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FEATURE

From racetrack to orbit, an additive revolution

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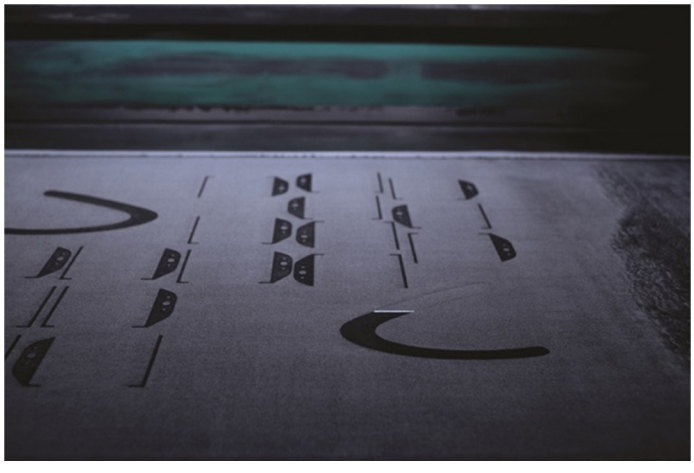
The use of additive manufacturing and reinforced composite materials in state-of-the-art applications has involved several fields, from motorsport to aerospace, from marine to medical, from design to automotive. In 1996, the CRP Technology R&D department developed WINDFORM® laser sintering (LS) materials. WINDFORM® materials make it possible for laser sintering technology to fabricate high performance parts for wind tunnel applications, as well as highly functional and beautifully finished parts. Until the parts that come out of the machine are the End Use parts, it will never reach its potential.

Windform and additive manufacturing are now moving from race on the track to the new Space Race

The recent predominance of consumer level 3D printers has brought much attention towards the additive manufacturing process. On November 19th 2013, 29 small satellites were launched from NASA's Wallops Flight Facility including KySat-2, a 1U CubeSat. KySat-2 was built with 10 additively manufactured, also called 3D printed parts made from Windform XT 2.0.

The launch into orbit

On Tuesday, November 19, 2013 the collaborative team of students from the University of Kentucky and Morehead State University along with Kentucky Space, launched the KySat-2 into orbit as part of the NASA ElaNa IV mission out or Wallops Flight Facility in Virginia. Thirty-five minutes after deployment from the launch



Windform additive manufacturing.

F1 Front Nose Prototype made in Windform additive manufacturing.

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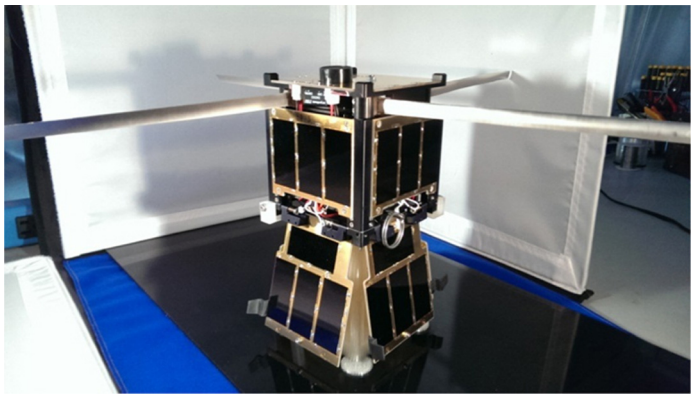


vehicle, KySat-2 began beaconing its telemetry data and was almost immediately heard by amateur radio operators. Since then, the KySat-2 team began performing system checks for each of the various subsystems that make up the satellite. According to the KySat-2 team, all systems have been performing nominally.

There were several 3d printed components on the KySat-2 made in Windform XT 2.0. One of the subsystems, is the camera systems that acts as an attitude determination system called Stellar Gyro. The 3d printed parts were produced using the additive manufacturing technology Selective Laser Sintering and Windform XT 2.0 material. The additive manufactured process 3d printed the mounting hardware for the camera system, extensions for the separation switches, clips for holding the antennas in their stowed position, and the mounting bracket for the on board batteries. The process and the material were critical to achieve the right components for KySat-2.

KySat-2's main mission was to be an educational tool and demonstration for the students working on the satellite. KySat-2 was designed, built, and tested entirely by students and engineers, with most of the subsystems designed in-house.

KySat-2 was launched on board a Minotaur I rocket built by Orbital Sciences. Typically, operational lifetime for a CubeSat is around 1 year due to radiation exposure and damage to the batteries. The KySat-2 will remain operational as long as the team is able to make reliable contact to the satellite. Testing has already begun on the subsystems and the team is hopeful they will be able to take pictures and download them from the spacecraft in the next few weeks.

Windform 3D printing

Windform materials at the beginning of their creation were strongly used in the industry of motorsport, in order to produce end parts and wind tunnel prototypes.

Advanced 3D Printing materials are represented by a wide range of Windform polyamide-based materials reinforced with carbon fibers and glass fibers: Windform SP, Windform XT 2.0, Windform GT, Windform LX 2.0 and Windform GF 2.0.

Windform XT 2.0

Features: Polyamide-based material carbon filled.

Windform® XT 2.0 assures the maximum mechanical performance for 3D printing and additive manufacturing. It is characterized by high stiffness, excellent strength and reduced weight.

Applications: Windform® XT 2.0 can replace finished parts for small run of production that are usually made with standard technologies such as injection mold, lamination of carbon fabric and metal replacement in some applications.

Windform® XT 2.0 is the material chosen to build components examples include: intake manifolds, UAV parts, and air control ducting. It is also used in functional applications such as dyno tests, racetrack tests, on car parts and pre-series parts. It is also useful to construct CubeSat's, since it is able to create thin and tough components.

Windform XT 2.0 has been used to create parts of the CubeSat that has been launched into orbit with excellent results.

Windform XT 2.0 is the lightest LS material vs strength.
According to study carried out by **Surrey Space Centre, Windform XT 2.0** has resulted to be the **leading performing laser sintering material for ultimate strength per density**.

Windform XT 2.0 has **UTS per density unit of 76.43 Mpa/(g/cc), tensile modulus of 8138.74 Mpa/(g/cc)** and **flexural modulus of 6689.33 Mpa/(g/cc)**

Windform SP

Features: Polyamide-based material carbon filled.

Windform SP is tougher material and it maintains maximum mechanical strength. Windform SP is a highly ductile material with top mechanical resistance, slightly lower than Windform XT 2.0. In addition it is waterproof with excellent sealing characteristics both to liquids (water, oil, gasoline, etc.) and gas.

Applications: Windform SP can be used where there is high stress fatigue even in time type vibration or shock without the risk of breaking. The elasticity helps to absorb these mechanical stresses. Windform SP is perfect in functional applications, for example it is particularly suitable for underhood parts, such as intake manifolds. It is also used for UAV components and in dyno tests, racetrack tests and in small run production.

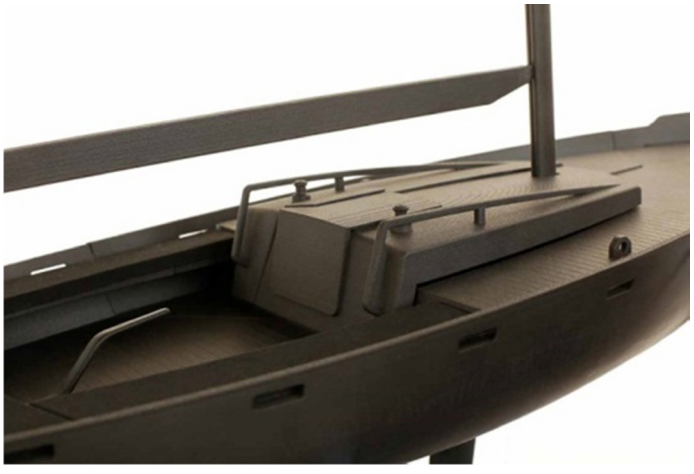
Windform SP is also suggested in applications where resistance to damage, vibration and deformation is required.

Windform GT

Features: Polyamide-based material glass filled.

Windform GT is highly elastic and it is resistant to liquids.

Applications: is highly elastic, therefore it is suitable in applications where the material must be flexible and resistant at the



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