

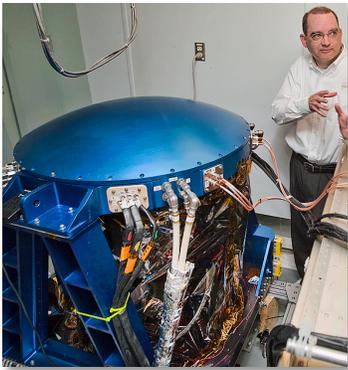


## ***Doppler Lidar for Measurement of High-Altitude Wake Vortices***

Grady Koch, PhD  
Electro-Optical Engineer

Over the years, a number of in-flight accidents have occurred when one aircraft enters the wake of a preceding aircraft. Unfortunately, there is no existing technology that can measure the wake vortices and provide pilots with an alert of the impending problem.

However, a team of researchers at NASA Langley Research Center, has now developed a Doppler Aerosol Wind (DAWN) *lidar* instrument that employs a novel sensor. Dr. Grady Koch, the project's chief engineer, says that DAWN *unique long-range capability enables users to study the safety issues associated with these wake vortices and subsequent wake turbulence.*



*Grady Koch with DAWN instrument*

According to Koch, "The turbulence behind the aircraft is a wind event. It's sort of a severe wind; sort of a miniature tornado, if you will, that's oriented horizontally."

Since the *lidar* uses pulses of light rather than radio waves, Koch has been able to use the instrument as an accurate measurement tool.

"The pulses can scatter off of particles that are very small. In this case, those particles are dust particles, or aerosols, which are naturally occurring in the atmosphere. Because those particles are so small and light, they are entrained in the wind and you can use them as a tracer of wind fields."

The wake dynamics can be different if the aircraft producing the wake is at altitude or is near the

ground, such as close to an airport. However, DAWN has the flexibility to be used either on the ground or on another aircraft, depending on the research goal.

Currently, Koch is working with the U.S. Air Force to test the instrument from the ground by having military aircraft do flyovers.

Although many measurements can be done from the ground and the cost is less, some need to be done in flight.

In addition to obvious aviation applications, Koch says that the technology may also be used in other applications such as wind energy and meteorology.

"We went hurricane hunting with the instrument to look at wind fields in and around, hurricanes that are not necessarily fully-developed, looking at the question of why do some storms become hurricanes and others do not."



Jeffrey Beyon and Paul Petzar work with DAWN Air Data Acquisition and Processing software aboard NASA's DC-8 research aircraft

"Working in an airplane is much more difficult. You have a confined space, confined power. It took quite a lot of engineering to be able to operate the system in an airplane. It held up to the vibration and the temperature extremes. It did well."