E-Textile Antennas for Space Environments

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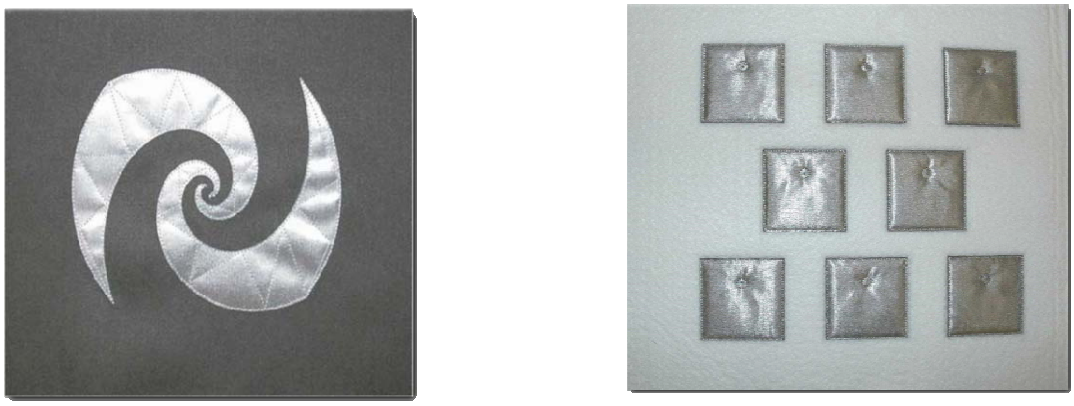
The ability to integrate antennas and other radio frequency (RF) devices into wearable systems is increasingly important as wireless voice, video, and data sources become ubiquitous. Consumer applications including mobile computing, communications, and entertainment, as well as military and space applications for integration of biotelemetry, detailed tracking information and status of handheld tools, devices and on-body inventories are driving forces for research into wearable antennas and other e-textile devices.

Operational conditions for military and space applications of wireless systems are often such that antennas are a limiting factor in wireless performance. The changing antenna platform, i.e. the dynamic wearer, can detune and alter the radiation characteristics of e-textile antennas, making antenna element selection and design challenging. Antenna designs and systems that offer moderate bandwidth, perform well with flexure, and are electronically reconfigurable are ideally suited to wearable applications. Several antennas, shown in Figure 1, have been created using a NASA-developed process for e-textiles that show promise in being integrated into a robust wireless system for space-based applications. Preliminary characterization of the antennas with flexure indicates that antenna performance can be maintained, and that a combination of antenna design and placement are useful in creating robust designs. Additionally, through utilization of modern smart antenna techniques, even greater flexibility can be achieved since antenna performance can be adjusted in real-time to compensate for the antenna's changing environment.



(a) **(b)**

Figure 1. Examples of e-textile equiangular spiral (a) and eight element smart array (b) antennas for a robust space-based wireless system.