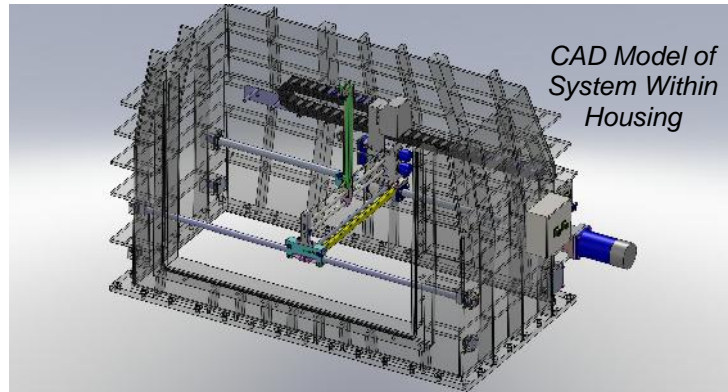




Turbine Exhaust Box Exit Probe Traverse System

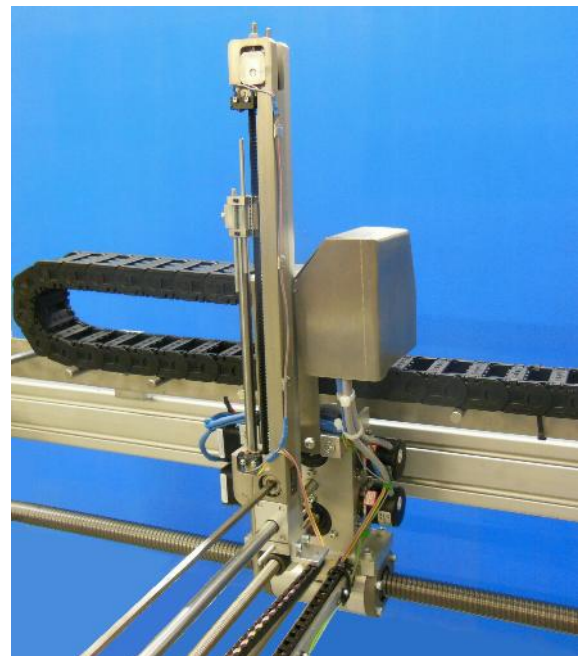
Description

Design and manufacture of a cartesian, 3 axis, aerodynamic test probe traverse system, mounted within the exhaust box area of an industrial turbine model test rig. The system was designed to be versatile and cater for a range of exhaust box exit shapes, areas and heights. Aerodynamic loads on the system were based on a Mach 0.4 axial exhaust gas velocity at the exit. The X (axial) & Y (transverse) axes were ballscrew driven with stepper motors and encoder positioning feedback. The design option selection for the Z (vertical) axis was driven by the requirement for a minimum cross section area to minimise flow disturbance in the exhaust exit. To do this, the cross section of the main body was minimised, but the size of the motor & encoder still largely determined the maximum size. An option was therefore investigated, looking at positioning the Z axis traverse actuator motor outside the main flow and driving the actuator itself via a spline drive. This was the final preferred configuration. Control was via a multi-axis stepper controller with associated amplifiers, power supplies, limit switches etc., all housed in a standard 19" control rack. This was then controlled by a PC using LabView Software.



Specification Summary

- Max stroke = 1220 mm (X), 510 mm (Y), 300 mm (Z)
- Accuracy (all axes) = +/- 0.25 mm
- Linear speed (all axes) = 0 - 25 mm/s
- Max probe dia 12.7 mm
- Vertical (Z) load capacity > 50 N
- Axial (X) load capacity > 500 N
- Transverse (Y) load capacity > 500 N
- 3 axis stepper motor control rack
- Working fluid = 93% Tetrafluorethane R134a, 7% air
- Rotor speed = 12,000 RPM
- 50 - 60 rotor blades



Exit Probe Traverse System

Disciplines Used

- Electro-mechanical design, fluid dynamics analysis, stress & vibration analysis, electrical & electronics design, software & control, manufacture, assembly, test & commissioning.