Thoughts on restarting VPO passenger carrying operations
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[Author's note: the original version of this paper, written April 16, 2020, was created in the context of a growing pandemic throughout most states, and thus emphasized the need to reverse that trend by limiting VPO operations to only the most urgent, by using an additional pre-flight review mechanism. The current version has a revised emphasis and recommendations due to new data sources showing the pandemic growth has indeed reversed, and the availability of new information on the community prevalence of COVID-19. It is intended to be a complementary piece to the excellent summary[i] authored by Hunter Handsfield, MD, available here and as the first reference in the References section]

With much of the country under stay-home orders and with the pandemic new-case curve flattening due at least in part to such distancing orders, and as both the federal government and states grapple with decisions regarding when and how to restart the economy, it is natural for Volunteer Pilot Organizations (VPO's) to consider when it will be reasonable to restart passenger carrying operations in general aviation aircraft. This document is intended to summarize the factors that bear on decisions that VPO's will be confronting for the foreseeable future.

Decision-making elements to consider

Elements that converge to make the decision to fly passengers at all, and within that context the decision whether a particular flight has benefits that outweigh risks, include the following.

A. Constraints of GA aircraft

As outlined in a previous white paper entitled "COVID-19 Effects on Volunteer Pilot Organizations[ii]" there are several factors that contribute to potentially elevated risk of in-flight transmission of COVID-19 to both pilots and passengers. These include inability to meet physical distancing standards and potentially long periods of respiratory exposure. Use of supplementary oxygen by crew and passengers via mechanisms such as nasal prongs reduces the effectiveness of masks in protecting against airborne transmission in aircraft cabins, and interference by masks with headsets, microphones, and speech clarity potentially add in-flight difficulties and safety issues for pilots.

The exact nature and extent of the elevated risks of decreased physical distancing created by small (4-6 seat) general aviation aircraft is not and may never be determined due to the many variations on cabin design, air handling and heating systems, and resulting airflow patterns as experienced by cabin occupants. This unquantified risk seems likely, in any case, to be reduced by increasing cabin airflow by opening outside air vents as a pragmatic countermeasure.

B. State of the science

Much has been learned about the SARS-CoV-2 virus that causes COVID-19 in the past three months. Important features of the biology of the virus include the ability of the virus to be spread by individuals who are either pre-symptomatic or remain asymptomatic and thus unaware they are infected, and clear evidence that individuals with some types of pre-existing medical conditions are at elevated risk of needing hospitalization and of having a fatal outcome if infected.

Epidemiologic data are now available on national and state level trends in the management of the pandemic. A useful analytical measure is the reproduction rate of the virus, often cited as R_0 ("R-naught"), which is an estimate of how many secondary infections will result from each newly diagnosed infection, when there is no pre-existing immunity (the zero in R_0). When the effective reproduction rate of the virus is higher than 1, the pandemic is growing; less than 1 indicate the pandemic is beginning to shrink. New aggregate data sites for COVID-19 such as Rt Live[iii] use publicly reported numbers of new cases in a continuously updated analysis of change. Currently these data are showing that public health measures such as physical distancing and stay-home orders have had a gratifying effect on reducing spread of the virus in most states.

Another favorable preliminary epidemiologic finding being reported is a relatively low prevalence of the infection, as determined by the fraction of individuals in a particular community or region who have COVID-19 antibodies. The methodologies of studies reported to date have been subject to controversy and results will no doubt be refined over time, however positive antibody rates in the 4-5% range are common in the data reported to date. This can be considered both "good news and bad news". The good news is that the likelihood one may encounter an asymptomatic individual who is infected and shedding virus is currently likely to be low in most community settings (though varying by population density, so that in densely populated areas it may be several times higher). The bad news is that these same findings indicate only a small fraction of the total US population may have yet been exposed to the virus, and the potential for subsequent waves of new infections larger than the initial wave, and capable of overwhelming health system capacity, is an ongoing threat.

C. Ethical standards for VPOs

Physician education ingrains the principal of "primum non nocere" (first, do no harm) as articulated in the Oath of Hippocrates. Similarly, in an evolving global pandemic, an anchoring principle of ethical operations should be, if at all achievable, 'first, do no harm' both for individual passengers and flight crews, and also for society at large, where the ethical mandate might be restated as 'first, do not make the pandemic worse' in the course of providing needed services for individuals.

A path forward: a principled approach to risk management

Restarting passenger carrying operations would be relatively simple if VPO's had the ability to do economical same-day testing of aircrew and passengers for virus RNA, with results available prior to departure. In the absence of that capability, a simple formula for knowing it is acceptable to conduct passenger operations, based on some set of quantitative measures such as current known prevalence of COVID-19 in a region or trends in new cases, does not appear to be in hand at this time, or available for the foreseeable future.

Organizations that engage in potentially high risk flight operations, such as NASA, have adopted risk management strategies[iv] based on the estimation of the *likelihood* an adverse event will occur combined with the *severity of the consequences* resulting from an event when it does occur. Thus, common events that do not endanger the completion of a mission are accepted while even exceptionally rare events that would result in loss of a critical mission capability or loss of life are judged to be unacceptable and a reason to not initiate a mission until the risk can be mitigated.

A similar approach to risk management may benefit VPO's as they restart flight operations in an uncertain environment where complete safety cannot be assured. This may reasonably begin with creating a list of conditions that are considered as precluding a passenger carrying flight. A non-exhaustive list of examples of 'no fly' rules might include:

1. No person (aircrew or passenger) with active respiratory infection of any kind.
2. No person with known exposure to COVID-19 infection in the preceding two weeks.
3. No pilot or other flight crew member in a group with elevated risk of severe COVID-19 outcomes (see below).
4. No pilot or flight crew member who is unable to wear a surgical mask during flight operations or finds them an unacceptable personal safety of flight issue (e.g., interference with eye glasses, ability to speak sufficiently clearly to be understood by ATC).
5. No aircraft with fewer than four seats or questionable ability to provide adequate air exchange.
6. No passengers whose medical condition prevents them from complying with droplet transmission protections (e.g., inability to wear a surgical mask).

It seems likely that each VPO will need to develop its own list tailored to its mission, region, pilots and aircraft available.

Beyond a core 'no fly' set of rules, there will additional conditions that may elevate risk but result in risks that the VPO, aircrew and passengers are willing to accept on a case-by-case basis. These may include pre-existing medical conditions that would contribute to serious medical complications if a COVID-19 infection were to occur as a result of the flight. The Centers for Disease Control and Prevention maintains an updated list of such conditions[v], which currently include:

- People 65 years and older
- People who live in a nursing home or long-term care facility

- People of all ages with underlying medical conditions, particularly if not well controlled, including:
    - People with chronic lung disease or moderate to severe asthma
    - People who have serious heart conditions
    - People who are immunocompromised.
      Many conditions can cause a person to be immunocompromised, including cancer treatment, smoking, bone marrow or organ transplantation, immune deficiencies, poorly controlled HIV or AIDS, and prolonged use of corticosteroids and other immune weakening medications
- People with severe obesity (body mass index [BMI] of 40 or higher)
- People with diabetes
- People with chronic kidney disease undergoing dialysis
- People with liver disease

For cases where the passenger to be transported has a condition on the CDC list, VPO's may wish to create a review process that includes ability to obtain an independent assessment of health risks posed by the proposed flight.

References

[i] Handsfield HH. Operational Considerations for Voluntary Pilot Organizations in Response to Covid-19. http://faculty.washington.edu/dmasys/COVID19_PassengerOperations.pdf

[ii] Masys D, Hunter HH. COVID-19 Effects on Volunteer Pilot Organizations. April 5, 2020. http://faculty.washington.edu/dmasys/COVID19_considerations_for_VolunteerPilotOrgs.pdf

[iii] https://rt.live/

[iv] NASA Risk Management and Health Standards
https://www.ncbi.nlm.nih.gov/books/NBK222156/

[v] https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-at-higher-risk.html