AN EYE FOR DIRECT DIGITAL MANUFACTURING

FDM reduces part costs 66% and shaves 7 weeks off production time.

"[Direct digital manufacturing] speeds up the development process more than we could have anticipated."

— Jan-Erik Strömberg, DST Control

DST's electro-optical devices are used for surveillance, law enforcement, and mapping and are used on aerial and ground vehicles.

Based in Linkoping, Sweden, DST Control delivers advanced embedded electro-mechanical products, primarily for unmanned vehicles, which include both aerial vehicles (UAVs) and ground vehicles (UGVs). These include unmanned helicopters, airships and spherical ground robots. These products can be used for surveillance, law enforcement, and mapping. For the past 20 years, the company has developed components in-house in its core competency areas: motion control, inertial navigation and electro-optical gimbals, which are essentially stabilized electronic 'eyes'.

The gimbal eye, or camera, rotates electro-mechanically on two axes. It provides stabilized images from non-stable carriers. Its embedded servo control system detects the motions of the carrier and corrects in real-time for these motions so that the camera remains stable – producing more accurate images with high resolution.

Real Challenge

In the growing unmanned-vehicle market there is increasing demand for reduced time-to-market and lower development costs. To maintain its market lead, DST Control commits to fast response and short delivery times despite the fact that most deliveries include some element of customization. Technology is critical to achieving this and DST Control has consistently invested in research and development and leading software and hardware systems.

Until recently, DST Control had been using various production techniques, such as CNC milling, mainly in the production of the aluminium core of its products. This had become problematic on three levels: First, costs to produce increasingly complex and sophisticated parts were rising exponentially using traditional processes, such as CNC machining. Second, there was a critical dependency on sub-suppliers of CNC milled parts which tended to prioritize high volume contracts giving DST Control's smaller orders a slower turn around. Third, some parts

How Did FDM Compare to Traditional Methods for DST?

Method	Part cost Estimate	Lead Time
Conventional machining and fabricating	€2,441	11 weeks
Direct digital manufacturing with FDM	€830	4 weeks
SAVINGS	**€1,611 (66%)**	**7 WEEKS (63%)**

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have to be customized, meaning the company was producing even lower volumes with resultant increased cost for these parts.

To solve these issues, DST Control reviewed various alternative technologies for more efficient production. The approach that emerged was to combine traditional production methods with modern in-house production techniques such as DDM (direct digital manufacturing). DST developed a strategy to produce its sensitive, custom parts in-house via DDM, while outsourcing the standard parts to be made via conventional processes.

The FDM enclosures are loaded with electrical, mechanical, and optical components.

Real Solution

During its evaluation process, DST reviewed models produced using Stratasys FDM technology. “The models looked good, but to get a real idea of the capabilities of the technology we ordered specific parts required by our own products,” says DST managing director, Jan-Erik Strömberg. “The results matched up to our accuracy and quality standards, so we purchased the [Fortus] FDM machine from Stratasys.”

The first DST Control product to be built using the Fortus system is a miniature high performance electro-optical gimbal named COLIBRI. An estimated 50 COLIBRI units will be produced per year initially, each including 20 parts manufactured using FDM. Additionally, DST will use FDM to produce several custom solutions.

Finished COLIBRI gimbal.

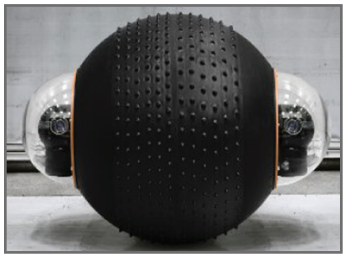
Real Benefits

The company has designed the COLIBRI so that the components subject to customizing are composed only of plastic so they can be produced in-house as they are needed. Metal and other parts requiring long lead-times are kept in stock. With direct digital manufacturing, DST Control can now deliver custom COLIBRI units in four weeks, rather than the 10 to 12 weeks required by competitors.

By replacing expensive and lead-time critical CNC-milled parts with in-house manufactured plastic parts, DST Control has reduced the part cost to one third. The plastic parts also perform better technically, weighing less and providing better electrical insulation. DST has also learned the benefits of direct digital manufacturing of production tools, such as jigs and fixtures. The technique has significantly lowered the cost and the lead time for such tools.

The COLIBRI is mounted on a helicopter and tested.

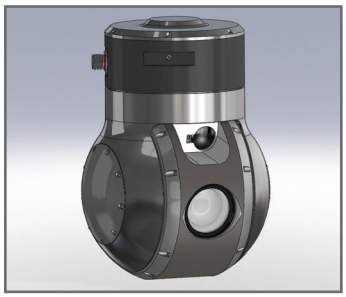
The FDM machine is now also contributing to the development of products on behalf of customers, not just in-house developed products. An example of this is the production of a unique, unmanned spherical ground vehicle Groundbot for DST Control’s customer, Rotundus. The Groundbot spherical robot is the first unmanned vehicle to carry the COLIBRI gimbal. The robot itself is also partially composed of plastic components directly manufactured with FDM, having been redesigned after CNC milled aluminium did not perform as needed.



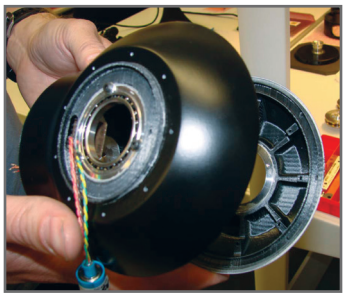
The COLIBRI is incorporated into other vehicals, such as this “Groundbot.”

“Direct digital manufacturing of parts in-house has helped meet critical deadlines for products that would have been delayed by last-minute design changes,” says Strömberg. “It speeds up the development process more than we could have anticipated. It also completely removes the overheads of third-party supplier interaction on many parts.”

[Editors Note: The COLIBRI product was a winner of the Swedish Embedded Award 2008 for product design].



CAD image of the COLIBRI, an electro-optical gimbal -- an "eye" that rotates on two axes, providing stabilized images.



Direct digital manufacturing: FDM is used to produce 20 of the COLIBRI's components, including the enclosure.

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