



The construction of an Unmanned Aerial System (UAS) with Additive Manufacturing and Windform material

The project has involved two companies: CRP Technology and PARROT. The aim is the construction of the First Leisure Drone: Bebop 2



Reinforced composite materials that were used in the construction of on-car and wind tunnel parts and components for racing teams have taken the technology of 3D Printing to new heights to produce parts for the entertainment industry and consumers. The case-study describes the construction of the first leisure drone: Bebop 2.

The project

Founded in 1994 by Henri Seydoux, Parrot launched a quadricopter piloted by Wi-Fi with a smartphone and equipped with embedded camera in 2010: the AR.Drone. Since then, Parrot has been leading the way in the civil drone industries with a range of drones and minidrones, and continues to guide the innovation with the state-of-the-art Bebop 2, launched in 2015.

Parrot Bebop 2 combines robustness and reliability in a lightweight and compact drone.



Powerful with impressive stability and maneuverability even in extreme conditions, Bebop 2 offers very easy-to-use piloting with no learning. Data collected by seven sensors are analyzed and merged thanks to the impressive calculation capability of its onboard computer.

Bebop 2 integrates a front-facing camera specifically designed for it. The pilot can digitally change the angle of the camera by 180° by just sliding a finger on the screen of the piloting device.

Digitally stabilized on 3-axis thanks to powerful algorithms, images are bright, perfectly stable and without distortion regardless of the drone movements.

Numerous systems reinforced the safety of the flights: emergency cut-out feature of the engines, emergency cut-out feature of the propellers in case of contact, limitation of the altitude and of the flying perimeter, automatic return home feature and a LED, at the back of the machine, to understand the direction of the flight while keeping the drone in sight.

The collaboration with CRP Technology

Parrot has developed the final Bebop 2 version with the help of Windform GT material.

The first Bebop 2 structure was built on injected parts made with polyamide based glass reinforced composite material.

Then Parrot moved to SLS (Selective Laser Sintering) technology in collaboration with CRP Technology in order to:



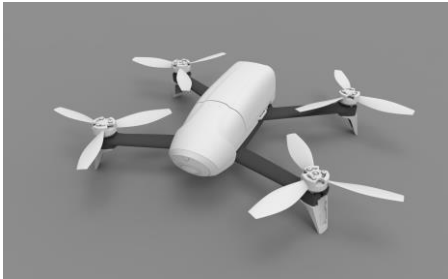
Bebop 2 main structure in Windform GT

- optimize the structure performance without developing long lead time and high cost injection tooling
- accelerate iteration generation
- improve manufacturing time
- facilitate production in series

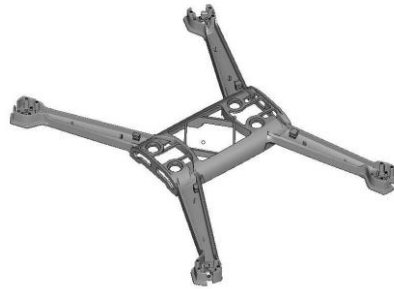
The Bebop 2 parts in Windform GT are the main structure (central body) and all single arms

The body is robust and flexible, and the arms are reinforced.

Parrot carried out an original development approach based on experimental diagnosis and FE model aimed at improving the quality of the video during flight (which is usually altered by the vibrations of the drone) through the optimization of drone design.



Bebop 2: black parts are made with Windform GT (courtesy of Parrot)



The structure made with Windform GT (courtesy of Parrot)



Bebop 2: central body and arms made with Windform GT

The structure has been mainly developed according to that target and by finding smart design to reduce weight.

Parrot has established that the natural frequencies of the parts made with Windform GT were quite similar to those of parts obtained by injection molding technique applied to glass fiber reinforced polyamide.



Parrot validated that natural frequencies of parts manufactured with Windform GT material were similar to injection molded parts with polyamide based glass reinforced composite material. Combined with FE analysis Parrot has reduced dramatically the development time.

Parrot was also able to evaluate toughness of the product structure (a consumer drone as Bebop 2 is a flying machine led to fall quite often with beginners).

Windform GT proved to be the only 3D printing material able to overcome the rigorous testing carried out by Parrot's technicians.

Parrot highlights others advantages obtained with Additive Manufacturing and Windform GT material:

- make small batches of production with acceptable mechanical properties to provide functional products to the team (i.e. very helpful to develop others product's functionalities like flying performances).
- good aesthetics feature

By CRP Technology point of view the requirements were fast iteration process, best ratio between structural strength and weight, acceptable consistent result and opportunity to combine multiples functionalities from one unique part.



CRP Technology provided fast response time to new requirements, very good cooperation with its engineers and CAD designers, and best output quality with unique proprietary process.

The body structure has been processed in less than 24 hours from receipt of the CAD-derived 3D file.

Using Laser Sintering technology, the end part is devoid of support material as well as the need for elaborate post-processing. Only traditional finishing techniques such as light sand blasting and hand finishing are required to remove unsintered powder. With almost 30 years of experience, CRP Technology specializes in traditional finishing and has developed a series of techniques that allow for a smooth and polished finish where required by the customer.

LINK video on YOUTUBE: <https://www.youtube.com/watch?v=LDBrrFJ0r50>