Cryogenic air sampler and a possibility of launching it aboard reusable sounding rocket

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The collection of stratospheric air samples has been made almost once a year since 1985, using a cryogenic whole air sampler on board scientific balloons. The sampler consists of 12 stainless-steel-sample tubes, a liquid helium dewar, a receiver/transmitter, and a control unit. The sample tubes were cooled to -269 deg. C by filling the dewar with liquid helium. The amount of air samples collected at each height was about 20 - 25 L(STP). The air samples, thus collected, were analyzed for concentrations of CO2, CH4, N2O, H2 and various halocarbons, isotopes of CH4, N2O, CO2, O2 and N2, and O2/N2 ratio. The observed results provide us with useful information about the stratospheric processes, such as photochemical destructions, stratospheric circulation, and gravitational separation. Reusable sounding rocket has a potential to realize collection of air samples in the upper stratosphere and mesosphere. Possible problems in a rocket-borne cryogenic sampling are lower sampling speed caused by lower atmospheric pressure above the upper stratosphere, an air contamination by rocket, and constrains of payload size and weight.