

Executive Summary

In response to the recession and near total collapse of my land surveying business, I reacted by innovating a method of accurately surveying land from the air using small unmanned aircraft. What makes us unique is the fact that we have created the most accurate aerial map from any unmanned or even any manned aircraft in the world. The spatial accuracy we achieved was +/-23mm, this is as accurate as ground surveying, which is truly ground breaking. This aerial survey method has astronomical time savings over traditional ground survey methods while at the same time delivering more informative topographical information.



C-Astral Bramor RPAS (Remotely Piloted Aircraft System) deploying its parachute for a landing

What was the Rationale behind this Innovation?

Baseline Surveys specialises in producing Topographic, Engineering and Boundary Surveys, supplying geographical information to the engineers, architects, golf course managers, facility managers, agricultural consultants, government departments, semi state companies, local authority and disaster response and coordination management teams. The motivation behind this innovation was to gain a competitive edge in producing land surveys. Ground surveying, until now, has traditionally been more accurate than aerial surveying even though surveying from the air has always been more

efficient. We wanted to produce aerial surveys from a small unmanned aircraft which resulted in the same accuracy as ground survey methods but with a vastly increased efficiency.

Is the Innovation an Improvement on Existing Technology?

- RPAS Surveying Saves Time

We can carry out land surveys using RPAS (Remotely Piloted Aircraft Systems) in a fraction of the time taken to survey land by ground survey methods. For example we surveyed 2000 acres in March 2014 at Lisheen Mine in 3 hours with RPAS, this would have taken a ground survey crew 100 days to complete to the same accuracy. We surveyed Dun Laoghaire town centre and harbour in less than an hour, which would have taken a ground survey crew 6 weeks to complete.

- RPAS Surveying is More Cost effective

On Lisheen Mine we were 4 times cheaper than the next highest bid. On Mahon Point Green Route Survey we were 50% lower than the next highest tender price. On Dun Laoghaire harbour survey in January 2014 we were 40% lower than the next highest tender price.

- Surveying with RPAS is Safer

On the Mahon Point Green Route Survey in February 2014, Cork City Council required an accurate survey of a busy road, which normally would have required implementing a section 8 traffic management system, as we weren't sending surveyors onto a live road. As we were surveying the road from the air using our unmanned aircraft we didn't require any traffic safety management system. On the Dun Laoghaire survey project we didn't have to consider the safety of ground surveyors working at quayside locations, we didn't have to risk sending surveyors to survey the town centre's roads nor did we have to risk staff by sending them on to Irish Rail tracks to survey the track lines.

- Quality of Data produced from RPAS is both Superior and Recyclable

Typical topographic surveys consist of points, lines and text while our RPAS data is photographic. This clearly leads to more informative data, which avoids the scenario where the end user is guessing what a certain line represents on a survey. All traditional land surveys are done for a specific purpose, which leads to the same area being surveyed many times for different purposes. Because our RPAS surveys everything at once, it means that a RPAS survey can be reused for many different purposes across a range of government departments.

Concept to Market Fruition

In 2011 the concept of using RPAS for ground survey projects occurred to me as RPAS is permitted to fly lower than manned aircraft it produces far higher resolution imagery. This higher resolution potentially allowed for the data capture of features such as gas valves, hydrants, gully traps which aren't visible from traditionally manned aerial surveys, but are required for land surveys.

To drive my concept further I had to up skill.

- 2011-2012: UCC, Cork: Higher Diploma in Geographic Information Systems
- 2011: Ascending Technologies, Munich: Manufacturers Training on Facon 8 VTOL RPAS
- 2012: Euro USC, UK: Ground School Training for Operation of RPAS
- 2012: C-astral Aerospace, Slovenia: Manufacturers training on Bramor-geo fixed wing RPAS
- 2012: IAA permit awarded to Operate both VTOL and Fixed wing RPAS in Irish Airspace

When we first obtained our permit to operate unmanned aerial vehicles in November 2012 from the Irish Aviation Authority we tested our equipment for the spatial accuracy of the data produced.

Our results were so accurate that we wrote a white paper on this titled “Accuracy of UAV Photogrammetry”, and it was published at the UAV-g Conference in Rostock University in September 2013 and also at the UVSI Conference proceedings in June 2013 at the Royal Military Academy of Brussels, where I also presented on this unmanned aerial mapping technology. We have presented our accuracy test white paper at the following conferences to market our new mapping product:

- Irish Earth Observation Symposium DIT 2012
- Engineers Ireland, Cork 2013
- UVSI Conference, Royal Military Academy, Brussels June 2013
- UCC GIS masters Class, Cork 2013
- IRLOGI GIS Ireland, Dublin 2013
- Irish Earth Observation Symposium Ashtown castle, Dublin 2013
- UAV-g Conference, university of Rostock, Germany 2013
- UVSI Conference, Royal Military Academy, Brussels Dec 2013
- AutoDESK Seminar, BIM for Infrastructure User Day, Cork 2013

Our white paper appeared in article form in Engineers Ireland ezine, Professional Surveyor magazine (USA) and the Civil Engineering Surveyor magazine (UK) during 2013.

Our accuracy levels are +/-23mm horizontally and +/-35mm vertically, which are the most accurate mapping results from any aircraft anywhere in the world, manned or otherwise.

This has given us a huge advantage in the market place and as a result we are quite busy today with 6 RPAS mapping projects ahead of us, this is the first time since 2008 that we are so busy.

What is the Wow Factor?

- We had our white paper published on a method of surveying using Unmanned Aerial Vehicles which has resulted to being able to produce the most accurate aerial surveys from any aircraft, manned or unmanned, in the world.
- We were invited to present in March 2014 to the European Commission on a hearing on responsibility, liability and insurance issues pertaining to the operation of remotely piloted aircraft systems
- We presented at 9 conferences in 2013 on our technology both nationally and internationally

- We have had articles published on our white paper on professional Engineering Surveying publications both nationally and internationally
- We have revolutionised land surveying using unmanned aircraft to produce cheaper, better and safer land surveys
- CO2 emissions free as we use batteries to power our unmanned aircraft.

What are the Benefits of Research?

From our accuracy test, which we published a white paper on, we could precisely determine the levels of accuracy that we could reliably achieve using RPAS for surveying land. This allowed us to determine exactly which type of surveys that the RPAS could be used on in terms of being fit for purpose with regard to the accuracy of the results required. This has also proved crucial in persuading end users of survey data quality that the data captured from RPAS was indeed fit for their purpose. Our published white paper on the Accuracy of UAV Photogrammetry also allowed us to market our product by presenting at a large number of conferences in 2013 attended by potential land survey clients and being published as articles in professional publications worldwide.

Does the initiative bring Cost Effective Solutions?

The answer is a resounding yes!

- Lisheen Mine Survey 2014: We were less than half the price of the next highest tender bid
- Mahon Point Green route Survey 2014: We were 50% lower than the next highest bidder
- Tipperary race Course Survey 2013: We were 1/5th of the next highest tender price
- National Sports Campus Survey 2013: We were 1/5th of the cost of a previous ground survey
- Dun Laoghaire Harbour Survey 2014: We were 40% lower than the next highest bidder
- Cobh Hospital Survey 2013: We were less than half the price of the next highest bid
- Curraheen Dog Track Survey 2013: We were less than half the price of the next highest bid

What is the Potential Impact of this Technology to the Aviation Industry Worldwide?

The impact of this technology is that Aviation Authorities worldwide should move to regulate the integration of Remotely Piloted Aircraft Systems into the world of manned aviation safely while allowing innovative solutions to age old problems to flourish.

Testimonials

“Baseline Surveys was able to deploy resources within days of their appointment, and the final information was provided in the 3D digital formats that the clients (cork City Council) required within a week. The quality and delivery time of the final information was beyond our expectations, considering that the survey area had limited access due to private land ownership, overgrowth, and significant height differences. There was also the added advantage of having a high resolution aerial image of the survey area which would normally had to be commissioned separately.”

Sanhung Poi, Design Engineer, Clifton Scannell Emerson Associates.

“Having put some time into researching available technologies to efficiently capture such a large site I ultimately decided on orthophotography collected using RPAS. Apart from the obvious deliverable of the high-resolution, rectified aerial imagery, we also had a requirement for a Digital Surface Model (DSM) to enable stockpile volume calculations. The relative accuracy we achieved for the project as a whole was way above my expectations and now we have started to use the data I am only now realising the technologies full potential as a survey tool. In my opinion, for certain applications orthophotography is now superior to LiDAR “.

Harry Twomey IIS, MIEI, Chief Surveyor, The Lisheen Mine

“I am amazed at the enormous potential this survey data will provide above and beyond the original basic requirement (to provide a survey in CAD format of the Harbour). All too often a survey is included with and filed within specific project documentation, and I then buried in an archive. The expansive, multi-format and digital nature of this survey will allow us to utilise it as a day to day management, time-line and planning tool for many years to come. I would strongly recommend this approach to any entity with a similar requirement.”

Tim Ryan CEng, CEnv, Operations Manager, Dun Laoghaire Harbour Company.

“ My role as Irish Aviation Authority Cork ATC Manager brought me into contact with Paudie Barry and Baseline Surveys over 12 months ago. Given the significant increase in Remote Piloted Aircraft Systems in this time, the working relationship that I have developed with Paudie has been significant and mutually beneficial.

Having come from an engineering/surveying background, it’s fair to say that Paudie had little knowledge of the aviation industry. However he fully engaged with the IAA, both from an Operations and Regulatory perspective, in gaining a deeper knowledge of Irish airspace and possible restrictions to his operation. I am confident in saying now that he can justifiably be considered an aviator in the truest sense in that he is a class leader in how RPAS activity should be undertaken and is an innovator in applying this new aviation technology.

We have worked closely together on a number of different and varied details and I have always been impressed by his application to ensure that the highest safety standards are maintained. In working with him I have also gained greater insight into RPAS activity which has enabled me to more accurately assess other RPAS activity affecting ATC operations.

From operations manuals to pro-active engagement with the IAA, Paudie has clearly shown his commitment to the aviation side of his business and I’m delighted to recommend him for the Aviation Industry Awards.”

Cathal Mac Criostail, Manager Cork & Shannon Terminal Services, Cork Air Traffic Services

