Scientists at the University of Minnesota will build mass spectrometer measurement instruments for the Langley Research Center under terms of a $455,669 contract.

The instruments will be flown into Earth orbit aboard two satellites that will measure the Earth's atmosphere at satellite altitudes for Langley's Dual Air Density (DAD) Explorer project.

The Minneapolis University's spectrometers will be part of the payload on the dual satellites, which are scheduled for a single launch in 1974 from the Western Test Range.

This newest Air Density Explorer experiment, a $5.3 million project, will be the first direct measure of the vertical structure of the Earth's upper atmosphere on a global scale.

A mass spectrometer measures atmospheric particles that are separated according to their respective molecular weights. The two Dual Air Density spectrometers will measure the vertical and lateral distribution of atmospheric gases such as helium, atomic oxygen and molecular nitrogen.

Langley scientists formulated a unique satellite design that causes mass spectrometer and atmospheric drag measurements to be completely insensitive to orientation, yet highly sensitive to the atmospheric environment. The design also allows the instruments to be recalibrated in flight.

The mass spectrometer and drag measurements made by the two satellites will lead to a better understanding of the upper atmosphere's density, composition and temperature; how these are affected by changes in solar heat input; and how rapidly the atmosphere is escaping from the Earth. The measurements may also give insight into the relationships between the upper and lower atmosphere.

The two Explorer satellites, each containing one of the mass spectrometers, will be launched aboard a single, four-stage Scout launch vehicle. The first satellite, a 0.75 meter (30-inch) diameter sphere, will be placed in an orbit of 500 by 1,500 kilometers (248 by 932 statute miles). The second craft, a 3.6 meter (12-foot) diameter sphere, will then be kicked into an orbit with a higher perigee (closest distance from Earth) of 700 kilometers (435 statute miles), and the same 1,500-kilometer apogee (farthest distance from Earth).

The system of dual satellites is being used because a single satellite cannot directly measure vertical distribution of the atmosphere; whenever a satellite changes position vertically, it also changes position laterally.

The atmosphere's vertical structure will be obtained by comparing measurements from the two satellites as they pass over one of several ground stations at their different altitudes.

The two DAD satellites will be the fifth and sixth spacecraft launched in Langley's continuing experimental program. Two other Air Density Explorer satellites are still in orbit, measuring atmospheric densities and helping to infer atmospheric composition at satellite altitudes.

Gerald M. Keating, head of the Aeronomy Section, Environmental and Space Sciences Division, is principal investigator for the DAD project. Working with him on the current experiment are Edwin J. Prior, also of the Aeronomy Section, project scientist and co-investigator; Alfred O. C. Nier and Konrad Mauersberger, both of the University of Minnesota, investigator and co-investigator, respectively. John E. Canady, Space Technology and Applications Division, is project manager for DAD.

Other Langley personnel associated with the project are W. F. Hinson, Space Technology, assistant project manager; L. T. Melfi, Environmental and Space Sciences, contract technical representative for prototype and flight mass spectrometers; J. W. Cheeley, Systems Engineering, technical project engineer; L. H. Hunt, Flight Instrumentation, manager of electronics and instrumentation; and R. D. English, head of the Scout Project Office, project manager for the Scout launch vehicle.

The project is being conducted under the overall direction of the Office of Space Science in NASA Headquarters.