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*Science and Technology for Tomorrow's Air and Space Force*

## **Success Story**

### **NEW MICROTUBE PATENT ISSUED TO PROPULSION RESEARCHERS**



Two Propulsion Directorate scientists recently received a patent for a new procedure for creating microscopic coils as well as free-standing microscopic tubes with any cross-sectional or axial shape. Drs. Phillip Wapner (left) and Wesley Hoffman (right) explored new ways to fabricate components used in miniature rocket engines, heat exchangers, and fluid separators as well as medical, dental, and scientific instruments. Until directorate scientists conceived this invention, it was impossible to fabricate many of the components this technology enables.



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### **Accomplishment**

Drs. Phillip G. Wapner and Wesley P. Hoffman, researchers in the Propulsion Directorate's Propulsion Materials Applications Branch, recently received a US patent entitled "Method of Making Microtubes with Axially Variable Geometries." This patent describes a technique for manufacturing microtube devices, which have peripheral geometries that are not uniform along the microtube or microdevice axis.

### **Background**

The new process for manufacturing microtubes involves forming a complex mandrel, or core, around which the material is coated, cast, extruded, or pultruded. One or more metallic and/or nonmetallic materials surround the complex mandrel before the manufacturer removes the core by appropriate chemical or physical means, leaving a microtube structure with an axial profile duplicating that of the mandrel.

This technique overcomes some limitations associated with conventional techniques such as lithographic techniques that use planar semiconductor material to manufacture microscopic channels. For instance, manufacturers can use this technique to make microtubes with a circular cross section, which is essential for many applications.

Microtubes manufactured by this process have numerous applications including heat exchangers, bellows, and actuators. There is particular interest in this technology for the manufacture of microelectromechanical, microfluidic, and microoptical systems.

Propulsion  
Awards and Recognition

### **Additional information**

To receive more information about this or other activities in the Air Force Research Laboratory, contact TECH CONNECT, AFRL/XPTC, (800) 203-6451 and you will be directed to the appropriate laboratory expert. (03-PR-22)