ALPA WHITE PAPER
AIR LINE PILOTS ASSOCIATION, INTERNATIONAL
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INTRODUCTION

This paper addresses the current practice of sharing oxygen masks among multiple users both in aircraft cockpits and in training simulators. These procedures may place pilots at increased risk for contracting transmissible disease. The risks arise due to the mask's inherent inability to be properly disassembled and cleaned between users. This concern exists not only in the aircraft but is of great concern in the simulator as well. After a formal request was made to the National Institute of Occupational Safety and Health (NIOSH), an expert opinion was issued by NIOSH that invites the airline industry to consider the serious consequences that can arise by maintaining the status quo. With the current threats associated with the swine flu (H1N1) pandemic and a forecast of additional pandemics on the horizon, we, as an industry, must move *swiftly* to ensure we are not unnecessarily risking pilot lives and contributing to the spread of disease.

Current procedures deny pilots a very basic level of hygiene in the workplace. For example, directives are issued to wash hands frequently and to avoid sharing pillows or blankets during rest breaks. Yet somehow, it has become completely acceptable to share an intimate piece of medical equipment among thousands of users without ever properly disinfecting the device. Pilot users could harbor a virus or life-threatening bacterial infection without exhibiting any symptoms. Since various pathogens can live for weeks on a hard surface, by using the mask during the incubation period, the illness can be unknowingly transferred to the next user.

We currently live in an age of pandemics. As noted by leading epidemiologist Larry Brilliant, **Chairman of the National Biosurveillance Advisory Subcommittee**:

> *"The 2009 swine flu will not be the last and may not be the worst pandemic that we will face in the coming years. Indeed, we might be entering an Age of Pandemics. In our lifetimes, or our children's lifetimes, we will face a broad array of dangerous emerging 21st-century diseases, man-made or natural, brand-new or old, newly resistant to our current vaccines and antiviral drugs. You can bet on it. Naturally occurring diseases with pandemic potential are much more ubiquitous and more certain to occur. Over the last decades, we have seen more than three dozen new infectious diseases appear, some of which could kill millions of people with one or two unlucky gene mutations or one or two unfavorable environmental changes."*[1]

CONCERNS

An infectious outbreak could destroy the airline industry in short order. We must take every conceivable precaution to mitigate these risks. Below is a short list of several health concerns that may be communicable through the sharing of oxygen masks.

[1]Brilliant, Larry. *The Age of Pandemics*. May 7, 2009.
http://www.edge.org/3rd_culture/brilliant09/brilliant09_index.html

- ***Tuberculosis (TB)***—Already a worldwide pandemic. Two billion people are infected with the bacilli, 10 percent will become sick. Highly contagious and becoming multi-drug resistant. People can harbor the bacteria for years before being triggered. Can be fatal.

- ***Methicillin-resistant staphylococcus aureus (MRSA) bacteria***—Deadly bacteria that has spread outside hospitals into the community. MRSA now kills more people than AIDS annually.[2] A rapidly spreading infection that can cause amputation and death. MRSA bacteria can live for weeks or months on a hard surface.
- ***Influenza***—Swine Flu (H1N1) and Bird Flu (H5N1): Both are easily acquired through contact with respiratory droplets. H1N1 can live for two to eight hours on a hard surface. Both potentially fatal.

- ***Meningitis***—Spread by exchange of respiratory and throat secretions. Bacterial infection is more severe and can cause brain damage, hearing loss, limb amputation, or death. The Centers for Disease Control (CDC) recommends not sharing eating utensils or water bottles to avoid transmitting the bacteria, which prevention can be extrapolated to include oxygen masks since respiratory fluids will remain after use.

- ***Various Bacteria***—Other various bacteria found in the environment are becoming increasingly resistant to antibiotics such as *c. difficile* or *pseudomonas aeruginosa*, which are opportunistic when a person's immune system is compromised. Pilot immune systems are constantly under assault from lack of circadian rhythm, radiation, stress, pesticides and chemicals used in aircraft, foreign environments, etc. Vulnerability escalates.

- ***Mold***—According to the oxygen-mask manufacturer, mold growth can be a serious health risk because bacteria can quickly reproduce on the surface of a moisture-laden mask or cannula.[3] Mold can be forced deep into the lungs during use to cause serious health problems.

- ***The Unknown***—Above is a partial list of the known threats at this time. The pathogenic landscape continues to morph daily. Time is of the essence. The World Health Organization predicts a strong resurgence of swine flu in North America during the fall and winter months.

While there are currently no regulations pertaining to the reuse of oxygen masks, logic dictates that the health risks associated with the sharing of respirators (which are regulated) would apply equally to oxygen masks.

[2]*HIV/AIDS Surveillance Report: Cases of HIV Infection and AIDS in the United States and Dependent Areas, 2007*. Centers for Disease Control.

[3]*Press Release – Aerox Product Information,* May 2008. www.aerox.com

NIOSH/CDC RECOMMENDATIONS

Below are the official recommendations of NIOSH/CDC in response to the aforementioned request for guidance.[4] The agency forbids the sharing of respirators between multiple users without following a six-step disassembly and disinfection process ***each time*** between users. The respirator must be disassembled and immersed in a disinfectant solution in order to reach all crevices. Currently, aviation oxygen masks cannot be disassembled to this degree due to electronics and microphone. Solutions to this dilemma are indeed possible and must be given the highest priority.

> *From the review of the literature, it appears that respirators could be a source of exposure to infectious agents [Rengasamy et al. 2004]. However, oxygen masks are not considered by definition to be respirators (devices to protect wearers from harmful contaminants) and, therefore, are not covered under the current regulations pertaining to respirators. Respirators are required to be cleaned before reuse under the U.S. Department of Labor, Occupational Safety and Health Administration respirator standard (CFR 1910.134 App B-2). I have included a copy of the NIOSH publication "Suggested Respirator Cleaning and Sanitation Procedures" (http://www.cdc.gov/niosh/respcln.html), which addresses devices shared by multiple users. In our discussions, you pointed out that the oxygen masks have built-in microphones that cannot be immersed in cleaning solutions. The ideal solution would be to redesign the oxygen masks to have removable microphones that can be cleaned separately, and then the oxygen masks can be cleaned in the same manner as respirators. The manufacturer needs to be consulted to determine the type of decontamination agent to use to prevent damage to the oxygen mask components.*
>
> *In the interim, because the oxygen masks cannot be immersed, they should be thoroughly washed with soap and water and then wiped down with a disinfectant recommended by the manufacturer before donning. Supplying each pilot with his or her own oxygen mask would reduce the potential for exposure to infectious agents; however, the masks may not be compatible with the oxygen systems on different airplanes and would still require cleaning. For training purposes, a disposable oxygen mask could be used to reduce the potential for exposure and eliminate the need to clean the oxygen masks between training sessions.*
>
> *In order to reduce the spread of viral and bacterial agents in the workplace, the importance of hand washing, staying home when you are ill, and covering your nose and mouth during sneezing/coughing needs to be stressed in pilot training programs.*

The CDC also recommends that employees stay home when sick. This would be ideal; however, in the airline industry there are complicating factors. Frequently, a pilot will feel normal

[4]Burton, Nancy C., PhD, MPH, CIH Industrial Hygiene Team Leader Hazard Evaluations and Technical Assistance Branch. Letter of Health Hazard Evaluation. National Institute for Occupational Safety and Health. July 10, 2009.

upon reporting for work and not begin to show adverse symptoms until well into the flight. If the flight is international, the pilot will often press on so as not to be hospitalized in a foreign country or disrupt airline operations. Due to the current economic climate, increased scrutiny of pilot sick leave usage also contributes to questionable decisions to report to work. These factors skew self-assessment of the health condition and also contribute to the potential spread of disease.

Adding to the list of health concerns is the fact that the inside of the mask supply hose is an oxygen-rich, dark, moist environment that may contain significant bacterial growth. Upon dissection of the hose, a loose powder type of material has frequently been found. This powder can then be forced into the lungs during initial breathing through the mask. Oxygen supply hoses are *never* cleaned after installation in the aircraft. This is an unsanitary practice that needs immediate attention.

One last point needing to be addressed is the use of the disinfectant wipe. Disinfectant wipes are somewhat effective against most viruses when they are reachable. However, as it relates to the oxygen mask, its effectiveness is limited due to the need to subject the mask to the wet solution for an adequate time period. Further, the microphone (where respiratory fluids accumulate) and the inside of the oxygen supply hose are completely inaccessible to the disinfectant. Compounding the problem is the fact that the active ingredient in many disinfectant wipes—benzalkonium chloride (BC)—has been shown to be a factor in creating super bacteria that are becoming more resistant to antibiotics. Allergic reactions have also been reported with continuous long-term use in sensitive users especially on mucous membranes.[5] Unfortunately, the wipes are less effective against certain types of bacteria. Gram-positive bacteria are generally more susceptible than gram-negative bacteria to BC.[6] Finally, there is also concern that the wipes have the potential to merely spread the pathogen to a wider area when wiping.

TWO-PART SOLUTION

1) ***Simulator***—A disposable version of the mask designed for simulator use is the easiest solution for the training environment. The oxygen mask is most infectious immediately after a previous user doffs it and it is still wet. A simulator version of the mask is currently under design featuring disposable paper. This insert would be replaced with each training session. Versions of a disposable mask have already been submitted for patent and should be available in short order. This would be a much more sanitary practice and could conceivably affect statistical sick leave usage after a stressful training event. FAA action to require the use of disposable masks for the simulator environment is of the highest urgency. In light of the current pandemics and other significant health risks to pilots, training scenarios requiring the use of the mask in the simulator should be suspended until the disposable mask system is implemented.

[5]Levy, Stuart B. Tufts University School of Medicine. "Antibacterial Household Products: Cause for Concern." Presentation from the 2000 Emerging Infectious Diseases Conference in Atlanta, Georgia. http://www.cdc.gov/ncidod/eid/vol7no3_supp/levy.htm

[6]http://www.statemaster.com/encyclopedia/Benzalkonium-chloride

2) ***Aircraft***—Changing the FARs to eliminate the requirement for a pilot to wear the mask below FL 410 when a single pilot is at the controls is the most sensible and cost-effective solution for the aircraft.

- FAR Part 121.333(c)(3) states, "Not withstanding paragraph (c)(2) of this section, if for any reason at any time it is necessary for one pilot to leave his station at the controls of the airplane when operating at flight altitudes above flight level 250, the remaining pilot at the controls shall put on and use his oxygen mask until the other pilot has returned to his duty station."

- Boeing and Airbus have collected data since the 1950s over millions of flight hours regarding rapid depressurizations above FL 250. Since that time, there has been only a handful of incidents, none of which had an adverse outcome due to pilot physiology. The statistical probability of rapid depressurization is miniscule, yet the resultant risk to pilot health from sharing contaminated oxygen masks is enormous.

- According to JAR-OPS 1.770 Supplemental Oxygen Pressurized Aeroplanes, there is no requirement to don the oxygen mask when a single pilot is at the controls below FL 420. In addition, Section 605.32(3) of the Canadian Aviation Regulations states that "the pilot at the flight controls of an aircraft shall use an oxygen mask if (a) the aircraft is not equipped with quick-donning oxygen masks and is operated at or above flight level 250; or (b) the aircraft is equipped with quick-donning oxygen masks and is operated above flight level 410." This rule only applies to the European and Canadian equivalents of U.S. Part 121 operations. Harmonization in the industry needs to be addressed. Clearly, the European Union and Canada have interpreted the research to indicate that their procedure is safe. Time of useful consciousness (TUC) averages 16–17 seconds at FL 410. This is actually a significant period of time when the pilot's adrenaline is elevated. Consistency in the industry is a desirable goal but non-U.S. pilots flying in U.S. airspace are using a different set of rules.

- Leaving the mask stowed in the box would also produce the added benefit of avoiding an inadvertent oxygen leakage event that goes unnoticed until the oxygen supply has emptied. Many aircraft do not warn of leakage until the oxygen supply is exhausted. Less wear and tear on the mask would be another positive result of keeping it stowed, and less oxygen leakage in and out of the box would yield significant cost savings in parts and routine maintenance.

- The practice of keeping the mask stowed would also decrease the stuck microphone events that occur due to improper replacement stowage of the mask.

- During ETOPS and polar operations with a double-augmented crew, it is critical that oxygen bottle pressures remain maximized so as to be available in the event of smoke or some other emergency requiring oxygen. A crew of four would not have

the lifesaving oxygen available to pilot the aircraft to a safe landing if significant amounts of oxygen had previously leaked or was wasted due to donning and stowing the mask multiple times. Amending the FARs to mirror rules in Canada and the European Union would actually increase the safety margin by keeping oxygen reserve levels maximized.

- Security would also be enhanced on two-pilot aircraft when the cockpit door is open by not having the single pilot encumbered with mask equipment. This equipment reduces pilot visibility of a terror threat with the cockpit door open. Hearing, mobility, reaction speed, and ability to verbalize a warning to other crewmembers in an attempted cockpit breach are also degraded while encumbered with the mask.

- Lastly, compliance with NIOSH/CDC suggestions would afford pilots the basic hygiene granted to other Americans in the workplace. Healthy pilots who are not spreading pandemic disease are critical during these times.

If an actual aircraft emergency required the use of the mask, the pilot would enter a maintenance write-up for the mask to be removed and sanitized. Mask redesign to allow disassembly and immersion in disinfecting solutions would be one approach to the issue. Science is dynamic, therefore other methods of disinfection that do not require disassembly are currently being researched and look promising.

RECOMMENDATIONS

1. The Federal Aviation Administration should provide an immediate exemption to the FAR 121.333(c)(3) regarding oxygen-mask usage in Part 121 operations that, as described above, would result in several positive outcomes:

   - Harmonization with European and Canadian regulations
   - Less risk of pilot illness or death due to transmissible disease
   - Cost savings for airline operators due to equipment maintenance and oxygen usage
   - Increased safety factor by decreasing the chance of inadvertent oxygen depletion and raising awareness
   - Increased security and ability to defend cockpit from a breach

2. The FAA should amend FAR Part 121.333(c)(3) by replacing "flight altitudes above flight level 250" in that citation with "flight altitudes above flight level 410."