ENERGY INDUSTRY EXECUTIVE ROUNDTABLE REPORT

Challenges and experiences in the use of UAVs in the energy industry

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2 Executive Summary

As part of Commercial UAV Expo Europe 2018 in Amsterdam on April 10-12, executives representing European Energy companies gathered on for a roundtable discussion session to address challenges in the use of UAVs and share their experiences with their utility industry colleagues.

The purpose of this report is to reflect the topics discussed during the Executive Roundtable event and to also include relevant information from the two Energy Industry sessions held during the conference. We have strived to document the discussion as per the ground rules of the session.

The level of innovation and experience in the room was impressive. Everyone was engaged and willing to share their experiences, hear from others and look for tips and tricks.

One overarching take-way from the session is that while there is a lot of information out there in relation to drones being used by the Energy Industry, there is a need for more targeted sharing of what works and what did not work across the Energy Industry.

In summary, the key outcomes from the session include;

1. Across the Energy Industry, there is no longer any discussion on the 'Return of Investment' for using drones for specific use cases such as inspection. Given the time savings, better use of resources and worker safety benefits, using drones is a 'no brainer'.

2. More and more energy companies are establishing their own drone operations in-house, as they look to use drones in the workplace just like any other 'tool' available to them. The need to develop the required competence and skills internally is becoming a priority.

3. There is a move away from full vertically integrated solutions being offered by drone service companies to more of a 'best of breed' solution eco-system. No one 'player' can do it all.

4. Data, data and more data. The volume of captured data is expanding at a rapid pace. Collecting, proceeding, storing and securing this data is proving to be a challenge. Data security, privacy and cybersecurity risks have to be assessed and mitigated.

5. Regulation is still very 'painful'. It varies widely between regions/countries and is evolving very slowly. The strategy and timeline around the EU's U-Space (UTM) is seen as positive, yet many are waiting to see the system rolled out and using it before passing judgement.

6. Beyond Visual Line Of Sight (BVLOS) capabilities are seen as the next big thing, assuming the technology and regulations allow safe and repeatable operations. Internal inspection capabilities for buildings/assets is another growing use case for many companies.

7. Machine learning algorithms are improving for a number of use cases. Artificial Intelligence (AI) is seen as a long way away. Supervised Machine Learning is the way forward for now.

8. Fully autonomous drones are seen as a 'nice to have' for now. There are a number of technology, regulation and process issues that still need to be resolved. Even then it will take some time for such autonomous operations to be 'trusted'.

9. Even with better automated operations and future AI, most companies wish to retain some level of human oversight before any significant decisions are taken 'automatically'.

10. Finally, don't just think of drones in terms of what we see today – think about crawlers, robots, high-altitude drones, low orbit inexpensive satellites … This industry is just getting started.

3 Roundtable Discussion Detailed Notes

The following list of topics were proposed to the attendees prior to the event and are ranked here in the priority order for discussion as requested by the attendees prior to the event.

Any NEW topics that arose during the roundtable are identified by the [NEW] label.

1. Most effective use cases today in 2018

Given today's technology, regulations and best practices, what use cases make sense in 2018?

- The 'low hanging fruit' use cases right now are all related to the inspection of physical assets. Compared to using a traditional crew to conduct time consuming inspections in a hazardous area, the ability to use a commercial drone system is so much faster, cheaper and brings huge worker safety benefits.
- There is little to no discussion related to the ROI of using a drone. The cost of using a drone is so much cheaper than the traditional inspection methods and it's so much safer than putting workers in harm's way. It's a "no-brainer."
- The 'usual' Inspection use cases include;
    - Transmission Towers & Lines (including BVLOS)
    - Facility Building Inspections
    - Renewable Energy Assets – Wind Turbines, Solar Panels, Hydro Dam Structures
    - Oil/Gas Platforms & Pipeline (including BVLOS)
    - Flare Stacks
    - Stringing new Grid Cables
    - Inside Boilers
    - Inside Oil Tanks
    - Vegetation Encroachment / Tree Hight
    - Soil movement/Slippage near Assets
    - Building Site(s)
    - Environmental Inspections (seal & bird surveys)
    - Ice Reconnaissance
- It must be noted that the ability to get the required authorization for any drone use varies widely across the EU today.
- BVLOS flights are extremely restricted today. Some companies have approval for some very limited and exceptional circumstances. BVLOS is not 'a typical' use case today in Europe.
- Depending on the situation, it's cheaper to sacrifice a drone to get required images faster than having to deploy a traditional inspection team to physically inspect an asset.

- Images from multiple points of view around an asset are becoming much more important, especially when developing 3D models. The ability for a drone to capture images from underneath any asset/structure is becoming a must-have for many use cases.
- The use of drones following a natural disaster is not as relevant in Europe compared to the US.
    - It was highlighted that some companies are looking to deploy drones to an avalanche area as the use of helicopters after an avalanche is restricted since the helicopter may cause additional avalanches.

2. Use cases for 2019+

In an ideal world, what use cases would you like to see in 2019+ time frame come to reality?

- Drones are not the 'only' answer. The ability to combine data from drones with data from your traditional inspections, helicopters, the use of ground and aerial lidar etc. will enable better utilization of data to make better decisions.
- Elimination of repetitive and boring work from employees by improved automation systems for drone flight, image processing and automated inspection results in order to free up resources for more productive tasks is imperitive.
- Instead of generating a 'pdf' report, the result of an inspection can get automatically submitted to the relevant Asset Management, Maintenance and Work Scheduling.
    - However, the general consensus was that some human oversight will always be required until such automation algorithms are proven to be reliable.
- Deployment of 'tethered' drones, with the tether providing power and communications to the drone, thus enabling the drone to remain in position for hours/days for given security/real-time monitoring use cases represents a distinct value proposition.
- Deployment of new high-altitude (HALE) drones, which could stay in position for weeks/months at a time and remain out of the way of commercial aircraft. Depending on the sensors they carry, one could get almost real-time imaging of a complete transmission line, pipeline or a facility.

What technology and/or regulations need to get implemented to make these a reality?

- BVLOS
    - Technology, regulations and the skills required to enable BVLOS flights is needed. As is the ability to fly at night.
    - It was assumed that the EUs future U-Space (UTM) will be designed for repeatable BVLOS flights along defined corridors for say transmission lines and pipelines. In some countries today, one is required to file a new authorization request for every individual BVLOS flight, and it can take weeks/months to get approval. This is not feasible if you need a BVLOS flight now to react to a fault.
    - Improved/new 'propulsion' systems, be that battery and/or other fuel source(s) need to be implemented in order to enable longer flight times, especially for long distance BVLOS.

- Image Processing
    - The technology will need to get better as right now some are dealing with 80% false positives but a very low percentage of false negatives. While it's better to have false positives versus false negatives, it still generates a lot of work. Therefore, the percentage of false positives will need to decrease.
- Next generation machine learning and artificial Intelligence.
    - Developments in analytics amd machine learning is required to eliminate repetitive work (manually scanning hundreds of images)
    - There was a healthy discussion on the positives and negatives of relying on future machine learning and AI platform to make 'decisions' on their own, without human oversight. While it depends on the scope of a given decision, such a system would be tasked to make, what society accepts as "Okay" or not will also need to be taken into consideration.
    - It's also of interest to call out that almost everybody has a different definition for what is and is not machine learning and/or AI. This needs to be addressed by the wider technology industry.
    - The question of 'Who would be responsible?' if such a system made a bad decision was also raised during the session.
- Sensor payloads - As more and more different sensor payloads become commercially viable a number of people expressed concern that the complexity of selecting the drone platform and then figuring out which sensor payloads it supports is going to become far more complex. This ability to mix/match drone platforms and sensors will need to get easier.
- Future Communications Networks – 5G
    - Assuming 5G lives up to all of its promises of lower latency, higher bandwidth and assuming adequate network coverage, then consensus was that all new sorts of use cases may arise, once the capabilities are understood.
    - However, it was called out that not all use cases require vast amount of bandwidth. So 5G is not the answer for everything. Additionally, 5G has some tough technical issues that will need to be addressed

3. Workflow Implications – data management

Dealing with huge volume of data, photometery, video, point clouds

- The amount of data is ever increasing which is creating real headaches. Simply transferring and viewing the data can be challenging depending on available bandwidth and the standard compute platforms available to workers.
- Securing the data is also a challenge – Refer to section 3.9
- Data needs to be broken down into manageable chunks so as to distribute/view just that sub-set of the data for a specific job / worker.

Integration of the new data into existing backend workflow process – Work Orders, GIS, Asset Management, etc.

- General consensus that the Industry needs 'end-to-end' workflow process, yet this is extremely difficult to do today as it requires being able to integrate all of a company's back-end systems.
    - Having drone captured data automaticcally updating the back-end Asset management and Maintenance Systems requires that all the relevant Asset Management and Maintenance Systems being integrated already. This is a non-trivial task.
- The 'novelty' of reviewing thousands of images and hours of video wears off fast. All this data needs to be stored and processed to be turned into required work items that can be acted upon.
- All the data needs to be stored for future analysis in order to develop better algorithms for predictive maintenance etc.

How much data do you need?

- It all depends on what the use case is, and how long the data will be stored. General practice right now is to capture what one can and refine the process as Industry gains experience.
- More is not always better. While the resolution of many sensors is improving day by day, if a drone is being used to simply get a quick snapshot of what's going on, the quality of the image does not have to be at the highest spec commercially available.

[NEW] Who owns the data

- General consensus is that the 'customer' owns the data. However, there are some companies out there offering services with a business model that states that they provide a service but wish to keep access to the data in order to have a bigger data set to use when improving their machine learning algorithms.
- Related to 'cloud' discussion - Some companies require all data has to remain in-house for workflow and legal reasons. Others are happy outsourcing the processing of data to a third party.
- Almost all companies want to own the data and they certainly want access to the data if they need even after a project is complete.

[NEW] Define a drone

Today most of us think of 'drone' in terms of a multi-rotor or fixed wing Drone. In the future companies may have a range of different 'drones';

1. Crawlers – Crawling along in tunnels, in pipes, in ducting, along cables etc.
2. Robots – For all sorts of specific use cases.
3. Indoor Drones for inspections of indoor facilities, tanks, boilers etc.
4. Anti-Drones – To stop the 'bad' drones. (CVAUs)
5. Swarms of Drones – A group of drones that synchronize for specific tasks
6. High Altitude Drones (HALE) – Providing imaging and other sensor technology over a specific area for potentially weeks or months at a time.
8. Low Orbit inexpensive Satellites
9. On Water / Under Water Drones
10. Driverless Vehicles – Could be called a 'drone'

4. Workforce Implications – organizational challenges

Deciding to go in-house or out-source

- A key trend at the conference and reflected during the roundtable discussion was the move for more energy companies to do more things in-house versus completely out-sourced.
- However, it is very nuanced. Some energy companies are looking to completely outsource the inspection analysis and inspection report of, say, wind turbines. However, for critical assets (like transmission lines) given regulatory and legal requirements they are very reluctant to outsource any aspect of the work to ensure compliance.

Training requirements for staff – IT, Operations, Management

- A key learning from a number of companies was to establish a Drone Center of Excellence in an organization. As many different departments and groups start investigating the use of drones, it can often lead to duplication of work across multiple departments. It's better to coordinate such activities and share best practices within the company.
- If an energy company does not already have an aviation function, then the skillset and procedures required to interact with the local air traffic control organizations will need to be acquired and any relevant workflow process be changed accordingly.

- Staff Training – This is based on the local legal/regulatory requirements and the complexity of the actual use case. The requirements in terms of 'pilot' skills can vary widely depending on the use case. The qualifications and skills needed to fly a drone inside a boiler are very different from those needed to fly a drone BVLOS or those needed on an oil platform out in the North Sea.
- The question was asked … 'once drones are fully autonomous, will we need drone pilots? General reply was we will always need 'human' oversight and ability to step in if needed, but not all drones will need their own pilot.
- **[NEW]** Implications for training of staff to respond to questions from public when using drones out in the field need to be considered. Typical Q&As may need to be prepared.
- **[NEW]** Given EU GDPR regulation, field staff need to be provided with relevant information in order to answer any on the spot questions from customers / general public.

Acceptance of drone technology in the organization.

- General consensus that initial reaction of most staff is that 'drones are cool'.
- Using drones can lead to much more efficient use of resources. Instead of spending many hours putting Inspection teams into potentially hazardous situations having to physically climb up or down an asset to inspect it, drones can do the initial inspection. Depending on what the inspection finds, the inspection/repair team may still need to be deployed, yet the overall time savings are huge.
- Drones will take my job - An anecdote heard a few times during the event was related to companies getting push back from some workers saying the 'drone will take my job' when they began to deploy drones. After a number of months, the comments were more along the line that the drones were finding so many assets that needed to be repaired by a human, then they 'had a job for life'.

Acceptance of drones by society and implications for field staff communications and training.

- While the topic was only briefly discussed, it was highlighted as an item for the Bin List. As companies deploy drones more and more, then staff operating drones will get more and more questions from the general public that they will have to address on the spot, including potentially questions relating to GDPR issues.

5. Limitations today – what 'features' caused issues…

Communications issues during operations – loss of control, video feed, etc.

- Communications issues can arise for many reasons. These can never be eliminated so it is important to have procedures to deal with such events as they will happen.

See comments in section 3.3.2 on 5G. electromagnetic

- Was called out as an issue particularly when operating near high voltage grid lines. Multiple drone companies are now certifying drones for use in such areas.
- Again, it was mentioned that this can never be eliminated so important to have procedures to deal with such events as they will happen.

Data Management – uploading large volume of data, data storage, processing

- Refer to section 3.3.1.

Drone Hardware reliability (including batteries, spare parts, etc.)

- While drone hardware failures do occur, they are not that common.

Location related

- Refer to section 3.7

Weather limitations – wind, storm, too Sunny etc.

- Was briefly mentioned. Weather is a variable that just has to be taken into consideration and does require some 'local' knowledge in order to plan/mitigate for it as needed.


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Battery life

- It came up during the event that while most commercially available multi-rotor drones today have battery life of 15-25 min, this is not a major issue. If an inspection team is monitoring the feed from the drone in real time, then human concentration for longer than 15 minutes is tough to maintain. So having to take a break to land drone and replace the batteries is not that big issue.
- For BVLOS, then battery life is a much more relevant issue.
- Interest was expressed in alternative fuel supplies used in drones, such a fuel cells, traditional combustion engine, etc.
- One issue that did arise time and again is the shipment of Lithium Ion Batteries. Given current aviation and industrial safety rules, transporting spare commercial drone batteries is a non-trivial task, even by road transport.

[NEW] Industry advisories

Another topic that came up in relation to this, is the lack of advisory notices from the drone manufacturers is disturbing. When people find a problem with a specific drone system, they work with that drone system provider to get it resolved. They are not getting this information proactively from the drone provider highlighting to them other potential problems that have been found by other companies. For commercial business, being proactively updated on potential issues and tips and tricks is critical.

6. Drone Regulations and Permits

In terms of current EU and country / city regulations, what works today, what does not work… lessons learned?

- Discussion varied hugely depending on who operated in which country. Some shared examples of where they worked with the regulator/policies and while not easy, they got the required approvals.
- Others shared 'horror' stories of where it was almost impossible to get approval, or cases where each individual flight (especially for BVLOS) has to be requested separately and one can wait months for a yes/no.

Based on what you know of EU's plans for regulations in 2019+, is this positive or negative?

- General 'natural' sentiment towards the EU's plans – most hoping for a more defined, timely, and deterministic set of regulations and processes to be established but need to wait and see how this develops.

7. GIS / Location Awareness

Is the current standard GPS system adequate for your current use cases?

- General option was the better the accuracy you can get for the least amount of effort, the better.
- Expectation is that the Industry will continue to improve the systems over time to make it easier for operators to achieve better accuracy with reduced costs.

Are differential GPS, ground waypoints, etc. required for accuracy?

- Again, this depends on what you are trying to do and the accuracy you really need. 'Standard' onboard GPS, DGPS, PPK, RTK & VRS all have a role depending on the accuracy you require.

Is anyone looking at Galileo based solution?

- Level of awareness of Galileo is low in the Industry. Most are not aware that many of the commercially available GNSS kits being manufactured by the likes of Trimble etc. already use the Galileo GNSS constellations (along with all others) today.
- As the new more accurate Galileo services come online in 2018+, then awareness level should increase.

[NEW] Indoor drones

- A key theme at the event and roundtable was acknowledgment that there is a great need and potential for using drones inside structures, be that buildings, fuel tanks, boiler inspections etc.
- Many companies are testing out specific use cases. Most rely on 'position' data being referenced from a defined point(s) inside the structure via some beacon type system, and thus the need to have GPS type functionally inside the structure is not that relevant.

8. Autonomous Drones

If technology AND regulations for autonomous drones (aka drone in a box solutions) exist, is this a solution you need given workforce / operating procedures / regulations?

- Refer to section 3.2 above.

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9. Cybersecurity

How did you deal with the cybersecurity risk?

- General consensus that cybersecurity is an area for concern but it's not just because of drones.
- A company's cyber security policies have to be applied for all aspects of drone usage and in relation to the resulting data captured/generated.
- The 'level of risk' for inspection data being compromised should relate to the 'risk' level of physical asset being inspected. Data relating to a transmission line will typically have a higher security level than say a feeder line in the distribution grid.
- EU GDPR regulations were mentioned but the implications of this are not yet fully comprehended, so it was a BIN list item.

What was your biggest cybersecurity issue – data related, data storage related, comms related, 3rd party, cloud based, etc.

- General discussion related to the 'safety' of 'cloud' based solutions came up, yet it was very nuanced, as it depends on;
    a) Use of cloud technologies VS using the 'public' cloud.
    b) There are different opinions out there in relation to what is more secure – an in-house data-center VS Amazon AWS/MS Azure/Google, etc. That's a long debate.
    c) The ability/requirement to 'geo-Fence' data was also briefly discussed.
- The full work process has to be accessed when it comes to cyber security. While most focus defaults to the storage/processing of data in the cloud, don't forget:
    a) Communications – how secure are the comms to/from the drone? How secure is the communications when transferring drone captured data to/from back end systems?
    b) Physical security of data devices – what policies are in place to ensure security of data devices and the handling of these devices such as SD cards, hard disks. Can someone simply pop out the SD card from the sensor and walk off with it. How do you 'prove' this did not happen?
    c) Are you encrypting the data? If so, what are the implications to workflow and S/W needs.

ABOUT THE AUTHORS

Kevin O'Donovan, Technology Evangelist... A bit of a storyteller

Kevin has been evangelizing how new technologies can transform the way we do things through-out his career. From OS/2 back in the 90s, right through to today's technologies such as cloud, IoT, AR/VR, drones and blockchain. He has held senior Technical Sales and Sales Management roles at Compaq, HP and most recently at Intel where he was Worldwide Sales Director for the energy industry.

Kevin is currently establishing his own company, focusing on accelerating the adoption of new technology in the energy industry. He has a number of advisor roles, participates in industry initiatives/events and he continues to spread the 'good news on new technologies' through his established social media presence and speaking at industry events.

Kevin was involved with the Commercial UAV Expo as the facilitator of the executive roundtable session and moderator for one of the energy industry track sessions.

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ABOUT THE COMMERCIAL UAV EXPO EUROPE

Commercial UAV Expo Europe and Commercial UAV Expo Americas are trade events exclusively focused on the commercial drone market covering industries including Surveying & Mapping; Civil Infrastructure; Aggregates & Mining; Construction; Process, Power & Utilities; Precision Agriculture; Law Enforcement, Emergency Response and Search & Rescue (SAR). They are presented by Commercial UAV News and produced by Diversified Communications.

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