Strategic Layered Disease Defense and UV-C Disinfection Webinar by AeroClenz & AMSUS

Explore a Layered Approach to Infectious Disease Defense

AeroClenz and AMSUS hosted the Strategic Layered Disease Defense and Biosecurity in a World of Risks webinar on August 7, 2025. This virtual event featured Dr. Kris Belland, DO, MPH, MB, and moderator Jameson Trettenero, and explored how real-time UV-C disinfection is being integrated into public health, military, and aerospace environments to combat biological threats.

Watch the UV-C Disinfection and Biosecurity Webinar on YouTube. The full transcript is provided below.

Video Link: AeroClenz x AMSUS Webinar: Strategic Layered Disease Defense and...

Welcome from AMSUS

Susan (AMSUS):

Hello everyone. This is Susan from AMSUS. Good afternoon, everyone. Once again, thank you for joining us today.

If you're not an AMSUS member and would like to join, visit amsus.org for a list of benefits and more information.

And now, without further ado, I pass it along to Jameson Trettenero.

Moderator Introduction

Jameson Trettenero (AeroClenz):

Thank you very much, Susan, and thank you to the larger AMSUS organization for providing us with this platform. We at AeroClenz are very excited to bring you today's presentation, specific to layering strategic levels of disease defense through the Swiss cheese model and operationalizing this approach to counter future pandemics and biothreats.

My name is Jameson Trettenero, Director of Marketing at AeroClenz, and I'm going to be your moderator for today. We'll host a Q&A session towards the end of the presentation, so please drop your questions and thoughts in the comments as they arise.

Among our presenters today is our founder and CEO, Matt Saberton. Matt began his career as a flight instructor and then became an air ambulance pilot, where he recognized the importance of cabin cleanliness. Rising through the ranks at one of the largest worldwide charter airlines, Matt became captain and then later chief pilot, gaining deep insights into maintaining safe environments within aviation.

This experience led him to found AeroClenz, where he now serves as the CEO. Under his leadership, AeroClenz has transitioned from an aerospace-focused company to a leader in UV disinfection solutions, offering custom products for both aerospace and terrestrial indoor applications.

While the company's roots are in aviation, its technologies now ensure high standards of cleanliness across various industries.

Additionally, we have AeroClenz's Chief Medical Officer, Dr. Kris Belland. Dr. Belland is an osteopathic physician and serves as the AeroClenz Chief Medical Officer, former President of the American Osteopathic College of Occupational and Preventive Medicine, as well as the President and CEO of Aerospace Medical Strategic Consultation, PLLC. He also recently served as the FAA Southwest Regional Deputy Flight Surgeon.

Prior to that, Dr. Belland was an aeromedical consultant to pilot and flight attendant unions, corporate and Chief Medical Officer for American Airlines, and also completed an over 30-year career in the U.S. Navy.

He is a graduate of the United States Naval Academy and Philadelphia College of Osteopathic Medicine, and is board-certified in family and aerospace medicine with master's degrees in business administration, public health, and strategic studies.

During his time in the U.S. Navy, he was qualified as both a flight surgeon and pilot, accruing 2,000 flight hours, 112 arrested landings, and 25 combat missions in aircraft like the F/A-18 Hornet, A-6 Intruder, EA-6B Prowler, and the F-14 Tomcat.

He has been recognized with the Legion of Merit, Air Medal, U.S. Navy Flight Surgeon of the Year, Sunny Carter Memorial Award, U.S. Air Force Historical Foundation's Award in Research and Writing, Aerospace Medical Association's Lyster Award, Society of U.S. Naval Flight Surgeons Bravial Award, Collins Award for Outstanding Publication in the Field of Human Factors, and the Captain Robert E. Mitchell Lifetime Achievement Award.

He is a Fellow of the Aerospace Medical Human Factors Association's Civil Aerospace Medical Association and, as past president of the Aerospace Medical Association, served from 2015 to 2016.

Without further ado, I'll turn it over to Dr. Kris.

Presentation – Dr. Kris Belland

Dr. Kris Belland (AeroClenz):

Thanks, Jameson. I appreciate that introduction. A little bit about AeroClenz and our partners—who we are at AeroClenz. We envision a world where safe, healthy air and surfaces are not a luxury but a standard.

AeroClenz seeks to revolutionize the way the world approaches air and surface disinfection. Our commitment is driven by three guiding values: innovation, safety, and responsibility.

You can see some of our partners in the bottom left-hand corner of the slide. We are fortunate to have Lieutenant General (ret.) Dr. PK Carlton, former U.S. Air Force Surgeon General, as a supporter. He has been very impressed with our progress and endorses our mission to deliver clean air.

We also work with Admiral Michael "Wizard" McCabe, retired U.S. Navy Third Fleet Commander. I served as his fleet surgeon at that time. The Third Fleet is the experimental test and evaluation command for the entire U.S. Navy aviation and fleet. He is very supportive of this evolution in air quality and was also instrumental in advancing refractive eye surgery. I'll draw some comparisons between that and UV-C later.

Now here's the challenge, particularly for AMSUS members: operational readiness is mission-critical. As you may recall, during COVID-19, a U.S. Navy carrier was taken offline in the Pacific due to an outbreak. That loss of capability had real-world consequences—political fallout, loss of confidence in leadership, and, most importantly, the death of a senior chief petty officer.

We know the world is woefully unprepared for a biological incident. Simulations show this clearly. Whether it's a naturally occurring pandemic or a bioweapon, we will face future threats. The COVID-19 pandemic demonstrated how quickly disease can spread globally in our highly mobile world.

The World Health Organization is hesitant to shut down borders because of economic impacts, which means the next pandemic is likely to spread worldwide before containment measures are enacted.

Historical Context – Pandemics and Lessons Learned

Looking back through recorded history, pandemics are nothing new. In 2025, we can review events from the Black Death, smallpox, cholera, yellow fever, the Spanish flu, HIV/AIDS, and now COVID-19.

The scale of these pandemics varies, but they all teach us lessons. The Black Death killed approximately 200 million people—about 51% of the world's population at the time. If COVID-19 had spread as easily as measles and been as deadly as the plague, we could have lost four billion people before a vaccine was developed.

COVID-19's death rate was about 0.1% in hindsight, but its impact on society, healthcare systems, and economies was immense. One critical lesson: individuals can be infectious two to three days before showing symptoms. We also know now that aerosol transmission is the primary route of spread—something the CDC did not fully recognize until over a year into the pandemic.

Hospital-Acquired Infections (HAIs)

For those working in hospitals or military medical units, HAIs remain a serious threat. The average hospital stay increases by almost 18 days when a patient acquires an HAI. One in ten patients who contract an HAI will die as a result. At any given time, one in thirty U.S. hospital patients has an HAI.

HAIs cause nearly 100,000 deaths annually in the U.S.—more than breast cancer and prostate cancer combined—and cost an estimated $28.4 billion each year.

A significant risk factor is prior room occupancy. If a previous patient had MRSA, C. difficile, or Pseudomonas aeruginosa, the next patient's risk of contracting the same pathogen increases significantly, even after standard cleaning.

Multiple studies also confirm in-flight transmission of diseases. Commercial aircraft toilets, in particular, are high-risk due to aerosolization during flushing, with pathogens able to settle on surfaces throughout the cabin.

Aviation Case Studies and Risk Mitigation

Dr. Kris Belland (AeroClenz):

Several studies show that the longer the flight, the higher the disease transmission rate. No mask use equals higher transmission risk. Laboratory studies confirm that commercial aircraft toilets emit aerosol plumes capable of spreading microorganisms rapidly, especially when toilet lids are raised. Even flatus can contribute to aerosolization in enclosed lavatories.

One particularly telling case occurred on March 2, 2020, on a London-to-Illinois flight. The index patient, confirmed through DNA and RNA testing, infected multiple passengers. Standard "two rows in front and two rows behind" contact tracing would have missed additional cases further back in the cabin, including a flight attendant who likely contracted COVID-19 from using a lavatory also frequented by the infected passenger.

Airline crew often use business-class lavatories while serving in economy, which can further complicate tracing and containment. The takeaway is clear: pathogens do not respect seating boundaries, and in-flight transmission can occur anywhere in the aircraft.

Navy Aviation and High-Reliability Organizations

While serving as Fleet Surgeon at U.S. Navy Third Fleet, we worked on CBRN (Chemical, Biological, Radiological, and Nuclear) defense initiatives. These included shipboard surgical systems, isolation and quarantine procedures, and biological combat assessments—some involving drones with sensors 20 years before drone technology became widespread.

We also tested HEPA filters and UV systems aboard aircraft carriers and amphibious assault ships to prepare for bioweapon, bio-threat, or emerging infectious disease scenarios.

From my time at Naval Strike and Air Warfare Center (Top Gun) and Naval Special Warfare Command, I saw firsthand how high-reliability organizations like aviation adapt to spikes in mishaps. Using the Human Factors Analysis Classification System (HFACS) and James Reason's Swiss cheese model, we learned that multiple layers of protection must align to prevent disasters. When those layers break down and their "holes" line up, catastrophic failure can occur.

Medicine is not yet a high-reliability organization, but it can learn from aviation's approach to risk mitigation.

International Aviation Health Collaboration

As Chief Medical Officer for American Airlines, I served on the International Air Transport Association (IATA) Medical Advisory Group alongside physicians from airlines across the globe. We worked closely with the International Civil Aviation Organization (ICAO) and the Collaborative Arrangement for the Prevention and Management of Public Health Events in Civil Aviation (CAPSCA).

During COVID-19, these groups collaborated to harmonize international health protocols for air travel—a process akin to "herding cats" due to varying national regulations. We adapted Ian Mackay's terrestrial layered disease defense model to aviation, incorporating individual and shared responsibilities.

On the individual level, measures include self-assessment, physical distancing, mask use, hygiene, health declarations, and testing. Shared responsibilities include effective communication, aircraft design improvements, routine disinfection, passenger compliance monitoring, border control measures, and public health standardization.

One critical insight: no single measure is 100% effective. Stacking layers significantly improves defense. UV-C disinfection adds another valuable layer to this model.

How UV-C Works

UV-C light falls in the non-visible spectrum and has been used for more than 50 years to inactivate pathogens in settings like hospitals, operating rooms, prisons, and schools. It works against bacteria, mold, fungi, and viruses by damaging their DNA or RNA, preventing replication.

Concerns about UV safety often stem from misunderstanding. UV-C penetration is shallower than visible light and cannot penetrate the outer dead layer of skin or the tear film of the eye at safe exposure levels. Peak germicidal effectiveness occurs at approximately 265 nanometers—a wavelength we can now precisely target with modern UV-C LED technology.

Compared to older mercury-based UV systems, UV-C LEDs are more efficient, mercury-free, ozone-free, and capable of instant on/off control. This precision allows for safe, targeted pathogen inactivation without harmful byproducts.

Technical Presentation – Matt Saberton

Matt Saberton (AeroClenz):

Thank you, Dr. Kris, and good morning, everyone. I'd like to walk you through some of our UV-C LED disinfection platforms—our Adaptive system for terrestrial spaces and our Avive system for aircraft cabins—and share the science and engineering that make them uniquely effective.

Our goal at AeroClenz is simple: safe, healthy air and surfaces should be a standard, not a luxury.

Limitations of Traditional Systems

Let's start with the reality: HEPA filters inside HVAC ducts do an excellent job removing particulates, but as soon as the air exits the vents, it mixes with pollutants already in the occupied space. Much of the effort is lost.

The same is true for in-duct UV-C systems. They only treat the fraction of air passing through the ductwork, and their effectiveness is limited by airflow rates. If you're pushing minimal air through the ducts, you're not increasing air changes per hour.

Volumetric Disinfection – Our Approach

Our approach is volumetric disinfection—rapidly and continuously disinfecting large volumes of air and surfaces in the spaces where people actually breathe and touch. We aim to get as close to the source of contamination as possible.

Legacy UV-C lamps use mercury, which is an environmental and health hazard now being phased out worldwide under the Minamata Convention, with many U.S. states following suit. Some older UV systems also generate ozone, which can irritate the lungs and create secondary risks.

UV-C LEDs eliminate both concerns. As semiconductors, they offer precise spectral clarity, instant on/off control, no harmful byproducts, and no leakage of UVA or UVB rays. That precision lets us engineer systems that deliver maximum pathogen inactivation with zero mercury, zero ozone, and maximum safety.

Why 265 Nanometers Matters

You've probably heard the saying "sunlight is the best disinfectant." Outdoors, UVA and UVB contribute to pathogen inactivation but carry skin cancer risks with prolonged exposure. UV-C, the shortest UV wavelength, never reaches the ground because it's absorbed by our atmosphere.

At 265 nanometers—the peak germicidal wavelength—UV-C disrupts the DNA and RNA of viruses, bacteria, and fungi. Think of it like an opera singer hitting just the right note to shatter a wine glass: precise, powerful, and targeted.

Modern UV-C LEDs allow us to tune wavelength and dose with unprecedented accuracy, enabling systems like Adaptive and Avive to deliver safe, effective disinfection without the drawbacks of older emitters.

Avive System for Aircraft Cabins

In the image on the left, you see a Gulfstream cabin cross-section with two disinfection engines and triple-redundant human presence sensing—using LiDAR, passive infrared, and ultrasound. The primary “puck” sensor sits flush in the headliner at the cabin’s apex.

Engine 1: Dial Direct Radiance

- Runs continuously, cleaning air directly between an infected passenger and others.
- Operates at intensity levels comparable to brief outdoor exposure, far below safety thresholds.

Engine 2: Aisle Scrub

- Targets the main cabin airflow zone with a high-intensity UV-C beam.
- Double-redundant sensors and failsafe electronics ensure activation only when unoccupied.

Together, these engines boost the equivalent air changes per hour—similar to adding fresh water to an overcrowded fish tank.

Lavatory Module

- Activates air and surface disinfection when unoccupied.
- Pauses instantly when someone enters, then resumes automatically.

Adaptive System for Terrestrial Use

Our Adaptive system is designed for any indoor space.

Smart Disinfection Device

- Dual sensors (millimeter wave radar and passive infrared).
- Runs a full 10-minute cycle after detecting vacancy, achieving high log reductions including for hard-to-kill fungal spores.

Upper Room Disinfection Device

- Runs continuously, shining UV-C into a custom optic that spreads light in a 360° pattern above the breathing zone.
- Utilizes natural convection: hot air rises, is disinfected, then cools and sinks back down clean.

When both devices are used together and paired with our proprietary mapping process, they can achieve over 50 equivalent air changes per hour—something that would require an expensive HVAC upgrade to replicate.

Efficiency and Targeting

We partner with Bolb Inc. in Silicon Valley, which produces the most powerful and reliable UV-C LEDs on the market—lasting over 15,000 hours.

The emission spectrum of these LEDs is tightly focused around 265 nanometers with only ±3 nm variation. This means:

- Maximum germicidal efficiency.
- Zero wasted photons outside the disinfection band.
- No ozone generation.
- No harmful UVA/UVB output.

By engineering Adaptive and Avive around this precision wavelength, we ensure powerful, targeted pathogen inactivation—nothing more, nothing less.

Validation, Safety, and Real-World Results

Dr. Kris Belland (AeroClenz):

Because UV-C LEDs are relatively new—especially for ultraviolet light—most earlier studies were conducted using older mercury-based lamps. These systems have multiple drawbacks: higher costs, mercury hazards, and reduced efficiency. LEDs are the future.

Bolb Inc., one of our technology partners, set up a laboratory study to validate our systems.

Why Lavatories Matter

Restrooms have long been recognized as high-risk environments for pathogen transmission. Multiple studies have found detectable SARS-CoV-2 RNA on restroom surfaces, even after daily cleaning in hospital isolation wards.

During the COVID-19 pandemic, testing showed that viral RNA was consistently found in restrooms, despite the same patients spending time in other parts of the facility. Factors like flushing, coughing, and sneezing all contribute to aerosolization, making lavatories a hotspot for transmission.

Adaptive in Lavatory Testing

We installed an Adaptive unit above a test lavatory.

- Activation: Automatic, on-demand cycles after each use.
- Safety: Dual redundant occupancy sensors and a physical shutter ensure no exposure risk. Even if the shutter is open, exposure levels remain far below safety thresholds—safe enough for continuous presence, but programmed to shut off when occupied for extra precaution.
- Coverage: Disinfects both air and high-touch surfaces, suppresses odors, and can impact non-line-of-sight areas via air circulation.

Testing was conducted by an independent third party under standardized conditions. Petri dish results showed a marked reduction in pathogens with the system active compared to no UV-C treatment.

Lab Results

- Fungus: 99% reduction
- Bacterium E. coli: 99% reduction
- Staphylococcus aureus: 99% reduction
- Aspergillus niger (mold): 99% reduction
- SARS-CoV-2: 99.3% reduction within 10 minutes

Even more resistant spores can be significantly reduced with longer cycles. The flexibility of UV-C LEDs allows system cycles to be adapted to specific threats.

Demonstration Video

A demonstration video showed the system in action:

- When someone enters, the system pauses instantly.
- Once the lavatory is vacant, it automatically resumes disinfection.
- Multiple zones can be covered in a facility, from restrooms to hallways.

- This provides multi-layered protection, complementing manual cleaning and adding continuous, automated defense.

Audience Q&A

Jameson Trettenero (Moderator):
We have a couple of questions in the chat. Let's start with the first one: How does your technology compare to some of the large UV robots? I've seen some hospitals adopt those during COVID-19.

Comparison to UV Robots

Dr. Kris Belland (AeroClenz):

Great question. Remember, we talk about multiple layers of defense. I actually supported the early development of UV robots during COVID-19 because they provided an additional layer of protection.

However, robots have limitations:

- They can only be used when the space is unoccupied.
- Operators need protective eyewear.
- They must be moved in and out of rooms, adding time and labor.
- They can break down and require specialized maintenance.

In contrast, our systems operate automatically—like a smoke detector—working continuously in the background. They pause instantly when someone enters and resume as soon as the area is clear. This enables protection around the clock, without the logistical challenges of moving equipment.

Matt Saberton (AeroClenz):

I'll add to that. Robots and pushcarts generally use mercury vapor lamps, which are outdated. With semiconductors, we can control UV output as easily as you use a TV remote. LEDs last tens of thousands of hours compared to hundreds for mercury bulbs, and cost far less over time.

Our systems provide the same disinfection benefits as robots but operate automatically, continuously, and at a fraction of the cost—without human intervention.

Question 2 – How does this differ from UV-C in HVAC systems?

Dr. Kris Belland:
Another great question. I think HVAC-based UV-C is a good additional layer, but it only treats air moving through the ducts. It doesn't disinfect where people are actively breathing, talking, or coughing. Our systems operate in those occupied spaces, addressing contamination at the source.

Matt Saberton:
Exactly. We focus on volumetric disinfection in occupied zones. In-duct UV-C can't deliver the equivalent air changes per hour we achieve. It's also harder to verify if in-duct units are working without physically inspecting them. With our systems, performance is constant and visible.

Question 3 – Were these products demonstrated at the 2025 Aerospace Medical Association Conference in Atlanta?

Matt Saberton:
Yes. We showcased both our Avive and Adaptive systems at that event. A cornerstone of our company is customization—we design UV-C systems to meet the specific needs of each client, whether in an aircraft or a building.

Dr. Kris Belland:
Absolutely. I'm deeply connected to the Aerospace Medical Association and passionate about advancing aerospace medicine. Being part of that conference allowed us to share cutting-edge technology with leaders in the field. We value that relationship and hope it continues for years to come.

Closing Remarks

Jameson Trettenero:
That concludes our Q&A portion. Thank you, Dr. Kris and Matt, and thank you to the larger AMSUS team. Susan, I'll pass it back to you.

Susan (AMSUS):
Thank you, Jameson, and thank you to our presenters and audience. We hope to see you again at a future AMSUS event.

If you'd like to download the slides from today's webinar, they're available in the handout section of the control panel. If you'd like a copy of the recording link, email membership@amsus.org.

Enjoy the rest of your day, and thank you again for attending.