

**THIN FILM SHAPE SENSING: THE DEVELOPMENT OF AN INTEGRATED
FLEXIBLE THIN FILM TEMPERATURE-COMPENSATED
STRAIN SENSING ARRAY**

by

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The purpose of the Thin Film Shape Sensing project was to develop an array of temperature-compensated strain sensors to be used as a shape sensing array capable of detecting changes in the shape of surfaces such as airfoils. In the case of morphing surface technology, this type of sensor array would provide the necessary feedback to remotely sense and control the shape of the surface. This project has employed the use of NiChrome (80% Ni, 20% Cr) strain gages and NiChrome/Platinum paired element thermistors for temperature sensing. The sensors were initially developed on DuPont Kapton® and later on a different DuPont polyimide substrate provided by Cirexx®. Three prototype arrays have been developed and tested for basic functionality. The first prototype was designed, built and tested. Basic sensor functionality (electrical response to strain and temperature) was shown. After a substantial redesign including sensor size reduction and processing refinements intended to improve the sensor properties, a second array was produced and tested, showing improvements in sensor performance and overall array functionality. A third and final prototype was fabricated at ½ the original linear dimensions of the second array to show scalability of the array's features. Overall, this prototype was also functional with sensor properties similar to the full-size prototype.

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