley aims to solve the problem in the future. "A vortex ring generator humidifies the air in passengers' breathing zones, thereby increasing comfort levels without any material increase in the overall relative humidity in the cabin," says Thomas Kirmayr, group manager at Fraunhofer IBP. The basic principle is that a generator produces small vortex rings of humid air – rather like the rings sometimes expelled by smokers. The vortex effect keeps the rings stable over a certain distance while preventing them from mixing to any significant extent with the surrounding air. The researchers have designed the generator so that the vortex rings make contact with the passengers' upper torso; body heat then causes them to rise towards the nose and mouth. Since the chest area is covered by clothing, it is less sensitive than the face would be to the light airflow. The researchers' goal is to increase air humidity in the breathing zone by up to 15 percent to reach a level of around 30 percent. This can be done by conditioning a minimal amount of air directed in the form of vortex rings exactly where it is needed.

#### **Dummy helps in testing**

The generator itself resembles an air pump; its pistons are driven by a linear motor. For the demonstration, the researchers produce the rings using smoke instead of water – this makes them easy to see. First tests have now been conducted with the prototype,

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#### **Contact**

**Klaudia Kunze** | Fraunhofer-Gesellschaft, Munich | Communications | Phone +49 89 1205-1333 | [presse@zv.fraunhofer.de](mailto:presse@zv.fraunhofer.de)

**Assja Terseglav** | Fraunhofer Institute for Building Physics IBP | Phone +49 8024 643-642 |

Fraunhoferstrasse 10 | 83626 Valley | [www.ibp.fraunhofer.de](http://www.ibp.fraunhofer.de) | [assja.terseglav@ibp.fraunhofer.de](mailto:assja.terseglav@ibp.fraunhofer.de)

using a dummy as the test subject. The dummy comes with an artificial nose that takes in and analyzes the air. This helps the researchers to pin down the system's basic settings, for instance the size of the rings, and the pace and rate at which they are expelled. There are plans to use real human test subjects for the final fine tuning.

Another step involves humidifying the air. Here the researchers are drawing on a development from another of Fraunhofer IBP's projects: a membrane that separates water from air, with the concentration gradient forcing water molecules through the membrane. The amount of water that is permitted into the air can be regulated via the membrane's active surface area and the temperature of the water – the bigger the active surface and the higher the water temperature, the more moisture enters the air. Meanwhile, the distance the vortex ring travels before breaking up is regulated by the original impulse delivered to it.

The vortex rings can deliver more than just humidified air; another potential application could be to use vortex rings to channel the fragrances increasingly used in ventilation systems. However, since this could also reach people with allergies, it would have to be in minimal doses and only at the request of the passenger. "The certification process in the aviation industry is extremely long, and it will be some time before the system is employed in aircraft," says Kirmayr. "Our plan is to integrate the generator into the back of the seats."

**Thomas Kirmayr, IBP group manager:**

"Our vortex ring generator allows us to improve comfort levels in aircraft without any material increase in the cabin's overall relative humidity."



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**Vortex ring generator prototype. The plan is to integrate the system into the back of passengers' seats. © Fraunhofer IBP | Picture in color and printing quality: [www.fraunhofer.de/en/press](http://www.fraunhofer.de/en/press)**