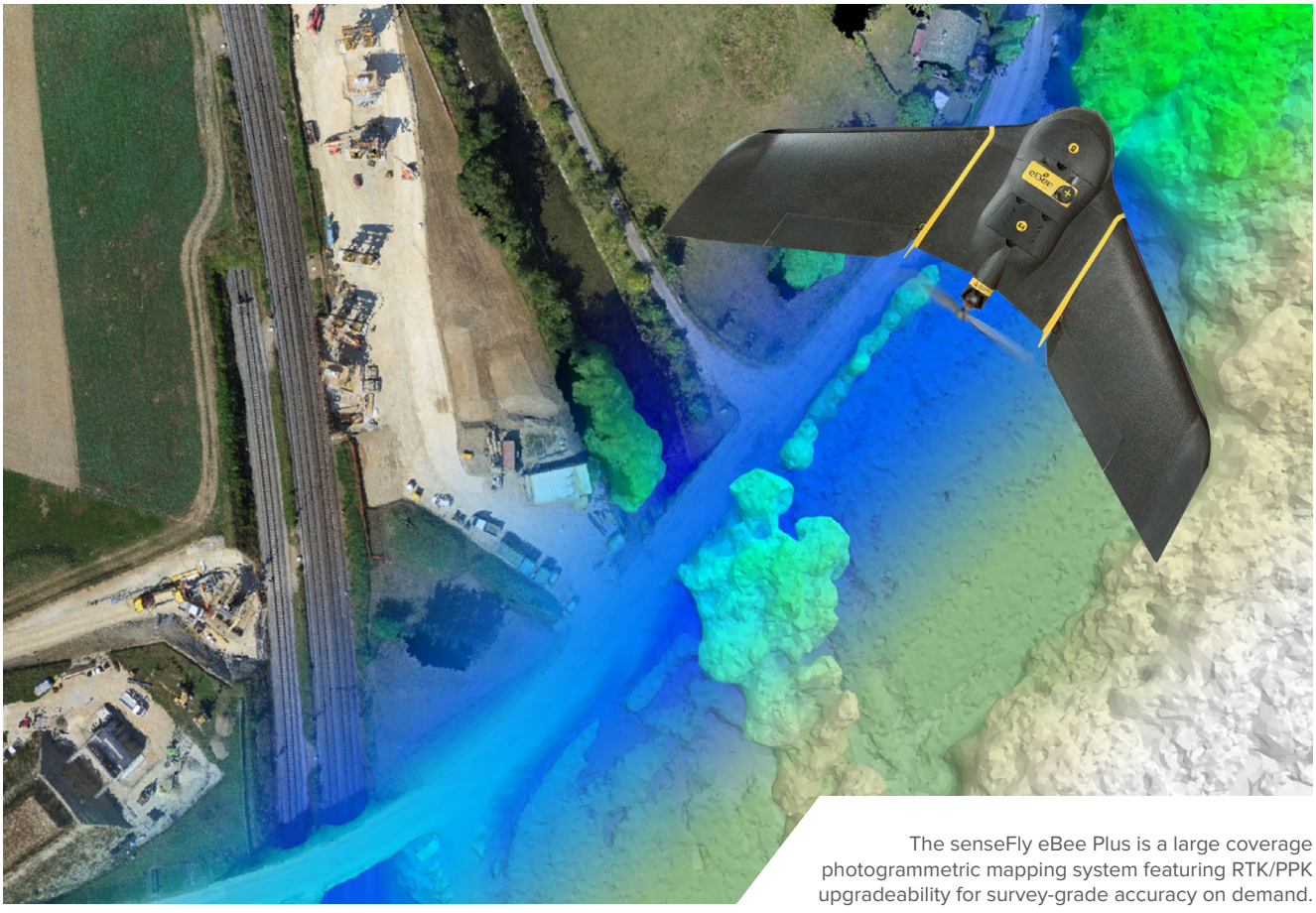


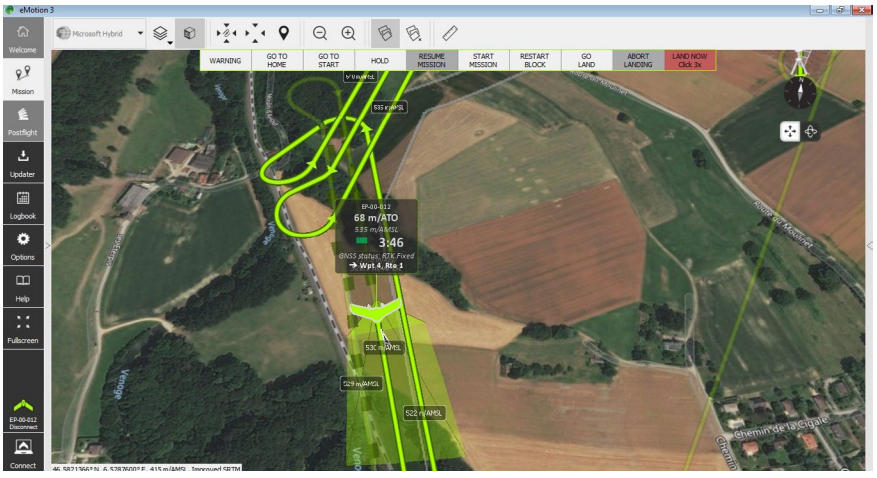
The senseFly eBee Plus is a large coverage photogrammetric mapping system featuring RTK/PPK upgradeability for survey-grade accuracy on demand.

# CORRIDOR CLOSE-UP

## Francois Gervaix Discusses senseFly's New Linear Mapping Release

BY MATT WADE

At the AUVSI Xponential conference in Dallas, senseFly unveiled a new eBee Plus platform enhancement designed to simplify corridor mapping. The company's project lead, Francois Gervaix, explores why documenting linear assets is so challenging and how senseFly Corridor addresses these challenges.




An eMotion 3 screenshot showing the exact ground coverage of one aerial image, captured by an eBee Plus with senseFly Corridor installed.

**Hi Francois. Let's start simple. What do we mean when we talk about corridor mapping and what types of linear sites are professionals looking to document?**

Hi. Well, by corridor mapping we're simply talking about the mapping of linear sites. In other words, areas that are much longer than they are wide. Such corridors are usually made up of several distinct segments; a new segment is usually defined each time a corridor changes direction.

Many types of infrastructure fall into this linear category, such as roads, rail lines, pipelines, telecommunication lines and channels, plus corridor mapping also applies to different natural features like rivers and coastlines.

**What kind of professionals are doing this work?**

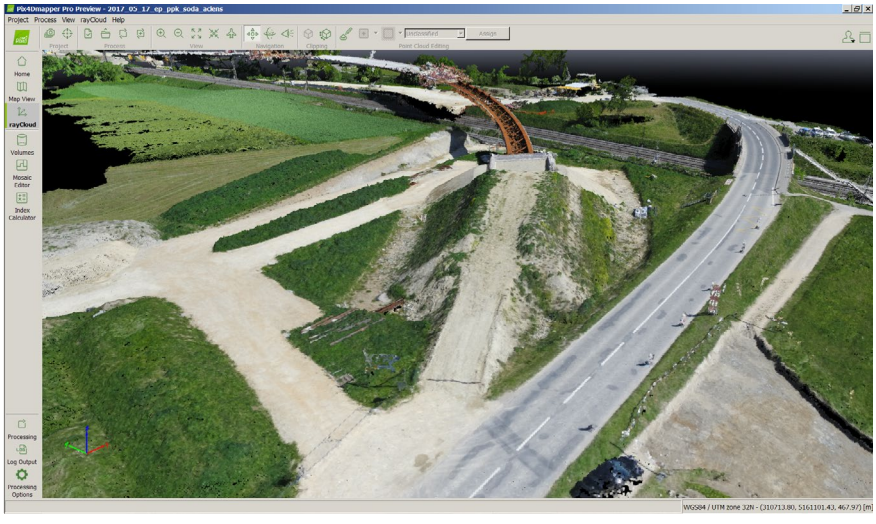
Professionals such as planners, builders, infrastructure managers and environmentalists are all using corridor mapping.

Take the example of a field visit, where a project's stakeholders come together to discuss the progress of a road construction. Gaining an overview of such a corridor, unless very small, is difficult on the ground; the size of the object is just too big to perform a site visit terrestrially. That's why aerial mapping is the obvious solution. The question is: what type of aerial mapping is best and most cost-effective today?

**So, how are linear assets and sites like these typically mapped and measured? What's the standard approach?**

Today, since aerial efficiency is key, corridor mapping is mainly carried out by helicopter. We're talking about an aircraft that carries a high-resolution camera or sensor such as a LiDAR sensor, as well as a precise GNSS and inertial measurement unit.

Terrestrial measurement, by contrast, is usually the least desirable option, because it's very slow and requires lots



A screenshot of the Pix4D point cloud of a new road construction project, close to HQ, derived from senseFly Corridor (eBee Plus) aerial imagery.

of stop-and-go, either on foot or in a vehicle—if the route is driveable at all.

**And what are the pro's and cons of this approach?**

The benefit of using helicopters is that you can cover your corridor very quickly. However, renting a helicopter is very expensive.

Currently, here in Switzerland for example, you're probably looking at fifty Swiss Francs—roughly fifty US dollars—per minute. Not to mention issues such as an aircraft's (probably limited) availability, flight authorizations, emissions and so on.

**That cost alone seems a good argument for companies to consider using drones. So, have drones already started to impact the use of helicopters (and if not, why not)?**

Certainly, some surveying and engineering companies have moved to drones, but many have not. I believe that this has mainly been due to the complexity and difficulty of mapping corridors with drones.

**Why is that, what's difficult?**

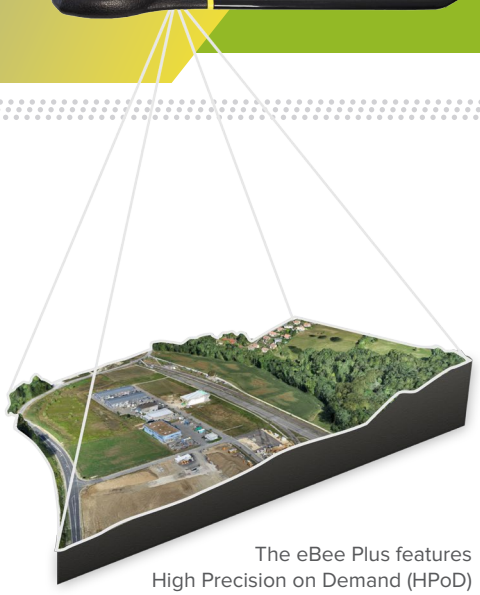
Two things make corridor mapping a challenge: the length and the width of the area being mapped, only for different reasons. And the longer and narrower, the more difficult.

When mapping corridors with UAVs, long corridors are challenging from a logistical perspective, in that you quickly start talking about needing to fly with extended and beyond visual line of sight—aka EVLOS and BVLOS—operations.

In most countries, the aviation authorities have not yet put in place a framework for drone operators to fly these kinds of missions. Or, if they have, the process of gaining such approvals is lengthy and currently a big hassle. However, these types of operations are definitely on the radar of most

regulators and here at senseFly we definitely see them as driving the next stage of the commercial market's evolution. We're hard at work, with our distributors in different countries, to help different authorities put in place BV and EVLOS regulations that make sense and will ensure safe operations. We're also working to support individual operators who are taking steps to become authorized for such missions.

However, conversely, the fact that corridors are, by definition, not very wide, presents a geometric challenge. Narrow, basically, means geometrically unstable. That's why geospatial professionals don't generally like narrow 2D and 3D geometry!



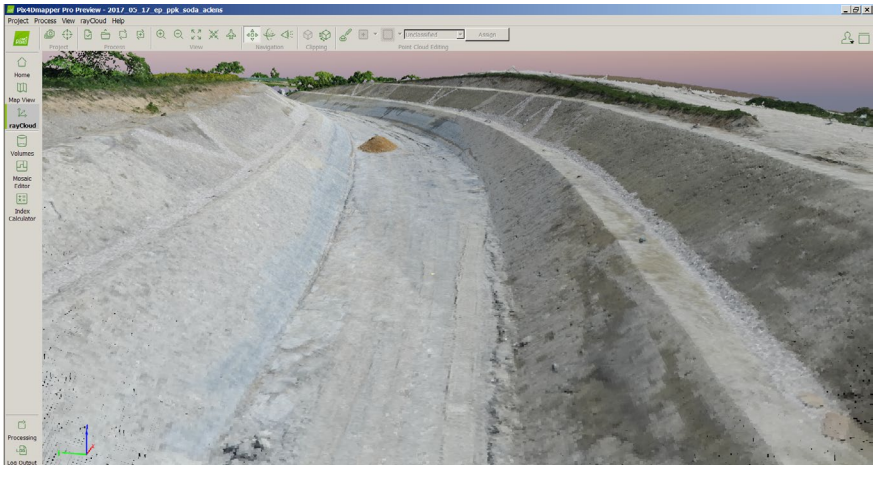
The eBee Plus features High Precision on Demand (HPoD) thanks to its built-in RTK/PPK functionality. It's survey-grade accuracy you control, without the need for ground control points.

**Could you explain why?**

Because of the lean shape of the object, geometric stability is difficult to obtain. Tunnel builders know this very well! Forward intersections are inaccurate, numerically unstable and easily affected by external influences, such as slightly blurry images. Therefore, professionals need to rely on high internal accuracy—intrinsic accuracy—to achieve good results. This is where precise GNSS comes into play; every projection center is accurately located and will be given more "weight" in the adjustment.

With senseFly Corridor, our solution uses a default three flight lines for each mapping section. This number both ensures redundancy in the positioning, and the angular stability of the photogrammetric reconstruction, while optimizing the drone operation's efficiency.

For wider corridors, the number of flight lines, always odd, will increase, for example to five or seven flight lines, and so on. We use odd numbers so that the drone is able to fly a section of corridor and finish up at the start of the next section—in the case of three lines for example, this means it flies out, back, out again and onwards to the next section.



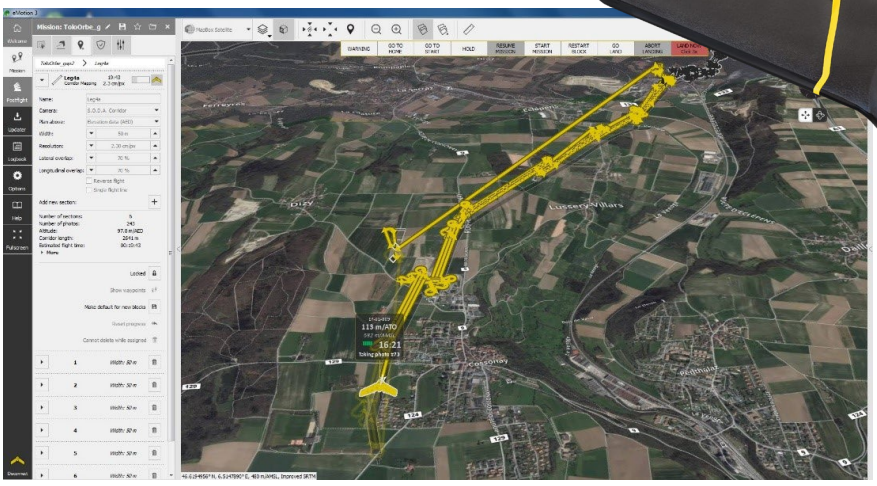
A closer look at the point cloud of the new road construction project, from senseFly Corridor aerial imagery.

**If we consider drone operators working today, what kind of corridor workflows are they using? How are they carrying out such missions?**

They're mainly using ad-hoc workflows that they've worked out by trial and error, basically devising their own method. They are usually creating their flight lines manually. They will be using rectangular coverage blocks, which they position manually end to end in order to map along the corridor. The issues with this approach are that, one, it takes a long time, and two, it can lead to inefficient planning (and therefore flying)—wasting flight time, wasting images and—because the approach is so manual, risking not having enough images or overlap to properly reconstruct the results.

**And how does that manual approach compare to the workflow you have developed for senseFly Corridor?**

Well, let's define quickly first what senseFly Corridor is: we're talking here about a combined hardware and software solution. This includes a camera integration kit, which houses the senseFly S.O.D.A. in a longitudinal (portrait) position, and a new corridor mapping mission block within senseFly's eMotion 3 flight planning software.



eMotion corridor missions are comprised of different sections; a new section for each change of direction.

The senseFly Corridor integration kit houses the eBee Plus' senseFly S.O.D.A. camera in a longitudinal position, enabling it to capture images in corridor-friendly portrait format.

This combined approach offers three potential benefits. First, if resolution is key to your project, you can achieve better ground resolutions than ever before, because a vertical camera position means you can fly the eBee Plus closer to the ground, for GSDs of down to 1.5 cm [0.6 inches] per pixel.

Or, if ground resolutions are less important than minimising your processing workload, you can fly at a standard height and need 30% fewer images to map the same corridor, compared to flying with the senseFly S.O.D.A. in its standard horizontal position. This means, of course, 30% shorter processing times, so your data workload is reduced.

And third, irrespective of whether you go for higher ground resolutions or fewer images, senseFly Corridor just makes planning corridor missions easy. With eMotion's Corridor mission block you just load up the route—for example by importing a project's pre-existing KML file—click along this once each time it changes direction, and the software automates the flight lines and image capture points according to the corridor width you specify. We give you a flight plan with just the right number of images—not too many, not too few. It's perfectly optimised.

**What effect do you expect senseFly Corridor to have on senseFly's business?**

Well, it allows us to better meet our customers' needs. That can only be good for business. It makes the eBee Plus, in particular, an even better fit for surveyors and engineers. By making linear mapping easier and more efficient, we're increasing the range of projects a professional can reasonably expect to fulfill.

**Thanks for your insights Francois, we appreciate it.**

Sure, you're welcome.

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**Matt Wade** has been writing about emerging technology for more than 15 years. In his current role as marketing director of senseFly, a Swiss commercial drone manufacturer, one of his many responsibilities includes getting to know senseFly customers and helping them tell their project stories.