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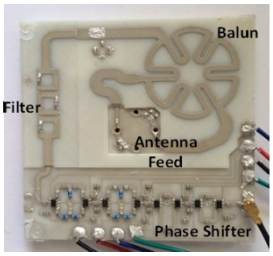
nScrypt Reveals Advanced 3D Printed Circuit Structures for RF Applications

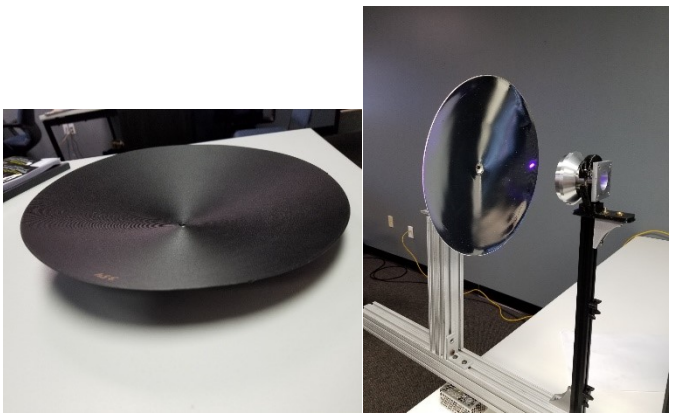
Orlando, Fl.: During the May 2019 Rapid conference and trade show in Detroit, nScrypt's CEO, Dr. Ken Church, showed examples of advanced PCS (printed circuit structures) for RF applications made with nScrypt's Direct Digital Manufacturing (DDM) system, called Factory in a Tool.

One example was the world's first 3D printed phased array antenna (PAA). The FiT 3D printed the PAA's substrate using a material extrusion tool head, Microdispensed the conductive traces and solder dots and filled vias with nScrypt's proprietary SmartPump™, and picked and placed actives with nScrypt's PNP tool head, without tool changes, yielding a fully functioning 4-element PAA. According to Dr. Church, "direct digital manufacturing the PAA resulted in an estimated 10X cost reduction over traditional manufacturing methods."



Printed and populated unit cell

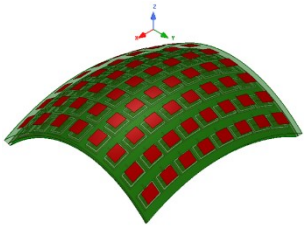
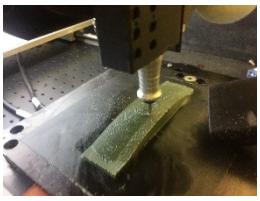
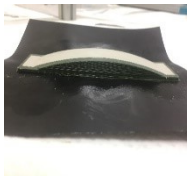
Another example shown was nScrypt's 3D printed 30cm tri-use dish antenna, which can be used for optical, RF, or acoustic communication. After 3D printing the dish with a material extrusion tool head, the FiT micro-milled, micro-polished, and micro-sprayed the dish, resulting in a ready-to-use antenna, without tool changes.



Another example was a 3D printed feed horn and circular to rectangular waveguide adapter, the performance of which compares favorably with a machined aluminum horn.

	Peak gain	Serial Number
Silver paste horn	14.7 dB @ 9.6 GHz	SN 07 Vertical polarization
Aluminum horn	14.9 dB @ 9.5 GHz	SN 41 Horizontal polarization
Aluminum horn	14.9 dB @ 9.5 GHz	SN 42 Horizontal polarization
Aluminum horn	15.2 dB @ 9.5 GHz	SN 42 Vertical polarization

Dr. Church also showed nScrypt's conformal printed phased array antenna concept, and conformally printed RF test pieces (co-planar wave guides), which the FiT 3D printed on doubly curved surfaces.

Unlike most 3D printers, which achieve three-dimensional parts by building up the xy layers of the part in the z axis, the FiT used 5-axis printing to manufacture the antenna in true 3D, first 3D printing the substrate with nScrypt's nFD material extrusion tool head, then conformally smoothing the surface with the nScrypt nMill tool head, then conformally Microdispensing the traces with nScrypt's SmartPump™ tool head on an ellipsoid surface with 150mm and 75mm radius of curvature, all on a single tool.

According to Dr. Church:

> We're not talking here about 3D printing as most people know it. It's really direct digital manufacturing, where the FiT takes a digital blueprint and turns it into a finished printed circuit structure. The tool contains all the functionality to make finished high performance and complex RF circuits, all on a single tool.

About nScrypt

Founded in 2002 and headquartered in Orlando, Florida, nScrypt designs and manufactures award-winning, next-generation, high-precision Micro-Dispensing and Direct Digital Manufacturing equipment and solutions for industrial applications, with unmatched accuracy and flexibility. Serving the printed electronics, electronics packaging, solar cell metallization, communications, printed antenna, life science, chemical/pharmaceutical, defense, space, and 3D printing industries, our equipment and solutions are widely used by the military, academic and research institutes, government agencies and national labs, and private companies. nScrypt is a 2002 spin out from Sciperio Inc., a research and development think tank specializing in cross-disciplinary solutions. The nScrypt BAT Series Bioprinter, which won the R&D 100 award in 2003, will travel to the International Space Station in 2019, in a joint program with Techshot. nScrypt Cyberfacturing Center is our direct digital contract design and manufacturing service.