

**Testimony of Mary Cummings, PhD
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**on
The Future of Unmanned Aviation in the U.S. Economy: Safety and Privacy
Considerations**

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Good afternoon Chairman Rockefeller, Ranking Member Thune, and distinguished members of the committee. Thank you for the opportunity to appear before you to discuss issues related to the future of unmanned aviation in the US economy.

I am the director of the Duke University Humans and Autonomy Laboratory, which focuses on the multifaceted interactions of humans and autonomous systems in complex sociotechnical settings. I am an internationally recognized Unmanned Aerial Vehicle expert and have advised all branches of the United States military concerning technologies and policies related to unmanned aerial vehicles, more commonly called drones. I also have significant personal aviation experience, as I was one of the US Navy's first female fighter pilots.

While I applaud the FAA's recent, but very late, naming of its six Unmanned Aerial System test sites I, like most experts in this field, agree that it is unlikely that the FAA will meet its charge to open our national airspace to drones by 2015. While we are making some progress towards this goal, the United States is lagging, not leading, the commercial drone boom.

For example, in Japan drones make up more than 90% of all crop dusters, an extremely dangerous job for human pilots. In the UK, drones can be used for commercial photography, to monitor crops, and to deliver food to your table at a restaurant and pizza to your home. In South Africa, music festival fans have been treated to drone beer delivery using a smartphone app. And well before Amazon made their recent announcement for drone package delivery, companies in Australia and China beat them to it.

Many government and watchdog agencies cite safety and privacy concerns as justification for delaying the use of drones for commercial applications. While I defer to my colleagues for a more detailed discussion about the privacy issues, in terms of safety, the statistics clearly indicate that safety across military drone platforms is greatly improving.

It is true that, according to accident data provided by the National Business Aviation Association and the Air Force Safety Center, when you compare accidents rates, as measured by the industry standard of *number of accidents per 100,000 flight hours*, drones have a higher accident rate than all other aircraft for the past 20 years. But this kind of comparison is apples-to-oranges since the drone industry is a fledgling one, and manned aviation has had more than a 100 years to improve safety. Asking

about the cumulative drone accident rate is akin to asking what the accident rate of manned aviation was in the 1930s, which was about 60 times higher than commercial rates today.

A better question is to ask about the rate of drone safety improvement. The United States military and the drone industry reached a landmark safety record more than a year ago when the Predator's annual accident rate dropped lower than both the average rates for manned fighters and bombers. For the first time in United States history, there are now missions that are safer when flown by a computer than by a human.

The military is not the only domain where recent drone safety records have surpassed that of humans. For the last 20 years, general aviation has had the highest accident rate overall for manned aircraft, and has not improved to the same degree as for all other categories of aircraft. Given recent Predator and general aviation safety accident rates, drones are now 25% safer than the general aviation community. As a former fighter pilot and a private pilot, I understand the importance of what I am saying – which is that a drone is, on average, a better pilot than I am.

For the first five years of operations, drones were more than twice as likely to have an accident as compared to manned aircraft. After fifteen years of operation, that number decreased to just 25% more likely. If this dramatic improvement in safety continues, theoretically drone safety could be on par with that of commercial aviation in just 10 years.

While I am not suggesting that passenger aircraft will become drones, I think it is important to look at these numbers in the context of the larger aviation safety picture. Manned aviation has formalized certification and inspection programs, as well as voluntary reporting programs, but as of now, the drone industry has no such parallel programs.

Despite this lack of a formalized safety program, drone accident rates have improved dramatically over the last 20 years because of industry self-regulation and customer demand. While there is certainly still a long road ahead to improve drone safety, adapting tried and true safety programs from manned aviation to unmanned, in addition to strong industry buy-in will be key in improving drone safety for the myriad of anticipated future missions.

As optimistic as I am about the improving safety accident rates of drones and what this could mean in terms of commercial growth, I am decidedly less optimistic about the ability of this country to grow the workforce it needs to design, deploy, and manage these systems. With current fiscal belt tightening, research and development budgets across government agencies have been significantly cut. This means that universities cannot produce enough graduates for drone and other autonomous system development like driverless cars, who need to be experts in

hardware, software, and human-machine interaction.

This choking of the pipeline not only hurts industry, who is desperate for such graduates, especially those that are US citizens, but this particularly hurts the government who cannot maintain sufficient staffing in the number of people it needs who can understand much less manage such complex systems.

In conclusion, I believe that drones have made great safety strides over the past twenty years, but will only become better when formalized safety practices are adapted from manned aviation. But in this implementation, this country needs to move more expeditiously towards the integration of drones into the national airspace. Lastly, government funding in drone and other related autonomous technologies needs to grow at least an order of magnitude to regain global leadership in an area in which we are now woefully behind.