Objective:
To map the performance of the APS 3200 vane pump

APU Information:
The APS 3200 APU (Auxiliary Power Unit) is currently in production and use by AirBus and other airlines. The APU is a turbine engine with an electrical generator located in the tail of most aircraft. The APU has multiple functions; one is to provide electrical power to the aircraft while it is on the ground, another is to supply the cabin with conditioned air, and to supply the main engines with compressed air to aid the start of the engines. The APU is used until the aircraft is nearing take off to minimize noise and fuel consumption, etc. Once the main engines are turned on the APU can be turned off as all of the other functions are powered by the main engines.

Key Needs:
• Ability to vary and measure: Temperature of oil
  Pressures at Pump Inlet and Outlet
  Flow Rate
• Able to easily accommodate different types of pumps

Preliminary Designs:
The initial design of the test rig was to simulate the environment of the APS 3200 APU. The differing designs were thought to physically recreate the actual in-service situation. As the designs matured, it was decided on testing the performance this pump in a more versatile rig, one that would allow the collection of more pure pump performance data.

The two major simplifications that were made were the removal of a gravity fed reservoir to simulate the return pump, and the removal of a vacuum chamber which was replaced by a valve system to simulate the high-altitude pressure drops.

Governing Equations:
\[ h_p = H_{out} - H_{in} + h_{lost} \]
\[ H = \frac{P}{\gamma} + \frac{V^2}{2g} + z \]
\[ h_{lost} = \sum f \frac{L}{D} \frac{V^2}{2g} + \sum K \frac{V^2}{2g} \]

Final Design:
The design was simplified as ways to measure the required information were found using less equipment, resulting in a test rig that was simpler, more reliable and easier to operate.

Performance Specifications:
• Temperature Range: -40 to 300°F
• Speed Range: 0-6000 RPM
• Flow Rate: 0 to 13.8 GPM

Estimated Cost:
$15,000

Acknowledgements:
• Larry Timmons, Jim Naper and Mark Shatz.
• John Grimes and Gary Held.
• Dr. Chuck Pezeshki and Jan Danforth.