GKN AEROSPACE'S ADDITIVE FOCUS

The company's AM program extends across the value chain, taking in new materials, applications, processes, and part qualification.

By Rob Sharman

GKN Aerospace is researching and developing programs to advance a variety of additive manufacturing (AM) techniques. Because AM creates the material as it makes parts, these processes open up new possibilities for component and system design. Eventually, we will develop totally new materials and functionally graded structures.

To obtain aerospace qualification for AM-produced components, GKN Aerospace is investing heavily in testing – and standardizing – processes and materials to generate quality procedures. AM-manufactured parts are flying today, and the company expects the number of additive parts to increase significantly during the next 2 to 5 years.

In parallel, the company is developing a thorough understanding of the design freedom afforded by AM, the processes and materials involved, and what will be required to produce the entirely novel parts needed for the next generation of aircraft.

Activity focuses on several AM technologies, including:

- Large scale deposition – producing larger scale, near-net forms that require less machining than traditional forgings. Future structures may be components too large for powder bed, or large bulkheads, wing ribs, or spars.
- Small-scale deposition – smaller net shapes with greater detail that can be directly deposited onto larger structures. Modification and repair of high-value engine and airframe components are also possible.
- Laser powder bed – producing small, intricate, highly complex, high-value components.
- Electron beam powder bed – to produce near-net shape and structurally optimized, small- to medium-sized engine and airframe prismatics.

AM processes promise to revolutionize aerospace component manufacturing by enabling the creation of new, efficient, lightweight designs, made by tailored, higher performing materials. Simultaneously, these developments will lower material waste associated with subtractive processes, reduce time and energy required in manufacture, and lower carbon emissions. AM will allow material optimization throughout the component and, most significantly, flip the established cost/complexity equation familiar to manufacturing, enabling design optimization and a level of structural complexity that is not cost effective – or simply not achievable – to manufacture today.

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producing full bonding between the two mediums.

Renishaw, a global engineering technologies company focused on machining, metrology, and process control is also actively participating in the AM/3D printing field. Offering a laser melting process, Renishaw's AM250 additive manufacturing machine benefits injection mold producers. Using a high-powered fiber laser, Renishaw's system melts and fuses metal powder grains (steel, aluminum, and other materials). The machine can build up complex parts, layer-upon-layer of fused metal. Layer thicknesses range from 20µm to 100µm. Low-volume parts for medical companies, aerospace contractors, or motorsports competitors can go directly from the laser machine to the user.

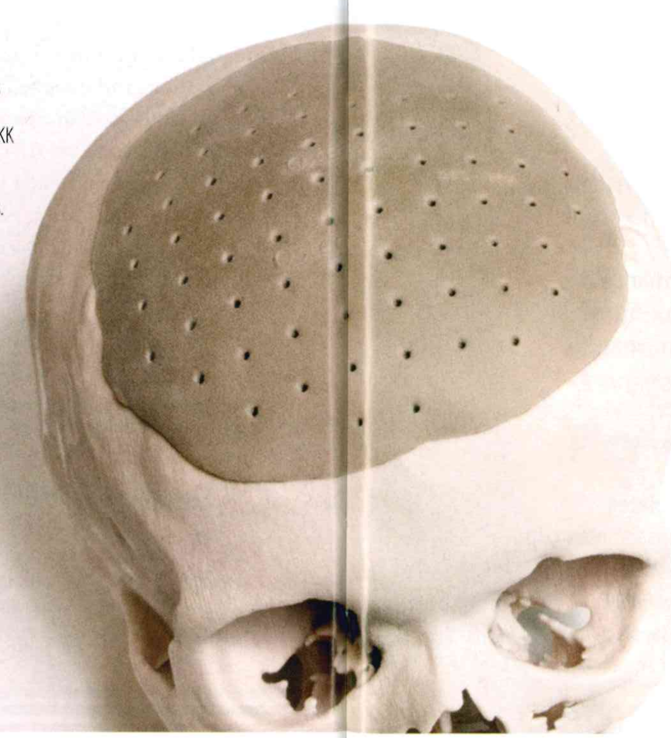
Materials and more

Beyond the machines are the materials used. Poly-ether-ketone-ketone (PEKK) is used widely in injection-molded parts, but Oxford Performance Materials (OPM) of South Windsor, Connecticut, wanted to use the high-performance plastic in laser sintering to replace aluminum and magnesium in parts.

OPM has three divisions: biomedical raw materials that uses PEKK-polymer-based OXPEKK material; a biomedical devices section that produces molded and selective-laser-sintered (SLS) OsteoFab medical parts and implants from OXPEKK polymers; and an industrial parts group that focuses on aerospace parts production.

OPM is a full-service provider, not a service bureau, notes Larry Varholak, vice president of programs, OPM Aerospace & Industrial. A proprietary design algorithm determines a proposed part's structural form to maximize strength, flexibility, and weight. The design is then 3D-printed directly from the digital file using SLS. The company can create complex parts otherwise too expensive to produce conventionally, in a build volume up to 16" x 20" x 22", using an EOS P800 machine.

If PEKK is to replace metals, it is essential to qualify its performance characteristics. One of OPM's first goals was



Patient-specific cranial implants made of high-temperature PEKK polymer can be delivered in less than two weeks. (EOS case study photo courtesy of Fred Smith Associates)

CUTTING THROUGH AM CLUTTER

Searching for the right additive manufacturing (AM) machines, material, or both used to be a monumental task, but the Senvol Database changes all that.

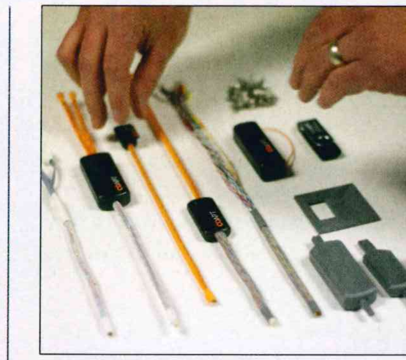
Senvol, a consulting firm offering quantitatively focused AM analytics, built a database of available machines and materials clients could use to cross-reference machines and materials that went together.

Launched in January 2015, the free, online Senvol Database currently contains detailed specs on more than 350 industrial AM machines and 450 materials.

When searching for machines, users choose from drop-down menus for manufacturers, model, process, and materials, and then have the option to input the minimum size of the build envelope required. Results display all available machines that fit the criteria. Users can then click on the details button for additional machine information. Searching for material offers input criteria for hardness, physical, thermal, and mechanical properties.

Results are not linked to the actual company, but the Senvol Database winnows the results to a manageable list for further research. Once the user has the cross-reference results, visiting that manufacturer's website will garner the specifics to start the in-depth comparison process.

Senvol Database
www.senvol.com



PROSTHESES CONTROL

Device

Coapt's Complete Control system enhances the control of upper-extremity prostheses with pattern recognition technology to non-invasively acquire information from muscle signals. The device's electronic components needed to be in an attractive and durable casing. Custom, hard tooling for injection molding was prohibitively costly.

Solution

ProtoCAM, a service bureau with PolyJet 3D printing capabilities, produced cases with the attractive finish of stereolithography and the durability of selective laser sintering. The Objet500 Connex3 3D system's 16µm build resolution delivered the required precision with faster turnaround and more attractive pricing than injection molding.

Results

With ProtoCAM-produced casings housing a powerful micro-controller, the Complete Control system has moved into full production.

ProtoCAM
www.protocam.com