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Abstract Title (15 word limit):

Development of a Small Scale DYNASWIRL® Phase Separator for Space Applications.

Abstract (350 word limit):

The limited amount of liquids and gases that can be carried to space makes it imperative to recycle and reuse these fluids. The absence of gravity deprives the buoyancy from the phase separation and makes it a challenging task. Utilizing its DYNASWIRL® nozzle technology, DYNAFLOW INC. has been actively developing a passive phase separator through ground tests and reduced gravity flight experiments over the past few years. With its unique swirl chamber design and gas extraction process, the DYNASWIRL® phase separator can generate a cavitating vortex core even at low flow rates and is capable of forcing gas out of very low void fraction mixture into the central gaseous core of the vortex for separation. A small scale DYNASWIRL® phase separator is needed to be integrated with a new breadboard flow-loop designed by NASA that

can fit into the Fluids Integration Rack (FIR) on International Space Station (ISS), in preparation for future experiments on ISS.

A completed small scale DYNASWIRL® phase separator was delivered to NASA, integrated into the breadboard test rig, and tested in NASA reduced gravity flights in June 2015. Before the delivery of the phase separator, systematic numerical simulations and ground based experiments in laboratory were performed to optimize the design of the phase separator and to evaluate its performance. In order to characterize the performance of the separator, an impedance probe was developed to measure the void fraction of the mixture input to the phase separator, a new signal analysis scheme is utilized to obtain the phase and amplitude of the measured signals more accurately, such that the relationship between the void fraction and the measured impedance can be better established with more accuracy. To characterize the outflow after the phase separation, an acoustic based bubble sizing and counting instrument (ABS ACOUSTIC BUBBLE SPECTROMETER®©) was used, which can measure very low void fraction. Details of these ground studies will be discussed in this topic while the details of the flight test results will be covered in a separate topic.