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ADDITIVE TECHNOLOGIES IN HELICOPTER MANUFACTURING

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Nowadays, we are increasingly confronted with innovations in helicopter construction and engineering, in general. One of the main trends now is the possibility of applying additive technologies in helicopter construction.

So what is additive technology? Additive technology refers to the possibility of layer-by-layer build-up and synthesis of an object using 3d computer technology. In simple terms, additive technology is 3-D modeling by printing, by melting components from special granules.

Additive manufacturing (AM) includes seven different processes. Products can be created in layers by: extrusion, sputtering (jet spraying), UV curing, lamination, material fusion.

The effectiveness of such modeling has been proven more than once and it is worth noting that it is used quite widely. Additive technology is used in architecture, foundry, mechanical engineering, aircraft construction, etc. The invention belongs to Charles Hull, who in 1986 designed the first stereolithographic three-dimensional printer. It is assumed that the use of additive manufacturing makes it possible to significantly reduce the weight of the helicopter and its cost.

It is worth noting that additive technology has long been an important part of aerospace manufacturing. Scientists are getting more and more immersed in this topic every year and are trying to incorporate these technologies into helicopter manufacturing.

"The helicopter industry is ideally positioned to take advantage of AM and the many demonstrated advantages," Salter begins. "While the aerospace industry as a whole has been slow to innovate, additive manufacturing has been part of the big picture for decades and has now reached a stage of technological maturity where it is a viable method of mass production. Because of its ability to produce parts that cannot be made by any other method, and its intelligent optimization of part geometry and shape, it provides a qualitative change in part performance over traditional technologies." [1].

Relatively small component volumes for helicopters, combined with the demand for parts of consistently high quality and performance, make AM an ideal manufacturing solution. It has already been shown to reduce costs in significant fixed-wing aerospace programs, and the use of 3D-printed components in the Boeing 787 is estimated to save about $2-3 million per aircraft.

Additive technology is a very promising idea for the entire helicopter industry, but one should keep in mind, that it is necessary to understand all the possible risks and resources that will have to be spent on the implementation of this technology.

Researchers and students around the world use Form labs 3D printers in wind tunnel tests to conduct their studies.

Texas A&M Oran W. Nicks' low-speed wind tunnel performs wind tunnel tests for a wide range of projects. Lisa Brown, manager and engineer of Texas A&M's wind tunnel, helps researchers develop test plans, design models and create code that helps them collect relevant data. Her team uses 3D printing to create scale models to test various facilities.

Brown recalls a project in which the team investigated a flapping helicopter blade and used 3D printing in a test. "If we are moving fast enough and the blades are closing fast enough, you actually get shock waves from the leading edge of those blades.

And that's not at all what helicopters need. So we were able to see how these shock waves occur in our low-speed tunnel, which was very interesting.," Brown said. " We had a small printed insert on the leading edge with sensors inside. So the whole model was an aluminum wing with this little insert that we could replace. " [2].

We need to understand that at this stage of technology development, the helicopter industry has a wide experience in the use of materials and technologies that have been previously tested and proven in practice. No one is saying that additive technologies are incorrect manifestation of production, but the power structures and components that are responsible for the quality and safety of flight have shown their reliability, being made from the materials that are used now.

Considering all the possible risks, there is currently very little evidence base to boldly state that additive technology can be used in helicopter construction in the form of load-bearing structures. The risks are very high. Although additive technology involves a reduction in price for the product, it is worth noting that the equipment that will carry out 3D printing is very expensive. In addition to equipment we will need professionals who know exactly how to work with it.

Precisely because of the risks and laboriousness of the process, additive manufacturing technologies are used in helicopter construction, but not in load-bearing structures and assemblies, but only as interior and exterior elements. Also, given the mass production, there is a question about the feasibility of additive technology outside the interior and exterior.

It is important to note that science does not stand still, and it is likely that our production will be able to modernize the technology and make it possible to design power structures in helicopter construction.

Such application of additive technologies in helicopter construction is the safest nowadays.

References:

1. Michael Tyrrell : “Additive and the future of rotary” September 21, 2022
2. FormLabs : “9 Applications of 3D printing in aerospace” November 17, 2022