Cross has been manufacturing brush seals for the aerospace industry since the 1970s and played an important role in introducing them into power generation applications during the 1990s. In order to prove brush seals’ effectiveness, in-house test facilities were built to validate the theory and test their performance under various conditions. The resulting research and development work has produced a number of publications.

**AIAA 90-2143 'Brush Seal Development System', R. Flower**
The first publication by Cross discussed the advantages of using brush seals within power turbines. The concept of a brush seal is described and compared to its alternatives. Using data collected from the test facilities, brush seals were found to be the favourable option in many areas including rotor wear and offset leakage performance.

**AIAA 98-3172 'Brush Seal Performance Evaluation', P. F. Crudgington**
The sealing performance of brush seals was evaluated in a simple static rig. Inter-changeable front and back plates were used to change the stiffness and fence height. Tests were conducted on seals with different wire sizes and pack thicknesses over a range of pressure drops and pressure ratios with various rotor diameters.

**Brush Seals for Improved Steam Turbine Performance, presented at the IMechE Retrofitting Steam Power Generation Plant Seminar 2005 in partnership with GE Global Research and GE Energy**
This offers a comprehensive understanding of the performance benefits of brush seals, along with part and system considerations and laboratory and field validation. It was established that steam-turbine shaft brush seals are a robust product, with validated leakage reduction and demonstrated reliability with successful running of an interstage shaft seal in an 85MW turbine after extended service.

**AIAA 2001-3480 to AIAA 2012-4003**
In 2001 Cross began developing an FEA model to simulate brush seal performance. Initial simple beam element models soon evolved into more complex 3D full contact models. Friction effects, both inter-bristle and between bristle and back plate, were found to have a significant effect. A CFD model was also developed and integrated into the solid model to give an accurate pressure distribution through the pack. All FEA and CFD models have been verified with test data.