NORTHWEST ENGINEERING
College Avenue
Pullman, WA 99164-2920

TO:
FROM: Dr. Jacob Leachman
DATE: January 13th, 2026
SUBJECT: Axial Fan Testing

We need performance plots of our two-stage axial flow fan for use in a building HVAC control system. The damping on the fan system will change; therefore, the performance plots should predict the fan operation under variable back pressure.

We need predictive equations to correlate flow, power requirements, and efficiency of our two-stage fan. We need the plots to cover the full rotational speed range of the fan. Your results should include performance curves in non-dimensional form that can be compared to competing fans. You will also need to demonstrate the ability to predict fan performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

Please prepare a written test proposal to be submitted on January 27th at the end of lab time. The final presentation and report must be submitted on February 12th at the start of lab time. If you have any questions, please contact me.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 13th, 2026
SUBJECT: Centrifugal Fan Testing

The centrifugal fan system in our laboratory has been configured in accordance with the applicable test codes and equipped with a digital data acquisition system. We need to develop performance curves and data for this system that may be used to size fans for HVAC applications around the WSU campus.

I want you to develop the equations to correlate flow, power requirements, and efficiency of our fan. We need the plots to cover the full rotational speed range of the fan. Your results should include performance curves in non-dimensional form that can be compared to competing fans. You will also need to demonstrate the ability to predict fan performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 13th, 2026
SUBJECT: Air Compressor Performance Testing

A local company is considering utilizing our compressor to supply pressurized air to their building. We need to characterize the performance of the compressor in terms of volumetric efficiency and mechanical efficiency over the accessible range of the test setup.

Your results should include performance curves that can be compared to competing compressors. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 13th, 2026
SUBJECT: Concentric Pipe Heat Exchanger Testing

A local company is considering the possibility of reclaiming heat from a commercial laundry operation. We need to develop a predictive model for the performance of the concentric tube heat exchanger in the laboratory.

Your results should include performance curves in epsilon-NTU form that can be compared to competing heat exchangers. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 13th, 2026
SUBJECT: Jet Pump Testing

A local company is considering the use of an air jet pump to both clean and paint surfaces. It is desirable to use a flexible hose to direct the flow from the jet pump, however, we do not know how this will affect the jet pump performance. We need you to determine how this modification affects the jet pump performance.

Your results should include performance curves in non-dimensional form that can be compared to competing pump systems. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 13th, 2026
SUBJECT: Roots Blower Testing

A brewery is considering use of our Roots Blower for aeration during brewing. We need to develop a predictive model for the performance of the roots blower in the laboratory.

Your results should include performance curves of volumetric and mechanical efficiency in terms of pressure rise and rotational speed that can be compared to competing systems. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 13th, 2026
SUBJECT: Cross Flow Heat Exchanger Testing

A company is considering using an air/water coupled-heat pump in a HVAC application. We first need to characterize the performance of the cross-flow heat exchangers that will transfer heat between the water and air streams. We need to develop a predictive model for the performance of the heat exchanger in the laboratory.

Your results should include performance curves in epsilon-NTU format that can be compared to competing systems. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 13th, 2026
SUBJECT: Water Pump Testing

My lab is considering utilizing the water pump to circulate chilled water between equipment. I need to know the flow rate through the pump at variable levels of flow restriction.

Your results should include performance curves that can be compared to competing systems. You will also need to demonstrate the ability to predict performance at non-measured conditions, quantify the confidence in your predictions, and establish limits for your predictive equations.

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MEMORANDUM

TO:
FROM: Dr. Jacob Leachman
DATE: January 13th, 2026
SUBJECT: AC Unit Performance

WSU CAHNRS is attempting to retrofit an old greenhouse to control the climate for investigating growth of a new barley variety. They need to know if the Air-Conditioner system they have specified is adequate.

We need you to conduct an analysis of the AC unit performance relative to various greenhouse internal temperatures. Your analysis should measure the Coefficient of Performance for the AC unit and compare to relevant SEER standard values. Present predictive performance curves for the AC unit performance so that CAHNRS can estimate costs for operation at various temperatures.

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