UMR Researchers Study Aircraft and Space Shuttle Exhausts Up Close

No head room. No leg room. No reclining seats. No magazines. No peanuts. No flight attendants. No temperature control. Turbulence, however, can be expected.

And all flights end at the same airport where they begin. Such are the flights that UMR's **Don Hagen** and other researchers from UMR's Cloud and Aerosol Sciences Laboratory (CASL) must endure in order to study aircraft exhaust emissions in the North Atlantic Flight Corridor.

The UMR researchers took advantage of ideal weather conditions in the skies over the North Atlantic last fall to study how aircraft exhaust emissions can build up in heavily traveled airways. Their study should give the scientific community a better picture of how aircraft emissions effect the upper atmosphere.

The UMR team – part of a consortium of scientists from the United States and Europe – say that the scientific flight into the heavily traveled "North Atlantic Flight Corridor" took advantage of an occasional atmospheric phenomenon called an anticyclone to study emission buildups.

Anticyclones are ideal for aircraft exhaust studies because the air recirculates several days over the same area, during which time the contributions from aircraft emissions build. Whenever an anticyclone settles over air traffic routes, it provides a snapshot view of the cumulative effect of aircraft exhaust.

"This international research project requires precise timing and coordination between a dozen team members, but the effort has proven worthwhile," explains Hagen. "All of the team members reported an increase in emissions in the anticyclone. If enough data is taken by all of the scientists, we can begin to get a picture of what is happening in our atmosphere as a result of aircraft emissions."

Top photo: Air Force shuttle exhaust collector
Bottom photo: Don Hagen at work in his mobile lab

UMR fielded a team of four CASL researchers at Shannon Airport, Ireland, during the eight-week study. They analyzed airborne particles aboard a specially equipped aircraft operated by the German aerospace research program. UMR's researchers fed the samples through a complex system of valves, hoses and a condensation particle counter to determine the size, number and concentration of sub-micron particles.

Particles are produced when gases and water vapor from the exhaust mix, and these particles provide surfaces upon which chemical reactions can occur. These reactions produce new materials that can pollute the atmosphere.

The UMR team also conducted similar tests of space shuttle exhaust during two launches last year to see how the exhaust affected the ozone layer. The Rolla representatives stayed on the ground preparing and running equipment, while exhaust samples were gathered by an Air Force WB57 that performed figure-eights through the shuttle's plume about 20 minutes after takeoff. The NASA-operated jet transmitted data during flight and brought samples and the equipment back to the Cape, where Hagen and co-workers began to evaluate the data. The Air Force and NASA want answers to questions about the local environmental impact of rocket exhaust. The UMR researchers' tests are the most comprehensive ones conducted on the shuttle's plume to date.

Articles on the space shuttle studies by Hagen and his co-workers appeared in the *Wall Street Journal, New York Times, USA Today, St. Louis Post-Dispatch,* and the *Orlando Sentinel.*