



# Baseline Atmospheric Measurements for the Bakken Oil Development Region

Dr. David Delene (delene@aero.und.edu)

**Introduction:** As development of the Bakken Oil Fields in Western North Dakota continues, it is critical that we act now to conduct measurements of baseline conditions in the region. Specially, we need baseline measurements of the atmospheric concentration of methane gas and of small particulate matter called aerosols. Methane may adversely affect a person's health and is an important greenhouse gas. Aerosols concentrations in many locations are high enough to have serious effects on human health. Aerosols also nucleate cloud droplets and hence influence the amount of precipitation an area receives. Creating accurate models of the impacts that atmospheric components have requires detailed knowledge of the physical processes involved. Understanding physical processes starts with knowing atmospheric concentrations, emission sources and sinks. Aircraft measurements upwind and downwind of the Bakken Oil Fields can determine the magnitude of surface emissions for the region. Conducting a research project now to determine surface emissions provides a baseline for comparison with future observations.

**Aircraft Measurements:** The University of North Dakota (UND) owns and operates a Cessna Citation II Research Aircraft that is able to measure gases, aerosols and state-of-the-atmosphere parameters over the range of flight conditions typically encountered by commercial aviation aircraft. The Citation Research Aircraft is based at in Grand Forks International airport (GFK). With a cruise speed of 340 knots and flight duration of over four hours, the Citation Research Aircraft can fly to the Williston region, conduct sampling and return to Grand Forks in a single

flight. This enables UND to conduct sampling flights over a yearlong period to obtain seasonal changes with a modest budget. UND has the instrumentation necessary for conducting the proposed measurements; however, a fast response (1 Hz frequency) methane instrument is currently not available.

**Atmospheric Sources:** Methane and aerosols have both natural and man-made sources. In the Williston region, petroleum production is likely to be the largest man-made source of methane and aerosols. The production, transportation and storage of crude oil can emit methane to the atmosphere. Aerosols can be emitted directly into the atmosphere from incomplete combustion (diesel truck engines) or form in the atmosphere from the condensation of volatile organic vapors emitted by crude oil.

**Partnerships:** The University of North Dakota is looking for partners for this project. The State of North Dakota has research funding opportunity available that would support a University/Private Sector partnership. A 50% corporate match of up to \$300,000 is required. The corporate match requirement can be salaries of company personnel who provide data on oil production, help with understanding likely emission locations and conduct ground surveys of emission sources. UND is also looking to collaborate with State agencies to conduct measurements in Western North Dakota. A partnership with UND would provide critical baseline measurements conducted by local scientists working with students who live in the region and hope to contribute to the regional's economic development while ensuring protection of our quality of life.



*The faculty at the University of North Dakota use the Citation Research Aircraft to conduct research projects for federal agencies (NASA, DOE, etc), state agencies (North Dakota Atmospheric Resource Board) and private companies (UTC Aerospace, Ophir Corporation). Through working on these research projects, students obtain valuable experience working with real world instruments and data. This experience is invaluable when students graduate and start working with industry.*