

ED-287A

GUIDANCE DOCUMENT ON AIRCRAFT CLEANING AND DISINFECTION

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FOREWORD

1. This document was developed jointly by EUROCAE Working Group 121 “WG Aircraft Cleaning” and RTCA SC-241 Cockpit and Cabin Cleaning and was approved by the Council of EUROCAE on 16 December 2021.
2. This document supersedes ED-287 Guidance Document on Aircraft Cleaning and Disinfection (December 2020).
The document has been updated to.
As compared with the previous version, the main changes are:
 - The new version corrected editorial and formatting issues from the previous version. Some of the wording was modified in some sections to facilitate better understanding of the technical concepts
3. This document is technically identical to RTCA DO-388A.
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CHAPTER 1

PURPOSE AND SCOPE

1.1 INTRODUCTION

This guidance document was developed as a response to the COVID-19 pandemic which has decimated the global aviation industry, and whose harmful effects are still being realized. The aviation industry recognizes that the development and adoption of guidance on the cleaning and disinfecting of aircraft can make positive contributions to the safety and wellbeing of aircraft occupants, and help increase confidence in air travel as a mode of transportation in response to current COVID-19 pandemic and possible future health events.

The target audience of this guidance document is aircraft operators and any third party contractors that provide cleaning, and disinfection trained personnel, equipment, products, or services for aircraft interiors. Its purpose is to provide an internationally agreed upon set of principles for the proper cleaning, sanitization and disinfection of commercial aircraft and covers aircraft interiors such as passenger cabin, galleys, lavatories, crew rest areas, cargo compartments and the flight deck.

The guidance summarizes the aviation industry's current best practices, known technologies, and options for equipment for eliminating pathogenic germs (e.g. viruses, bacteria, etc.) in the air and on contact surfaces. This guidance provides valuable information for development of appropriate procedures and applicable training for cleaning personnel, maintenance personnel, and pilot and flight attendant crewmembers.

While this guidance covers aircraft cleaning and disinfection in general, in-flight disinfection practices will involve consideration of additional factors not explicitly addressed in this document.

NOTE: Please refer to available industry guidance in Appendix A for the additional information on in-flight cleaning and disinfection: US CDC Preventing Spread of Disease on Commercial Aircraft: Guidance for Cabin Crew Preventing Spread of Disease on Commercial Aircraft: Guidance for Cabin Crew, IATA Suspected Communicable Disease Guidelines for cabin crew

The guidance is intended to be updated in the future as new and improved methods of eliminating pathogens are developed.

1.2 ASSUMPTIONS

This guidance document does not and is not intended to describe all of the measures to be used to kill pathogens in the air or on contact surfaces. Rather, it provides a description of additional measures which operators and labor can use in this regard as part of a layered approach to mitigate the harmful effects of a pandemic or seasonal viruses, such as influenza. It builds upon recommendations of the World Health Organization and individual State health and safety organizations to combat viruses, such as COVID-19, including physical distancing, wearing a mask, washing hands frequently, and not traveling when feeling ill. Vaccines, if available, may also be utilized.

1.3

DEFINITION OF TERMS

Airborne (diseases) means: The spread of an infectious agent caused by the dissemination of droplet nuclei (aerosols) that remain infectious when suspended in air over long distances and time;

Aerosol means: A colloidal suspension of particles dispersed in air or another gas;¹

Aircraft means: Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions against the earth's surface;²

Airport means: A complex of runways and buildings for the take-off, landing, and maintenance of civil registered aircraft with facilities for passengers;¹

Asymptomatic means: An infected person who does not develop symptoms;

Bacteria means: Any various groups of unicellular micro-organisms lacking organelles and an organized nucleus some of which can cause disease;¹

Cabin means: A room or compartment in an aircraft for passengers or crew;¹

Cabin Crew means: A crew member who is qualified to perform, in the interest of safety of passengers, duties assigned by the operator or the pilot-in-command of the aircraft, but who shall not act as a flight crew member;²

Cargo means: The goods or merchandise carried in a ship, aircraft, or vehicle;¹

Clean in this document means: The first step in the disinfectant process, and is defined by the removal of visible dirt or particles through mechanical action;³

Coronavirus means: A large family of viruses which may cause illness in animals or humans;⁴

Crew Member means: A person assigned by an operator to duty on an aircraft during a flight duty period;²

Communicable disease means: An illness due to the transmission of a pathogen from an infected person, animal or inanimate source to a susceptible host, either directly or indirectly.

COVID-19/SARS-CoV-2 means: An infectious disease, first discovered in 2019, caused by a novel coronavirus SARS-CoV-2;

Dangerous Goods means: Articles or substances which are capable of posing a risk to health, safety property or the environment and which are shown in the list of dangerous goods in the Technical Instructions or which are classified according to those instructions;²

Disinfection means: The procedure whereby health measures are taken to control or kill infectious agents on a human or animal body, in or on affected parts of an aircraft, baggage, cargo, goods or containers, as required by direct exposure to chemical or physical agents;² Disinfection procedures can be routine or event-driven;

Disinfectant product means: A commercially produced chemical liquid or spray that destroys germs;¹

Dwell means: Continue for a time in a place, state or condition;¹

¹ Simpson J., et al, "Oxford Dictionary Second Edition", Oxford University Press, 30 March 1989

² International Civil Aviation Organization, "Cabin Crew Safety Training Manual (Doc 10002)", second edition, 2020 (URL: https://portal.icao.int/icao-net/ICAO%20Documents/10002_cons_en.pdf)

³ International Air Transport Association, "Aircraft cleaning and disinfection during and post pandemic", edition 1, 19 June 2020 (URL: <https://www.iata.org/contentassets/5d42ffd2b6ee43a8963ee7876584de5a/aircraft-cleaning-guidance-covid.pdf>)

⁴ World Health Organization, "WHO Q&A", [web site] URL: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/q-a-coronaviruses> [cited December 2020]

Face Covering/Medical Mask means: Covering the mouth, nose and chin ensuring a barrier that limits the transmission of pathogens. It should be worn, consistent with applicable public health guidelines and in accordance with ICAO Cart Take Off guidance. Face coverings refer to non-medical masks made from a variety of fabrics and excludes professional medical masks. Note that industrial N95 masks are considered to be non-medical masks. Medical masks refer to professional medical masks worn by healthcare workers - also referred to as surgical masks or medical N95 respirators;

Flight Crew Member means: A licensed crew member charged with duties essential to the operation of an aircraft during a flight duty period;²

Flight Deck means: The part of an aircraft where the pilot or navigator perform their duties;¹

Galley means: The kitchen of an aircraft;¹

Health Screening means: A system of checking for the presence or absence of a disease;¹

Helicopter means: A type of aircraft without wings, obtaining lift and propulsion from horizontally revolving overhead blades or rotors;¹

Ionization means: The process of producing ions as a result of solvation, heat or radiation;¹

Pathogen means: An agent causing disease;¹

Pandemic means: An epidemic occurring worldwide, or over a very large area, crossing international boundaries and usually affecting a large number of people;

Passenger means: A traveller in a public or private conveyance;

Personnel means: Any person performing cleaning and disinfection operations and/or any person involved in cleaning and disinfection process as identified by the company Risk Assessment;

Physical/Social Distancing means: A public health measure to limit the spread of a disease by having individuals keep at least a specified distance from each other at all times to limit spread of the disease-causing pathogen; For COVID-19, the recommended minimum distance is 1 to 2 meters, depending on the advice of the national health authorities;⁵

Public Health means: Health services such as immunization, preventive medicine that are provided by a government and intended to improve the general health of citizens;¹

Quarantine means: Isolation imposed on persons or animals that have arrived from elsewhere or have been exposed to, and might spread, infectious disease;¹

Sanitize means: Make hygienic or thoroughly free from germs;¹

Symptomatic means: A change in the physical or mental condition of a person, regarded as evidence of a disorder;¹

Thermal Disinfection means: Thermal disinfection relies on heat (dry or moist) that is applied at or above the recommended temperature to all parts of the organism for the recommended time. The time needed to kill or disable organism depends on the organism type and the disinfection procedure;⁶

⁵ World Health Organization, "COVID-19: physical distancing", [web site] URL: <https://www.who.int/westernpacific/emergencies/covid-19/information/physical-distancing> [cited December 2020]

⁶ Royal Melbourne Institute of Technology and Melbourne Technical College, "Cleaning and disinfecting equipment", [web site] URL: https://www.dlsweb.rmit.edu.au/Toolbox/infection/content/lr_cleaningdisinequip/003_thermal.html [cited December 2020]

1.4

ACRONYMS

ACI: Airport Council International
A4A: Airlines for America
AHM: IATA Airport Handling Manual
APU: Auxiliary power unit;
AOSHR: Aviation Occupational Safety and Health Regulations;
ASME: American Society of Mechanical Engineers;
CAA: Civil Aviation Authority;
US CDC: Centers for Disease Control and Prevention;
US DHS: Department of Homeland Security;
US DOE: Department of Energy;
US DOL: Department of Labor;
US DOT: Department of Transportation;
EASA: European Union Aviation Safety Agency;
ECDC: European Centre for Disease and Prevention and Control;
EFB: Electronic Flight Bag;
EPA: United States Environmental Protection Agency;
ECS: Aircraft Environmental Control System;
FAA: Federal Aviation Administration;
GHS: Globally Harmonized System
GPU: Ground Power Unit;
GSE: Ground service equipment;
HEPA: High-efficiency particulate air;
HHS: Department of Health and Human Services;
IATA: International Air Transport Association;
ICAO: International Civil Aviation Organization;
IFE: In-flight Entertainment Unit;
IGOM: IATA Ground Operations Manual
IHR: International Health Regulations;
NIOSH: National Institute for Occupational Safety and Health;
NPBI: Needlepoint Bipolar Ionization;
NRC: National Research Council;
OEM: Original Equipment Manufacturer;
OSH: Occupational Safety and Health;
US DOT OST: Office of the Secretary of Transportation;
PPE: Personal Protective Equipment;
RNA: Ribonucleic Acid;
SDS: Safety Data Sheets;
SMS: Safety Management Systems;
SRA: Safety Risk Assessment;
STC: Supplemental Type Certificate;
TC: Type Certificate
TCCA: Transport Canada Civil Aviation;
TOR: Terms of Reference;
UPK: Universal Protection Kit;
US: United States of America;
UV: Ultraviolet Light;
UVGI: Ultraviolet Germicidal Irradiation; and

WHO: World Health Organization;

1.5

ROLES

The guidance in this document reflects one aspect of a multi-layered approach to support protecting travelers and workers from a communicable disease or other pathogen, and a decrease in the risk of transmission of any disease. A collaborative approach between aircraft operators, civil aviation authorities, aircraft manufacturers, public health and environmental authorities, aircraft lessors (if applicable), suppliers, employee work groups, and some product manufacturers is required to support an effective response by: evaluating the health hazard or pathogen;

1. evaluating the health hazard or pathogen;
2. developing strategies for combating or reducing the transmissibility of the pathogen such as by cleaning and disinfecting;
3. determining the procedures or products that are effective in killing the pathogen;
4. ensuring that the procedures or products selected are safe and do not result in an additional safety hazard to the aircraft components or structure of the aircraft;
5. ensuring that the application or use of the products do not cause any health hazards to those applying the products or other occupants of the aircraft environment that may be exposed to the product;
6. providing education and training to employees and contractors on the pathogen itself, specific occupational exposure precautions for any procedures or products used to reduce or prevent the further spread of pathogens in the aircraft environment including air and aircraft interior surfaces, and exposure information on any related hazards; and
7. determining (assess/estimate) the implications and impact of the approach to the airline operations (e.g. impact on turnaround times, costs etc.).

While much of the burden of the items listed above will fall to the aircraft operator to develop the protocols and procedures for addressing any pandemic event, working with other organizations is imperative for success.

It is unrealistic to assume an aircraft operator will have the expertise related to various health hazards or pathogens. Therefore evaluating the hazard requires the aircraft operators to utilize the guidance of official organizations such as the World Health Organization (WHO), the European Centre for Disease Prevention and Control (ECDC), and the US Centers for Disease Control and Prevention (CDC). Communication with other stakeholders such as the International Air Transport Association (IATA), Airlines for America (A4A), or Airports Council International (ACI) Group can provide additional organization sources to help evaluate and develop strategies for mitigating any potential health hazard in air travel.

Much of the document below provides suggested guidance on the issue of developing strategies, determining procedures, and selecting products to limit infection and transmission of the pathogen via either surfaces or airborne. However, like understanding the pathogen, the aircraft operator needs to address the development of strategies and procedures with multiple stakeholders. In order to ensure that either the processes or products do not compromise or affect the functionality of the aircraft structure, system or components, the recommendations of the aircraft manufacturer should be followed. The aircraft environment is different than other work or recreational environments. The aircraft interior is a safety critical environment and, therefore, caution should be exercised when determining procedures or selecting products to ensure their suitability for aircraft use.

Creating the initial response to the health hazard also requires collaboration with the employee or contractor stakeholder representatives. Suggesting a practice or process that cannot be accomplished by those stakeholders does not support protecting public health. Likewise, as mentioned in the section on risk-based approaches the processes and products utilized must be continuously analyzed and changes to the mitigation measures may be required based on any new risks that may not have been evident in the early processes of developing the procedures or selecting products. This process requires an active evaluation feedback loop.

1.6 FUTURE WORK AND CONSIDERATION

This guidance is considered by SC-241 to be a “living” document to be updated in the future as circumstances and needs indicate. It is based on the best practices and technologies available, but these change over time. The COVID-19 pandemic has demonstrated that preparedness for future pandemics, and perpetual attention to cleanliness and disinfection are essential for the airline industry.

CHAPTER 2

CONSIDERATIONS FOR PRODUCTS AND APPLICATIONS

2.1 SAFETY RISK ASSESSMENT

The COVID-19 pandemic, which prompted the development of this document, will likely be different from diseases/pandemics of the future, which may require different products and methods to mitigate their transmission. Any new products or procedures to combat future pathogens or communicable diseases must begin with a Safety Risk Assessment (SRA) to evaluate a proposed response.

Safety Management Systems (SMS) are key to identifying, addressing, and reducing organizational and systemic risks. An established SMS as published by a governing regulatory agency or ICAO should be used. SMS is supported through traditional data collection as well as understanding the impacts of organizational culture and policies regarding safety. The goal of these programs is to identify active failures and inadequate defenses so that hazards can be contained while preventative measures can be reinforced. The SMS adds value to an organization's safety structure by identifying hazards and mitigating risks before they develop into full accidents. The programs are complex and require assessments of human factors and their relation to other workplace components. A successful SMS incorporates a collaborative effort between the organization, their regulator, labor organizations, manufacturers, and other stakeholders to build a robust and diverse team. The team's objective is to leverage data and knowledge to collectively build risk assessments and design systemic improvements and support a positive safety culture.

2.1.1 Tracking and Testing

The Safety Risk Assessment (SRA) process is a critical segment of SMS because it examines the individual factors that contribute to the overall system and reviews both the frequency and severity of undesired outcomes for mitigation. Safety risk assessments typically begin with the overall system analysis, followed by hazard identification. Each hazard should be analyzed by utilizing both qualitative and quantitative data, and assigned a value based on the likelihood and severity of the hazard. From this stage the team should determine the need for risk control development based on the results of their assessment and develop feasible mitigations. This stage should also include a plan to monitor and assess the mitigations for effectiveness, which fits into the Safety Assurance segment of SMS and is an integral part of the closed loop process. This would include inspection intervals to ensure no detrimental effects have occurred from either the original use or repeated use of any chemical or non-chemical process. Tracking and testing should include a venue for employee reporting.

2.1.2 Employee Reporting – Monitoring and Effectiveness

When conducting the SRA phase, a team of subject matter experts composed of stakeholders from all organizations and affected departments should include variables such as organizational culture, current workforce demographic, and human factors. This may affect how personnel interact when safety precautions such as Personal Protective Equipment (PPE) are utilized. Other inadvertent hazards brought on by the introduction of changed cleaning or disinfecting procedures should be considered in the risk assessment and could include, but are not limited to condensed turnaround time, sensitivities to chemicals, and other operational changes. Even if items are deemed as an acceptable risk, data and reports from the front line should be continuously gathered to ensure the risk stays at an acceptably low level. Additionally, the safety risk assessment should consider the local legislation and guidance from the regulator or health organizations for effective ways to mitigate known risks. This process for addressing and controlling risk is an industry standard for all aspects of the operation and supporting documents and guidance have been published by international agencies

such as ICAO. These supporting documents provide detailed information to build a successful SMS and conduct a thorough risk assessment.

2.2 OCCUPATIONAL SAFETY AND HEALTH

2.2.1 General

Occupational Safety and Health (OSH) measures should be implemented to protect personnel, including any inflight personnel, performing disinfection operations. Proper training of employees will also ensure the effectiveness of any cleaning or disinfecting products or processes. This would include proper personal protection including proper training and use of Personal Protective Equipment (PPE), understanding the risk of exposure to any specific pathogens as well as other risks associated with disease outbreak, epidemic or pandemic situations. It is also necessary to evaluate any adverse health effects of persons in the area of the disinfection process, or if the process could result in any residual substance that could be harmful to occupants.

As noted in the section above, workplace risks need to be assessed and mitigated in accordance with the company's Safety Management System (SMS) and/or Risk Management as well as all applicable legislations and health authorities' guidelines pertaining to disease outbreak, epidemic or pandemic situations. It is important to update company risk assessments and check systematically if all risks have been addressed and taken all the necessary measures to respond to disease outbreak, epidemic or pandemic situations.

During disease outbreak, epidemic or pandemic situations all personnel, not just those performing disinfection operations, can be exposed to various new risks such as the possibility of infection and illness.

2.2.2 Personnel Protection

Cleaning and disinfection should always be carried out by qualified personnel.

To protect personnel from the exposure to pathogens it might be necessary to implement a multilayered approach as suggested below. The level of protection should be risk assessed and evaluated on a case-by-case basis. The following list represents areas to be taken into consideration:

- Enhanced hygiene routines
- Physical distancing during job and breaks
- Limitation of exposure
- Personal Protection Equipment (PPE)
- Syndrome recognition, testing and health screening
- Enhanced environmental controls

For protection of personnel from risks associated with disinfection methods, e.g. the disinfectant being used, and the device being operated, please see sections 3.2 Chemicals and 3.3 Non-chemicals.

Relevant and effective PPE should be provided to all personnel performing disinfection operations to perform the job safely, to prevent contamination of other areas and other individuals, as well as to minimize occupational health and safety risks.

It is essential that PPE types and procedures for use by the aircraft personnel performing or overseeing disinfection operations are reviewed and amended based on the risk of exposure and the transmission dynamic of pathogens, regulatory requirements related to pandemic, changes in cleaning and disinfection methods, changes of chemicals used as per product manufacture's safety data sheet recommendations and other changes from the previous procedures.

2.2.3 Education Related to Disease Outbreak, Epidemic or Pandemic Situations

Guidance should be provided to personnel on the preventive health measures to eliminate risk of exposures to pathogens such as:

- Hygienic behaviours such as physical distancing, hand hygiene, respiratory etiquette
- Proper use and proper disposal of PPE

- Avoidance of contact with people presenting any sickness to reduce or prevent the further spread of pathogens symptoms
- Seeking medical advice early if signs and symptoms develop and not reporting to work if sick
- Process to report concerns (e.g. feedback forms to improve process)
- Specific characteristics of the pathogen including symptoms and impacts,
- Outcomes of disease outbreak, epidemic or pandemic management
- Any regulatory requirements and any specific health guidance
- Any health/quarantine restrictions specific to the pathogen, including required paperwork implemented by a countries' immigration or health authority.

2.2.4

Training for Personnel

Personnel performing cleaning and disinfection operations should be competent to perform cleaning and disinfection tasks with the specific chemicals and equipment in use. Each person should be provided with initial training before starting the job and with recurrent training within the recurrence period as per regulatory requirements or as defined by the company. The training should be relevant to duties and tasks performed. Personnel providing cleaning and disinfection in the flight deck may be required to receive special training.

Additionally, personnel performing disinfection operations need to understand and apply disinfection processes and tasks that will ensure the effectiveness of the disinfecting products and procedures to reduce or prevent the further spread of pathogens, these may include:

- Disinfection methods, tasks and disinfection products as per aircraft operator instructions. These personnel may also require specialized hands-on training on the product or procedure especially if recommended by the product manufacturer or as noted by the operator's SRA.
- Use of the proper PPE to prevent contamination of other areas to minimize occupational health and safety risks to other personnel.
- Regulatory and airlines requirements related to disease outbreak, epidemic or pandemic as applicable.
- Event-driven and non-routine disinfection procedures see section 3.1.3 for additional information.
- Application of disinfectant in such a manner that follows manufacturer's instructions for use and meets manufacturer's and/or regulatory application guidance such as temperature, humidity, or wetted contact time requirements.

CHAPTER 3

PRODUCTS AND APPLICATIONS

3.1 GENERAL REQUIREMENTS

Infection control and prevention requires a disruption of the transmission of a pathogen. Understanding the different routes of disease transmission is imperative for an informed, multi-layered approach to mitigate the health hazard. Transmission of pathogens can be by different routes: direct contact, fomite, aerosol (airborne), oral (ingestion), or vector-borne.

Understanding of the pathogen can help operators make an informed selection of disinfection products relevant to the pathogen and its transmission path while at the same time taking into consideration the unique environment of the aircraft. Just as important as selecting the correct product, the product or application method chosen must not compromise, damage, or adversely affect the functionality of the aircraft structure, systems or components.

APPENDIX A lists the multiple documents used to develop this paper. Many of those documents used the terms “cleaning” and “disinfection” interchangeably. While this document’s focus is related to product selection and procedures relevant to disinfection, it is necessary to clarify the similarities and differences in the two important processes needed to break the pathogen transmission route.

3.1.1 Pathogens

In the past, aviation has needed to respond to health events like Severe Acute Respiratory Syndrome (SARS), Swine Influenza A (H1N1), Ebola, and Zika virus. The current threat pathogen, SARS-CoV-2, has been identified as either present on surfaces or in aerosol form with both chemical and non-chemical processes being utilized against the SARS-CoV-2 virus. Different agencies in the US and internationally have evaluated the toxicity and health implications of chemicals in other work places. Non-chemical approaches, including solutions currently in use and emerging solutions in development, vary in terms of description (equipment, processes, procedures) and documented efficacy.

Sections 3.2 and 3.3 provide more detailed information on both chemical and non-chemical approaches to combating pathogens, including evaluating their effectiveness and use in the aircraft.

Specific pathogen characteristics are beyond the scope of this guidance and those data should be made available through agreed sources, such as the US CDC, WHO and other resources. Likewise, a specific disinfectant product or procedure related to the effectiveness against a pathogen, or the specific disinfection frequency is beyond the scope of this guidance. As noted above, an SMS process should be followed for evaluating both chemical and non-chemical processes and disinfection frequencies based on the information gathered from the multiple sources including the respective health organizations, aircraft manufacturers and others as appropriate.

3.1.2 Cleaning

Cleaning is an important first step in the disinfection process. Cleaning as defined by the IATA Ground Operation Manual (IGOM) is the removal of visible dirt or particles through mechanical action. During a pandemic, general cleaning procedures are still a best practice, but may need to be conducted more frequently or the process adjusted. Cleaning and disinfection can be combined into one process if disinfectants are used during the cleaning. There are a number of considerations for an effective cleaning procedure:

- Cleaning personnel require proper training in correct cleaning procedures to safely clean without damaging the aircraft or harming themselves or others.