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Development of a high accuracy continuous CO_2 analyzer system for deployment on commercial aircraft

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Measurements of trace gases on commercial aircraft within the MOZAIC project (Measurement of Ozone, water vapor, carbon monoxide and nitrogen oxides by AIrbus in-service airCraft) have been proven to be cost effective, productive and complementary to available observations. These measurements can be used not only to reduce uncertainties in transport models and validate satellite data, but also to improve process understanding of trace gas cycles. We are currently preparing the CO2 measurements within the EU design study IAGOS (Integration of routine Aircraft measurements into a Global Observing System). Here we present the development of a high accuracy continuous CO2 analyzer system for unattended deployment on commercial aircraft. With respect to constraints for size, weight, and the requirement of long term operation, we have assessed analyzer systems based on different techniques: broadband infrared absorption, photoacoustic effect and cavity ring down spectroscopy. Laboratory tests were made to assess the stability under flight conditions (temperature, vibration, pressure). Testing of broadband infrared systems reveals that frequent multipoint calibration and drying systems are necessary in order to achieve the target accuracy, which would lead to a significant increase in overall package size. Investigation of the cavity ring down system indicates that it meets the requirements of high accuracy and high stability; however, it is vibration sensitive and pressure dependent. In addition, the system needs to be redesigned to shrink the size and weight. The photoacoustic system has promising precision, small size and light weight; however, the prototype version is still under development. The CO2 analyzer system will first be deployed on

the airbus A340 aircraft in 2011; Plans within the European Research Infrastructure project IAGOS-ERI foresee seven aircraft instrumented with the CO2 systems.