

ME107A
Experimentation and Measurement

October 3, 2003

TO: ME107A Consulting Group
FROM: George C. Johnson
RE: LDV/Fluid Flow Stand Characterization

The flow stands and associated laser Doppler velocimeter systems for this course have been used for several years and have been characterized under certain conditions, but a recent observation has surprised me. I would like your help in assessing whether the observation was correct and how it can be explained. In a recent drain-down test, in which the flow control valve was left in a fixed position and the pump was turned off, the velocity appeared to decrease linearly from its initial value to zero. This is not what I had expected to observe, but seemed to be repeatable.

Your specific tasks are to:

- Determine the minimum and maximum velocities that can be attained and/or measured with this system, and identify the factors that limit the measurement at each extreme.
- Estimate the velocity resolution that can be attained with this system at velocities less than 20 mm/s.
- Measure the flow rate versus time for a variety of valve positions during the drain-down process. In choosing your measurement location, please be aware that there is a cylinder mounted in the flow that is used in other experiments. Your measurement position should be sufficiently far away from the cylinder that the measured velocity is not dramatically affected by the cylinder's presence.
- Propose a model explaining the observed drain-down behavior.

Even though you are preparing this lab report for someone who knows this system reasonably well, you should provide some background on laser Doppler velocimeters and describe the geometry of the flow stands. You should also comment on any aspects of this system that you feel could be improved.