EUROPEAN DRONE FORUM

UAV DACH

PROGRAMME
Oct. 12th, Berlin

#EDF2020
From Vision to Reality – Next Level of UAS Operations

EU Drone Forum

www.EuDroneForum.org

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Achim Friedl
Chairman UAV DACH e.V.
Unmanned Aviation Association

Welcome Note

The year 2020 is a year that will be remembered for a long time to come for the world population due to the Corona pandemic with its terrible consequences for health and life, but also for the economy and lifestyle. For the drone economy because of the intended start of the unmanned operations in all EU member states based on uniform rules. However, the start date had to be postponed from July 2020 to the beginning of 2021. The corona pandemic is to blame for this, and this is where the wheel comes full circle.

We are satisfied with the risk-based approach for drone operations:
- at low risk without prior operational authorisation (open category)
- in the case of medium risk with an operational authorisation based on SORA and adequate mitigating measures (specific category), but without the need for a complex certifying process
- finally, at high risk, with the certification of the UAS and of the UAS operator and the licensing of the remote pilot (certified category).

UAV DACH is committed to a cooperative integration of UAS into airspace and a high level of operational safety. We will pay close attention to this in the implementation of European rules in the Member States. On the other hand, we will ensure that the legislature introduces proportionate regulations and does not extend the requirements of the certified category to the low and medium risk areas through the back door.

At the EUROPEAN DRONE FORUM 2020 we want to inform the UAS community and discuss about the next level UAS operations. I therefore cordially welcome you to an exciting program.

Yours

Achim Friedl

Speakers of three EU member states, European Commission and Swiss FOCA

Over 20 Experts life on stage and worldwide online

Efficient and safe UAS operations – discussed in three key topics

Prof. Dr. Wolfgang Koch
Fellow IEEE
Chief Scientist Fraunhofer FKIE

Partner Note

UAV DACH and Fraunhofer FKIE have been working closely together for many years to realize the positive potential of the “drone revolution” together. For a long time a new founder generation has been developing creative business ideas within the framework of UAV DACH with incalculable benefits in the everyday life of all people, with new jobs and economic value creation.

Fraunhofer FKIE is paving the way for new “utility drones” through innovative research in many fields. One strategic challenge is their safe integration into the airspace – buzzword: Future Drone Identification System (FDIS). This infrastructure for safe and reliable UAS traffic also leads to new research questions and product ideas which are being developed in the triangle of UAV DACH, Fraunhofer FKIE and industry. In particular, drone defence is becoming an “enabling technology” for socially accepted, legally regulated and economically viable drone deployment.

However, protection against harmful drones must not impede the use of commercial drones. In the interest of the common good, public safety and opportunities through new mobility must be harmonized.

The Conference

The EUROPEAN DRONE FORUM (EDF) is dedicated to the specific needs of the drone community. The focus will be on the acceptance, safe and commercial operation of unmanned aerial systems. Renowned experts from politics, business, legislation, research and development will provide valuable insights on current questions and topics. EDF will provide one of the few windows of opportunity in 2020 for discussion and exchange of ideas, addressing tasks and challenges, facing the unmanned aviation industry. Operation of unmanned systems within the framework of the European legislation is the EDF's main focus, in order to be able to initiate further strategies and encourage business models and technical developments.
EUROPEAN DRONE FORUM by UAV DACH e.V. will be a blended event. The event is a face-to-face style conference, held under covid-19-regulations, and is available via video conference for those who prefer to join us online.

1) Political statements and discussion - Plan of action for UAS
2) UAS operations Beyond Visual Line of Sight (BVLOS) (European legislation, responsibilities of applicant and authorities involved, cross-border flight operations, qualification of pilots, experience reports and lessons learned)
3) Flight operations in urban air space (UAM) (Legal framework, flying over populated areas, European and International concepts of U-space, UAS operations in U-space airspace, air traffic service providers, common information service)
4) Sensor data for detection and identification (Threat assessment for Europe, legal framework, multiple sensor counter-UAS, sensor fusion)

"The EUROPEAN Drone Forum 2020 is one of the few opportunities this year to directly engage with the UAS community in the light of the upcoming European drone legislation and future common challenges in this emerging industry"

Ronald Liebsch
DJI Germany

"Drones have continuously gained in importance and will have a considerable influence on many areas of aviation in the coming years. The European Drone Forum offers a very good opportunity to gather information on this subject"

Max Scheck
Vereinigung Cockpit

EUROPEAN DRONE FORUM

Programme

10:00 - 10:10

BEGIN ON-SITE and VIDEO CONFERENCE SESSION

WELCOME **Achim Friedl**, Chairman UAV DACH

10:10 - 10:30

VIDEO MESSAGE

UAS AND INNOVATIVE AERIAL CONCEPTS
PSt Steffen Bilger
Federal Ministry of Transport and Digital Infrastructure, (BMVI)

10:30 - 11:30

DISCUSSION PLAN OF ACTION FOR UAS

MdB Thomas Jarzombek
Federal Ministry of Economic Affairs and Energy, (BMWi)

Dr. Joachim Lücking, *European Comission, (DG Move)*

Johann Friedrich Colsman, *Federal Ministry of Transport and Digital Infrastructure, (BMVI)*

Elisabeth Landrichter, *Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)*

Christian Hegner / Markus Farner, *Federal Office of Civil Aviation, (FOCA)*

11:30 -12:00 BREAK

ONLINE BREAKOUT SESSION
Telespazio VEGA Deutschland GmbH

12:00 - 13:30

TOPIC 1 UAS OPERATIONS BEYOND VISUAL LINE OF SIGHT

Michael Petrosjan, *FlyNex GmbH*

Frank Rathlev, *Thyssen Gas GmbH*

Dr. Andreas Lamprecht, *AIRMAP GmbH*

Dieter Klein, *WINGCOPTER GmbH*

Nicolas Marcou, *Direction Générale de l'Aviation Civile, (DGAC)*

13:30 - 14:30 LUNCH BREAK

14:30 - 16:00

TOPIC 2 FLIGHT OPERATIONS IN URBAN AIR SPACE

Sabrina John / Franziska Biermann, *Project Medifly*

Filippo Tomasello, *UCI Drone Italy*

Dr. Isabell del Poza de Pozo, *Airbus*

Veronica Schlömer, *Vereinigung Cockpit*

16:00 - 16:30 BREAK

ONLINE BREAKOUT SESSION
FlyNex GmbH

16:30 - 18:00

TOPIC 3 SENSOR DATA FOR DETECTION AND IDENTIFICATION

Prof. Dr. Wolfgang Koch, *Fraunhofer Institute for Communication, Information Processing and Ergonomics*

Peter Braun, Telespazio Vega Deutschland GmbH

Hans Peter Stuch, *Fraunhofer VVS*

Ronald Liebsch, *DJI GmbH*

Thomas Markert, *DeDrone GmbH*

Markus Wolf, *Hensoldt GmbH*

18:00 - 18:30 DISCUSSION
(18:30 END of VIDEO CONFERENCE SESSION)

18:30 - 20:00 NETWORKING

UAV DACH

FLYNEX

COMPANY ONEPAGER

ÜBER FLYNEX

FlyNex ist mit Standorten in Leipzig, Hamburg und San Francisco der führende Lösungsanbieter für die kommerzielle Drohnen-Nutzung. FlyNex deckt mit seiner Software-Lösung den gesamten kommerziellen Einsatzbereich für unbemannte Flugsysteme ab. Sei es für die Vermessung, zur Dokumentation oder zur Überprüfung von Bauwerken, Brücken oder Energienetzen.

Von der Planung, über die Befliegung bis hin zur Analyse erhobener Daten können Unternehmen und Piloten über die FlyNex-Plattform Drohnen-Projekte managen. FlyNex arbeitet unter anderem mit dem DIN e.V. sowie dem Deutschen Zentrum für Luft- und Raumfahrt zusammen und hilft bei der Entwicklung von Normen und Leitlinien für einen zukunftsfähigen Einsatz von Drohnen.

SOFTWARE
Ohne Vorkenntnisse Projekte planen

WORKFLOW
Befliegungen verwalten und automatisieren

PROJECTS
Erhobene Daten speichern, teilen und analysieren

DAS PRODUKT

Die FlyNex Software verbindet einen Kartendienst mit einer Projektmanagement Software (ERP).
Wir bieten:

- Digitale Flugplanung
- Validierung der Flugroute auf Gesetzeslage
- Implementierung des Workflows in das Unternehmensgeschäft aller Branchen

Schon 10 Millionen Mal vertrauten Menschen auf unsere Map2Fly-App als Regelkontrolle für unterwegs!

UNSERE MISSION

FlyNex befähigt Unternehmen weltweit, Drohnen für eigene Zwecke einzusetzen. Dabei konzentrieren wir uns auf drei Elemente:

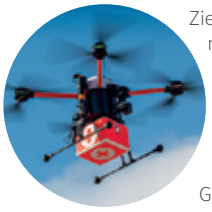
- Sicherheit für Betreiber und Unbeteiligte
- Qualitative Daten und Geo-Informationen für präzise Flugplanung und Kontrolle
- Zusammenführung aller Prozesse und Beteiligter in einer kollaborativen, digitalen Lösung

DIE MITNETZ-BEFLIEGUNG

Es wurden über 2700 Bilder auf einer Strecke von 20km gesammelt. Insgesamt konnten in einer Zeit von 45 Minuten 70 Masten inspiziert werden.

Mit MITNETZ STROM haben wir erfolgreich gezeigt, dass automatisierte Drohnenflüge außerhalb der Sichtweite sich eignen, um an den Strommasten und Freileitungen Vogelnester, Seilschäden, aber auch Systemnummern zu erkennen. Dank unserer Software konnte die Flugplanung zuverlässig und genau geplant und durchgeführt werden.

DAS PROJEKT „MEDIFLY HAMBURG“



Ziel war die Transportdauer von medizinischen Proben vom OP-Saal zum Pathologielabor zu verkürzen. Der Stadtverkehr der Metropole wurde mit der Drohne umgangen. So konnte das Projekt bestätigen, dass der Drohneneinsatz für den Gewebetransport schnell und sicher ist.

Das Projekt ist geglückt, dank der Zusammenarbeit mit unseren Partnern, unserer Expertise im Thema Urban Air Mobility und unserer Software, die das benötigte Kartenmaterial und das Planungsumfeld für den kontrollierten Flug lieferte.

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Gute Drohnen – böse Drohnen

von Christina Haberland, Fraunhofer-Institut für Kommunikation, Informationsverarbeitung und Ergonomie FKIE

Eine Drohne fliegt auf den Reichstag zu. Transportiert sie ein dringend benötigtes Medikament? Oder kommt ein Kind gerade nicht mit seinem neuen Geburtstagsgeschenk zurecht? Oder – und das wäre der heikelste Fall – soll hier die Gedenkfeier auf dem zentralen Platz der Stadt, an der hochrangige Regierungsmitglieder teilnehmen, gestört werden? Fragestellungen wie diese gehören heute zum Arbeitsalltag von Sicherheitskräften. Und damit sie beherrschbar werden, müssen leistungsstarke Systeme zur Detektion und Abwehr von Drohnen verfügbar sein. Gleich mehrere Fraunhofer-Institute entwickeln daher Komponenten zur Bewältigung dieser Aufgabe. Sensorintegration, Sensordatenfusion, nutzerzentrierte Lagedarstellung und Entscheidungsunterstützung sind in diesem Kontext wichtige Forschungsschwerpunkte. So entstand mit AMBOS. core im Fraunhofer FKIE beispielsweise der Demonstrator einer Zentraleinheit, an die Sensoren und Effektoren für diese Aufgabe angeschlossen werden können.

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UAS OPERATIONS BEYOND VISUAL LINE OF SIGHT

European legislation about BVLOS flights,
Responsibilities of applicants and authorities involved,
Cross-border flight operations,
Qualification of pilots operating BVLOS

Pitfalls in the BVLOS Inspection of Power Grids

By Michael Petrosjan, FlyNex GmbH

1 BVLOS Flights

BVLOS flights (flights out of the pilot's visual line of sight) are a challenging undertaking. However, the added value they offer makes it worth to not only deal with the regularities but also to work towards better regulatory for BVLOS flights in general.

In the Medifly Hamburg project, we have shown that it is possible to obtain permits for difficult BVLOS flights. We completed a tissue sample test flight over the metropolitan region of Hamburg, Germany. The unmanned aircraft flew over humans and also passed an airport nearby. With the right safety precautions and intentions, BVLOS flights are possible. The results of Medifly Hamburg show a significant reduction in transport time compared to medical transportation through traffic. Thus, an advantage for the hospital and the patients has been proven.

In winter 2020, the energy company MITNETZ STROM decided to test drone-based inspection flights for their power poles and power lines. With FlyNex, it took overall just a couple of weeks between the idea, planning the mission and executing the flights. In total about 20 km of powerlines and more than 60 power poles had been inspected at once. The AI-supported BVLOS project has been successful in showing an improvement in efficiency and effectiveness compared to traditional inspection processes.

1.1 Previous Methods

Although previous methods are seamlessly integrated into current workflows and value chains, FlyNex believes in useful investment of time and energy to improve traditional systems. Germany's power grid, for example, covers over 2 million kilometers. Those powerlines and power poles have to be inspected regularly to ensure power stability for the citizens. Depending on the inspection process German energy industries used to hire climbers, who would examine mast by mast for damages or bird nests. Nowadays, climbers, as well as helicopters, are being used. Those methods have numerous disadvantages compared to drone usage. Climbers and the helicopter-inspectors are at a high risk of occupational accidents. Also, there might be restrictions on electricity supply during the inspection. Besides that, helicopters are not environmentally friendly. On drones, those things do not apply. [FIGURE 1]

2 Understanding the Workflow

From planning and flight management to data analysis through analysis connection within the software, drone projects can be managed easily and fully compliant with the FlyNex cloud solution.

FlyNex Enterprise Suite is the central platform for planning, implementation, and analysis of commercial UAV flights. It consists of a digital project and planning solution, a dedicated Connect App for pilots, and an interface to different analysis applications. Accurate results and high-quality data can be captured and processed in three dimensions easily.

2.1 The Hurdles

There is currently no all-in-one solution when it comes to hardware. Different applications need different methods and hardware. Depending on the use case, a sensor system needs to be chosen.

Implementing drones also raises the question, whether a process should be replaced 1:1 or whether a new process should be established. Network operators will have to decide upon their desired degree of automation, evaluation, and how the multitude of new data should be processed.
Moreover, the regulations of drone flights lead to increased limitations for companies to deal with.

3 What's next?

The next is to overcome the hurdles and improve the process of implementing drones into workflows and value chains.
Hardware, software, and sensor systems are already at a solid level of development. The crucial factor is the right combination between the network operator and the use case. With years of experience from projects and test flights, FlyNex is able to provide valid data to consult network operators.

In addition, permission processes have to be improved. Unequal state-specific regulations and operator-dependent decisions complicate the permissions process unnecessarily. FlyNex, therefore, helps to develop standards and guidelines for future-proof drone operations, for example collaborating with the German Institute for Standardization (DIN) and the German Aerospace Center (DLR).

3.1 Changing Regulations

In perspective to new drone regulations on a European level beginning 2021, legislators and aviation authorities have to adopt EU-wide legal and regulatory frameworks to a national level.

Regarding commercial drone deployment and, in particular, future BVLOS operations, the drone sector will be impacted directly, and operators have to align their activities, processes, and know-how to those upcoming regulations.

FlyNex, as an active part of several drone industry associations, is ongoingly dealing with implementing changes in rules and regulations into its solutions. Besides that, supporting customers and companies in permission processes and regular exchange with aviation authorities, this topic is, at the same time, complex and crucial for successful while safe and reliable drone operations in the public realm.

One of the most important regulations for the energy industry will be the regulations regarding permanent flight permissions for repetitive flights.

Finally, data protection regulations regarding digital data collection, storage, and processing must improve. Current laws are sometimes impractical and unclear in interpretation regarding drone-based projects.

4 About FlyNex

FlyNex is the leading solution provider for commercial drone projects. With our expertise in industrial and commercial drone projects, we help companies from all industries, especially construction, energy, and real estate, to implement drones in their value chain.

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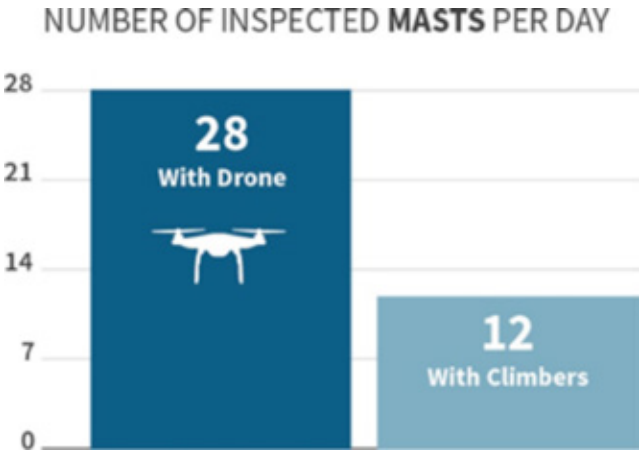

Figure 1: Evaluated on the basis of manual,not-automated VLOS drone inspections. Advantages of drones for repeatable BLVOS-deployments unequally higher.

UAS Operations beyond visual line of sight

By Frank Rathlev, COO, Thyssengas GmbH, Dortmund

Abstract

Thyssengas ist einer von deutschlandweit 16 Gastransportnetzbetreibern, die über ein Pipelinenetz Gas zu den Verbrauchern (Verteilnetzbetreiber) bringt.

In Deutschland gibt es über 40.000 km Gastransportnetz Pipelines, die regelmäßig überwacht werden müssen.

Die Überwachung kann durch regelmäßige Begehung, Befahrung oder Befliegung der Erdgastrassen erfolgen.

Der DVGW (Deutscher Verein des Gas- und Wasserfachs) legt dazu das Regelwerk fest. Aktuell sind die Mindestanforderungen für die Überwachung ein vierwöchentlicher Befliegungszyklus.

Das Netzgebiet von Thyssengas umfasst 4.200 km, das überwiegende Netzgebiet ist im bevölkerungsreichsten Bundesland Nordrhein Westfalen und in Teilen Niedersachsens.

Von den ca. 400 Mitarbeitern des Unternehmens arbeiten 200 im Netzbetrieb. Das Netz wird alle 2 Wochen regelmäßig komplett beflogen. Bei jedem Befliegungs-zyklus werden ca. 600 Störungen erkannt, die sich auf die Trasse zubewegen und anschließend vor Ort überprüft.

Ziele des Netzüberwachungsprogramms von Thyssengas und Einsatz von Drohnen, sind die Reduktion von Emissionen im Vergleich zum Hubschrauber (Lärm und Abgase), eine Qualitätssteigerung in der Netzüberwachung durch Einsatz von Sensorik und künstlicher Intelligenz und ein wirtschaftlicher Einsatz.

Bereits 2011 hat Thyssengas die ersten Versuche zum Einsatz von Drohnen in der Netzüberwachung durchgeführt. Die damaligen Regelungen ließen allerdings keine BVLOS Flüge zu und die Verbots-tatbestände waren zu behindernd.

Erst 2017 konnten im Thyssengas / Telekom / DFS Forschungsprojekt durch mehrere Usecase Befliegungen signifikante Fortschritte in der BVLOS Befliegung von Erdgastrassen erreicht werden.

Seit 2019 hat Thyssengas ein eigenständiges Innovationsprogramm Netzüberwachung etabliert und führt es erfolgreich weiter. Aktuell sind mit Multicopter, Fixedwing und VTOL fast 1000 km (von Landesluftfahrtbehörden genehmigte) BVLOS Flüge durchgeführt worden.

In den folgenden 10 Teilprojekten werden die unterschiedlichen relevanten Themenfelder weiter bearbeitet, um die Trassenbefliegung mit Drohnen erfolgreich zu etablieren.

- Bemannten Sensorträger ausrüsten
- Unbemannten Sensorträger ausrüsten
- Sensorikeinsatz und Tests
- KI Entwicklung
- Möglichkeiten und Einsatz Lokale Luftlagesysteme (Drohne)
- aktuelle Genehmigungen bei LLB`n & Verbots-Tatbestände (Naturschutz)
- Entwicklung Europäische Regulierung und Umsetzung in Deutschland
- Business Case Entwicklung Drohnen-einsatz
- Integration der Lösungen in die betriebliche Praxis
- Machbarkeitsstudien mit anderen Netzbetreibern kritischer Infrastrukturen

Die technischen Herausforderungen bei der Ausrüstung der Fluggeräte als auch die Einbindung in die Betriebsprozesse der Netzüberwachung sind lösbar.

Die größten Herausforderungen für Thyssengas als Betreiber einer kritischen Infrastruktur und zukünftiger Anwender und von Drohnenbefliegungen, sind die gesetzlichen Rahmenbedingungen und Grundlagen für Genehmigung zur Durchführung von Netzüberwachungs-flügen.

Die praktikable Umsetzung von europäischen Regelungen als auch die naturschutzrechtlichen Rahmenbeding-ungen in Deutschland sind erfolgskritisch für den Einsatz in der betrieblichen Netzüberwachung bei Thyssengas.

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From vision to reality to universal prevalence – suggestions for a German BVLOS approach

By Dieter Klein, Wingcopter GmbH

Where we are coming from

The Wingcopter GmbH was established only three years ago as a manufacturer of VTOL UAS in Germany. Engineering this kind of technology started already in 2012 when Jonathan Hesselbarth, an enthusiastic mechanical engineer and passionate model airplane pilot, wanted to prove that an efficient unmanned aircraft with both vertical take-off and fixed-wing features could be designed. The key invention that made this undertaking possible was the technology of a tilting mechanism which was finally patented in this special design.

Since October 2017, when only the three Co-Founders started their enterprise, the company has grown to roughly 100 employees, from engineering to production and business development to flight operation.

Driven by the vision to create efficient and sustainable drone solutions to improve and save lives everywhere, the entire team is focused on doing good with the Wingcopter technology.

The characteristics and the usability of the current product, the Wingcopter 178 Heavy Lift, have dictated and directed the path of the company since the beginning. It is the operation beyond the visual line of sight, a field that has always been a very innovative one for engineering as well as flight operations. To leave the near field and come back after one (1) hour or more has opened a new door with new job descriptions. Yes, military drones have been doing this kind of operation for more than 20 years, but within a typical totally different field of application and envelope.

Wingcopter's track record shows that in a transparent way. BVLOS operations started for the company at the end of 2017 in Tanzania. At the same time, cooperation and negotiation with national authorities in various countries of the world kicked off. Looking back, the company's project road map of the last three years mirrors really well the step-by-step evolution of evaluating regulations, assessing the use cases and reflecting the means and strategies for risk mitigation in constantly progressing ConOps backed by SORA analyses. Today, Wingcopter is ready to use EASA standards available and SORA analyses when planning with customers or on the company's own behalf.

Business development is key to get the market acquainted to new solutions that work out to the benefit of one's vision. The potential is high. However, there is still a long way to go between an "idea" and what we call "Proof of Business". Wingcopter reflects this development of the market in a special approach. This "Proposed Approach" is our way to start small in information and asset (Showcase Technology) and develop customer's idea as well as the necessary skills and knowledge by "Training & Setup", partnering for the "Launch", "Scale Up" with technology, and finally roll out a "National Network". This is supported by a next generation of products that will need and have capability to fulfill the demand of operators as well as their customers. It will not be enough to see the vision and the possibilities – we need to get on the way.

How we can get there

In May 2020, the German Administration presented a document called "Action Plan for Unmanned Aircraft Systems and Innovative Aircraft Concepts". It is good to see what the stakeholders have in mind when they think of developing a new industry to "leave the hangars and go out flying to serve the people, the environment, and society – an industry that will also function as a new growth driver for the economy". But as this evolving industry is still setting up its position in the economy the answer to the complex question is not one-dimensional only, it is not enough to pave the track and wait.

Wingcopter 178 Heavy Lift

There is much more to come which is difficult for start-ups and the new entrepreneurs in this ecosystem.

Typically, a reasonable amount of money is needed to develop all the new technologies. And realistically, not all the money needed can be raised through revenue. We know the mechanisms of the market and financial networks have done this kind of job for decades. In this special situation of unmanned mobility and with the national focus on the companies and technology existing already, the administrational approach is only a gesture. That is – to make it more obvious – a step but not a desired leap.

In addition to what is stated above, it is not the technology of getting into the air – it is the efforts of getting to aviation standards and solutions beyond today's technology. What we see these days is the beginning only, with technology still born and raised based on model airplanes. That is from quality of vendors' parts to technical support, as well as international coordination of standards and permissions for test areas.

We need vendors in the market that do their own R&D. The technology installed cannot come from the manufacturers only. The typical make or buy decision is still not possible and if speed is key, then manufacturers will be slowed down significantly. In other words, the German competitors – world leaders in the field of VTOL UAS – are threatened in their existence.

Just a side note: for some reason, the German Administration seems to acknowledge multi-copters only. There is not even a picture of an eVTOL or Hybrid in the document issued.

If we want to maintain our technological lead in Germany, we should consider doing more in terms of (here are some examples)

- "approvals for own test areas" The testing ground needs to allow the test the operational envelope – for BVLOS and multi UAS operation not only and airfield

- "R&D initiatives" Which key technology needs to be supported (AI, sense&avoid, UTM, weather apps, …) and what can be done to leave it not only to the market.

- "market support for existing manufacturers" The existing technology in other aviation areas could be shared with others, especially financed by state funds. It is still a Hercules task.

Author
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FLIGHT OPERATIONS IN URBAN AIRSPACE (UAM)

Legal framework of flightS in Urban Airspace

- Flying over populated areas
- European and International concepts of U-space
- UAS operations in U-space airspace
- Air traffic service providers
- Common information service

Reporting of AIRPROX

By Veronica Schömer, Vereinigung Cockpit e.V

1 SafeSKY 2020

The flight safety department of the German Airline Pilots Association Vereinigung Cockpit e.V. (VC) looks back at a history of more than 50 years. Permanent staff and professional pilots who involve themselves as volunteers work on a wide range of safety and security related topics in aviation. Earlier this year the VC published the flight safety concept SafeSKY 2020 as a result of this work. The concept supplements the ICAO Global Aviation Safety Plan and EASA´s European Plan for Aviation Safety. It adds the perspective of flight crews. Chapter 4.8. unmanned aviation and new technologies addresses challenges in this area. Several other chapters such as air traffic management or security are also of interest for the drone industry.

2 Collision avoidance

The VC supports the efforts to integrate manned and unmanned aviation in one airspace. Collision avoidance is one of the major challenges to be met. One method to identify hazards that increase the risk of midair collisions is safety reporting.

2.1 Reporting requirements for drone operators

Several regulations require safety reporting in both manned and unmanned aviation. According to Article 19 of Commission Implementing Regulation (EU) 2019/947 of 24 May 2019 „[e]ach UAS operator shall report to the competent authority on any safety-related occurrence and exchange information regarding its UAS in compliance with Regulation (EU) No 376/2014“.

According to Part C Chapter UAS.LUC.030 of the above mentioned Regulation operators who apply for a light UAS operator certificate (LUC) are required to „establish, implement and maintain a safety management system corresponding to the size of the organization, to the nature and complexity of its activities, taking into account the hazards and associated risks inherent in these activities“.

2.2 Safety management

Safety management is a proactive approach to prevent accidents. A safety management system (SMS) uses methods known from quality management1 to constantly evaluate the risk that lies in an organization's activity.

Management commitment, safety accountability and precise documentation of the SMS create “an environment where safety management can be effective” 2. In this environment hazards can be identified and the associated risks may be assessed and mitigated. An organization has to validate constantly if the safety risk controls are effective3. The findings and the improvements that have been achieved hereby need to be communicated and reflected in training and education4.

Safety reporting is one option to identify risks. Accident investigation has shown that many accidents had been preceded by occurrences that shared contributing factors or hazards. The more you know about hazards the greater the chance to develop mitigation measures before an accident happens.

Regulation (EU) No 376/2014 includes a list of occurrences, that have to be reported. A near collision is a mandatory reporting item.

2.3 Conditions for successful reporting

Several conditions need to be fulfilled to achieve effective safety reporting. The reporting system has to be easily accessible and the anxiety has to be minimized: what happens to the report, what happens to the reporting person, what happens to other persons involved?5 These questions are of special interest, when human errors are reported.

Just culture is the term that describes a culture that is neither blaming people who make errors nor accepting wilful violations6 (a strictly non punitive culture would accept even these). In reality the distinction between error and violation is not easy. The involved persons, the drone operator, the authorities, the public – they all have different expectations.

In addition to the previously described conditions the benefits of reporting must be clearly visible.7 The benefits for both the organization and the reporter have to be apparent. A survey among airline pilots as part of my thesis has shown that pilots who see reporting as a way to reflect the occurrence and their part in it are more willing to share their experience.

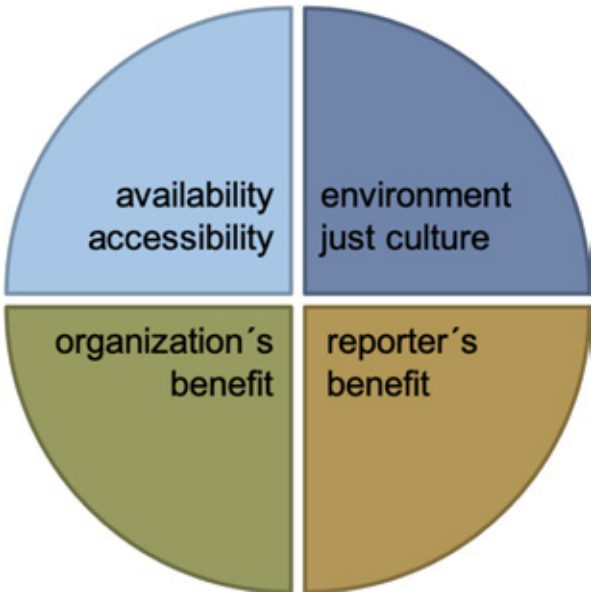

Figure 1 conditions for successful reporting

2.4 Reporting of AIRPROX – status quo

As mentioned above a near collision or AIRPROX is a mandatory reporting item. In Germany the pilot in command has to file a report either to the organizational reporting system of his company (that forwards the report to the National Aviation Authority (LBA) and the Safety Investigation Authority (BFU)) or directly to the two authorities. The report can be filed electronically via phone, fax, an electronic form on the authorities' website or the European reporting systemECCAIRS. Do many ways create accessibility or confusion?

A voluntary report may be filed to the Air Proximity Evaluation Group (APEG) which is hosted by the Bundesaufsichtsamt für Flugsicherung (BAF). The panel of experts is established on ICAO recommendation specifically for the assessment of dangerous aircraft proximity events. What do you think: how many near collisions with drones involved were reported to the APEG in 2019?

Zero8... Zero? Does that mean the problem doesn´t exist? Does it mean nobody knows the APEG? Are operators simply not willing to write three reports on the same occurrence? Do operators fear the use of their report in administrative offence proceedings because the APEG is hosted by the BAF?

2.5 Reporting of AIRPROX – suggestions

SafeSKY 2020 suggests the integration of the APEG into an independent federal authority to avoid potential conflicts of interests and ensure the application of just culture principles. The LBA should forward airprox reports received through its mandatory reporting system to the APEG. The possibility of voluntary reports should be actively promoted among air operators exempted from the reporting obligation. Rescue, police and military missions are exempted just like drone operations for research purposes.

The information gained from the reports has to be communicated effectively to the operators to allow accelerated learning of the whole drone industry. This may lead to a broader acceptance of large-scale field tests by the public and the willingness of the authorities to grant permission of these.

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ABOUT THE COMPANY

Originating in the aerospace industry, Telespazio VEGA Deutschland GmbH has built a strong reputation for reliability and excellence in delivering advanced technology solutions to major players in the aerospace, defence, security and telecommunication market over the last 40 years.
Telespazio VEGA Deutschland GmbH with its 400 employees is a subsidiary of Telespazio S.p.A., a joint venture of Leonardo S.p.A. and Thales SA and one of the world's leading suppliers of satellite services.

ABOUT THE PRODUCT

Our Drone Detection Solution (DIDIT) detects, locates and tracks small UAVs and their pilots in a fully automated way. By combining different sensor types, DIDIT ensures an optimal detection rate and the best possible protection against all types of drones. Its modular design allows perfect tailoring and guarantees an optimal price/performance ratio to our customers. More details about DIDIT are available here.

- Threat Analysis
- Site Survey
- Consultancy
- Design of the Solution
- Implementation

OUR UNIQUE APPROACH

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Industry Standards for U-Space (alias UTM)

By Filippo Tomasello, Senior Partner at EuroUSC Italia
Professor at University Giustino Fortunato Expert in Project AW-Drones

1 Rules and standards for UTM

Modern aviation regulation tends to be "Performance-Based", meaning that legally binding rules (e.g. EASA Part 21) should be "technology agnostic" and only focusing on safety objectives, regulatory processes, legal actors and respective privileges and responsibilities. Technical details should instead by published either by Authorities as "soft rules" (i.e. non legally binding) such EASA Book 1 of CS-23 or, even better, by Standard Development Organisations (SDOs) such as Book 2 of EASA CS-23 which indeed contains a list of industry standards.

This approach can be followed also for U-Space, alias UAS Traffic Management (UTM).

Today there is not yet an internationally agreed definition of UTM. However ISO has developed a draft definition:

Draft definition of UTM
(CD ISO 23629-12)

Set of traffic management and air navigation services aiming at safe, secure and efficient integration of multiple manned and unmanned aircraft flying in the Designated Operational Coverage

In the context of "Performance-Based Regulation" consensus-based standards may be used as:

a) Acceptable Means of Compliance (AMC) related to EU/EASA common rules on aviation safety;
b) Possible AMCs anywhere in the world, subject to local regulations; or
c) As AMCs in domains beyond the scope of current common EU rules on aviation safety (e.g. privacy; cyber-security of networks; etc.)

2 Standards under development

Several SDOs, such as ASTM, RTCA, SAE, Underwater Laboratories (UL), etc. have published or are developing standards which could support regulations on UTM. In the EU the most relevant SDOs for this are:

a) ASD-STAN tasked by the European Commission (DG-DEFIS) to develop draft European Norms (EN) for airborne functions relevant in the U-Space (i.e. direct remote identification and geo-awareness);
b) EUROCAE producing Minimum Operational Performance Standards (MOPS) which also cover the ground network; and
c) ISO, through its Technical Committee TC/20 and in particular by Sub-Committees SC/16 (UAS) and SC/17 (airport infrastructure and equipment, including vertiports).

3 Why ISO is unique?

Among these SDOs, ISO is however unique for several reasons, including not only its really global geographical scope, but also:

a) Connection with all national standard institutes in the world (e.g. DIN in Germany);
b) Connection with CEN and through IEC, also with CENELEC, which implies that the European Norms (EN) have the same status of ISO standards, al though limited to the European region;
c) Connection through CEN, also with ASD-STAN which is working under mandate by DG-DEFIS and so in the end, even the ASD-STAN deliverables would become EN; and
d) Last but least a network of thousand of accredited, independent and competent 3rd parties for certification scattered around the world, recognised in EU legislation (mainly Reg. 765/2008) as "conformity assessment bodies" or "notified bodies".

4 Two free web-based tools

Implementing Commission Regulation 2019/947 establishes three risk-based categories of UAS operations. In the medium-risk category a risk assessment is always required by Art. 11 therein. To carry out such risk assessment EASA, in its AMC related to mentioned Article 11, recommends using the "Specific Operation Risk Assessment (SORA) methodology developed by the Joint Authorities for Rulemaking on Unmanned Systems (JARUS). This methodology ends up into demanding implementation of certain risk mitigation measures. Each mitigation shall however be implemented with a certain level of:

a) Integrity robustness, for which usually SORA requires to demonstrate compliance with a suitable consensus-based industry standard; and
b) Assurance robustness.

The prime aim of SORA is establishing and maintaining a sufficient level of safety, while reducing the Level of Involvement (LoI) of the Aviation Authorities, whose resources are not exuberant.

Therefore, in case of high level of assurance robustness, SORA requires a certification of conformity issued by a competent, independent and accredited third party. In the EU legal order this parties are:

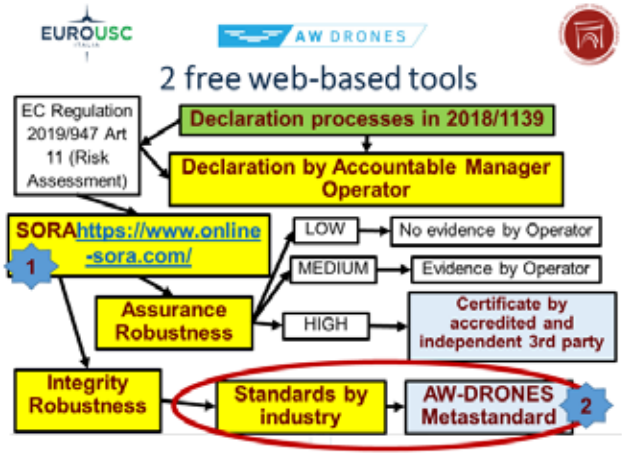
a) Either a "Notified Body" based on Regulation 765/2008, of which there are thousands in EU and which are no more and no less than ISO certifying bodies;
b) Or a "Qualified Entity" based on Art. 69 of EASA Basic Regulation 2018/1139.

However, the application of SORA may be time consuming for the UAS operator. Therefore EuroUSC Italia has made available, free of charge, the web-based tool SAMWISE: https://www.online-sora.com/

Even using SAMWISE, SORA nevertheless does not suggest which specific standard the operator should use to implement a certain mitigation.

Therefore a second tool, allowing to trace the one or two standards applicable in relation to a mitigation, has been developed by the Project AW-Drones, funded by INEA.

Also this tool, nicknamed "Metastandard" is available free of charge on the web in its first iteration: http://ortelio.co.uk/aw-drones/view/rep3.php v



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SENSOR DATA FOR DETECTION AND DEFENCE

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Multisensordatenfusion – Schlüssel zur Drohnenerkennung

Prof. Dr. Wolfgang Koch, Fellow IEEE, Chief Scientist Fraunhofer FKIE

Drohnen für Jedermann revolutionieren die Welt. Eine neue Gründergeneration verwirklicht kreative Geschäftsideen mit unabsehbaren Folgen für den Alltag aller Menschen. Dennoch ist diese Technologie janusköpfig. Der Schlüssel zu ihrer sicheren Integration in den Luftraum ist multisensorielle Drohnenerkennung. Multisensordatenfusion wird so zur "Enabling Technology" für den gesellschaftlich akzeptierten, rechtlich geregelten und wirtschaftlich rentablen Drohneneinsatz.

Wie bei den vom Automobil ausgehenden Risiken wird sich eine Dreifachstrategie bewähren: Sie fußt auf einem juristischen Rahmen, risikoadäquater Versicherung sowie einer zu erforschenden und mit der Industrie zu entwickelnden Drohnensicherheitstechnik. So sind „elektronische Kennzeichen" absehbar, durch die registrierte Drohnen jederzeit zu identifizieren wären. Dadurch würde erkennbar, ob ein potenziell bedrohlicher Drohneneinsatz vorliegt. Außerdem ist „geofencing" eine Option, die mittels geografischer Informationssysteme „no-fly zones" etabliert. Zu betrachten sind vor allem signaturschwache Drohnen. Da sie hoch agil operieren und Pkw-Geschwindigkeiten erreichen und überschreiten, sind die Reaktionszeiten für Gegenmaßnahmen kurz.

Wesentlich zur Überwachung des Drohnenverkehrs sind leistungsfähige Sensoren, die unterschiedliche Aspekte anfliegender Drohnen erfassen. Zu einem Drohnenerkennungssystem werden Sensoren aber erst durch leistungsfähige Algorithmen der Multisensordatenfusion. Aufgrund seiner Reichweite und Allwetterfähigkeit ist drohnenoptimiertes Radar zentral. Derartige Sensoren senden entweder selbst Signale aus oder nutzen vorhandenen "Elektrosmog" als Beleuchtung. Von Drohnen reflektierte Echos werden analysiert, um Orts- und Geschwindigkeitsdaten sowie den Typ zu schätzen. Passivradar nutzt z. B. Abstrahlungen von Mobilfunkbasisstationen. Da Genehmigungen für aktiven Radarbetrieb immer seltener erteilt werden, ermöglicht Passivradar überall dort, wo Mobiltelefone funktionieren, die Überwachung des von Drohnen genutzten Luftraums ohne Emissionsbelastung.

Radardaten sind mit Datenströmen bildgebender Sensoren zu fusionieren, die typischerweise mehrere Spektralbereiche erfassen. Obwohl sie meist geringere Reichweiten als Radar erzielen und wetter- bzw. tageszeitabhängig sind, erleichtert ihr Auflösungsvermögen die Zielklassifikation und reduziert Falschalarmraten durch Multisensordatenfusion. Ferner machen Eigenemissionen Drohnen detektierbar, etwa durch Funkfernsteuerung: Durch Auswertealgorithmen werden die Drohne und ihr Pilot lokalisierbar. Aber auch autonom operierende Drohnen bauen wenigstens intermittierend Daten-Links auf. Ebenfalls vielversprechend sind akustische Emissionen, die durch Mikrofonnetze erfasst werden, wobei der Array-Signalverarbeitung eine Schlüsselfunktion zukommt. Die Bedeutung der Multisensordatenfusion ist evident. Gefordert sind aber auch spieltheoretische Methoden des Sensorressourcen-Managements, ohne die keine robusten Systemlösungen realisierbar sind.

Fazit: Der Multisensordatenfusion und dem Management der Sensoren und Gegenmaßnahmen fällt eine Schlüsselrolle bei der Drohnenabwehr zu. Im Verbund "Führung, Aufklärung, Wirkung und Unterstützung" ist sie jedoch lösbar, setzt aber enge Kooperation der Nutzer, der Forschung und der Industrie voraus. Die Einbindung der Fusion in Führungsinformations- und Kommunikationssysteme ist entscheidend.

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Hierbei wird die gesamte Verarbeitungskette von Daten und Informationen betrachtet: vom Gewinn, der Übertragung und Verarbeitung über die nutzergerechte Anwendung bis hin zu ihrem zuverlässigen Schutz.

Die Forschung des Instituts ist dabei auf die Verbesserung der Leistungsfähigkeit cyber-physischer Systeme ausgerichtet. Der Schwerpunkt liegt auf der Weiterentwicklung informationstechnischer Systeme im Hinblick auf ihre Bedienbarkeit, Datensicherheit, Interoperabilität und Vernetzung sowie der Auswertung verfügbarer Informationen mit hoher Präzision und Zuverlässigkeit. Methoden der Künstlichen Intelligenz sind hierbei besonders hervorzuheben und werden am FKIE anwendungsorientiert entwickelt und eingesetzt.

Im Bereich der UAV forscht Fraunhofer FKIE sowohl am Einsatz von Nutzdrohnen, etwa zum Zwecke der Aufklärung, als auch an der Abwehr von Schaddrohnen. Entwickelt wurde mit AMBOS beispielsweise ein mobiles, modulares Drohnenabwehrsystem, das Daten unterschiedlichster Sensoren fusioniert, um UAV zuverlässig zu detektieren und zu identifizieren.

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Bild: Aneese / 123RF

Sensor Data Fusion – Benefits & Challenges

By Peter Braun, Telespazio VEGA Deutschland GmbH

1 Fusion of Sensor Data – Why?

The tentacles of Drone Detection systems are sensors like radio sensors, electro-optical cameras, radar. They have to reliably detect, classify, localize and track all types of drones at all weather conditions. The observers need to get information like drone model, location of first detection, position of drones and pilots, carried payload, trajectory and speed. Isolated sensors can only provide a fraction of this information. For instance an isolated radio sensor is able to give the direction from which RF signals are received but not the distance. A camera has reduced performance at night or at harsh weather conditions. A radar is able to detect non-transmitting drones but not the pilot of a controlled drone. All sensors have their limitations.
Fusion of the data by a central processing unit using intelligent algorithms allows to derive indirect parameters like the position of a drone or its pilot from the direct parameters provided from isolated sensors.

Examples:
An isolated radio sensor is able to determine the direction from which RF signals are transmitted only.
A camera visualizes the model of a drone and the carried payload only.
Fused data from two radio sensors provide the position of a drone but with low accuracy.
Fused data from more than two radio sensors give the position with increased accuracy.
Fusion of data from radio sensors and radar results in position and speed.
Because various types of sensors have different detection ranges the position derived from fusion of data from long range sensors can be forwarded to short range sensors and the latter are able to lock immediately on the drone.

2 Fusion of Data from Multiple Sensors of the Same Type

2.1 Measuring the Same Object

Measuring the same object with a number of identical sensors offers significant benefit. Comparison of the sensor data allows to detect deficiency of one of the sensors. The redundant sensors will execute continuous measurements without noticeable decrease of the service. Fusion of the sensor data ends up in increased accuracy of the measured parameter. Last but not least: multiple sensors of low quality are often cheaper than one high end sensor but produce identical results by means of intelligent data fusion.

2.2 Measuring the Same Object Aiming at Determination of an Indirect Parameter

Example 1: Sensors of the same type measure the distance to an object. A central processing unit fuses the data together with the position of the various sensors. As a result the position of the object is determined as an indirect parameter.

Example 2: Sensors of the same type measure the direction to an object. Fusion of the data from the sensors determines by means of triangulation the position of the object as an indirect parameter.

3 Fusion of Data from Different Types of Sensors

3.1 Measuring the Same Object

Using different sensor technologies for measuring the same object and fusing the gathered data eliminates the weak points of the various technologies whilst their strengths complement each other. The longest detection range can be combined with the ability to detect the pilot and with the best performance under harsh environmental conditions to achieve the highest possible detection rate.

3.2 Measuring the Same Object Aiming at Determination of an Indirect Parameter

Example: The data of radar, radio sensors and electro-optical sensors are fused to determine the position, the direction of movement and the model of a drone as indirect parameters. These data are displayed to the observer together with the visualisation of the drone.

4 Methods of Sensor Data Fusion

Method A: Two sensors

A network of only two sensors ends up in a closed system of equations. Direct and definitive results can be calculated.

Method B: More than two sensors

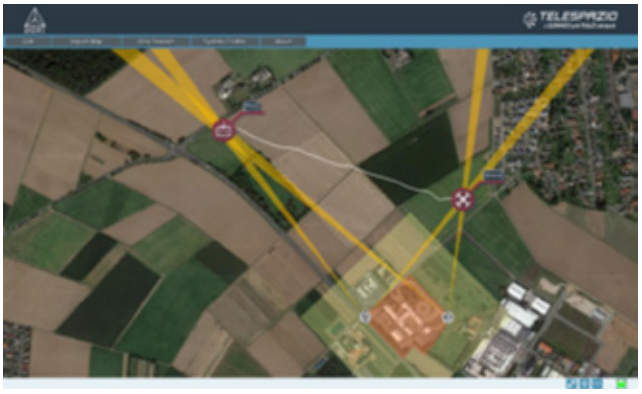
More than 2 sensors deliver an overdetermined system of equations. For data fusion approximation procedures must be applied.

Method C: Different types of sensors

Various types of sensors generate a non-linear system of equations. For data fusion iterative procedures must be used.

Method D: Implementation of sensor characteristics

To achieve robust results characteristics like accuracy of a sensor have to be taken into account. Data fusion is done by means of matched filters.
The complexity of the methods increases continuously from method A to method D.



5 Drone Detection Solution DIDIT

DIDIT is the Drone Detection Solution of Telespazio VEGA Deutschland. Radio sensors, electro-optical sensors and radar are integrated into the system. DIDIT is configurable according to customer requirements and can be tailored to the environmental conditions. A modular design allows scalability and integration of other types of sensors. A central processing unit fuses the data according to the methods explained in section 4. The information gained from data fusion is displayed to the observer. The position and trajectory of the drones and their pilots are graphically overlaid on a configurable local map and can also be made available to counter-drone technologies and UTM. All relevant events are recorded and can be replayed at any time. More details are available at www.telespazio-vega.de/en/solutions-services/drone-detection

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Remote ID – EU implementation on UAS

By Ronald Liebsch, DJI

1 Introduction

Everyone understands why cars need license plates: drivers have to be accountable. Like a car's license plate, Remote ID, a way of identifying the pilot of each drone with an app running on a commonly available mobile device, is essential for accountability of UAS pilots. A broad implementation of remote ID is the key to allowing more complex drone use, and to solving concerns about safety and security.

DJI, the world's largest civilian drone manufacturer, fully supports this approach. Since 2017, we've voluntarily implemented Remote ID in our consumer drones, and we've long advocated for Remote ID to be required by governments and adopted by the industry.

As one major building block of the new EU regulatory framework for drones remote ID will become a main product requirement for future drones in the open and specific category in Europe, entering into force from 1st of January 2021.

2 Remote ID Concept

There are two ways of Remote ID, a direct broadcast and a network solution. While the direct broadcast transmits the Remote ID information continuously from the UA to the ground using a Wi-Fi or Bluetooth protocol, the network solution will transmit the remote ID information to the network either directly through the UA or through the UAS Ground Control Station. Both solutions have their advantages:

Because it does not need to connect to a Wi-Fi base station, a cellular network or any other external system, the direct broadcast solution works independently of any network coverage, availability, etc. When a good network coverage can be established in the flight area then the network remote ID solution brings advantages of a higher range for flying and managing BVLOS operations.

3 EU Remote ID Requirements

In order to support the remote identification as one of the necessary elements for the upcoming EU drone regulation as well for the functioning of a future U-space system (under development), UAS in the open category classes C1, C2 and C3 and all UAS operated in the specific category should be equipped with a remote identification system (direct broadcast and/or network solution).

The direct remote ID broadcast is a mandatory product requirement for CE classes C1, C2 and C3 in the open category (Regulation (EU) 2020/1058 Part 2, 3 and 4) and C5 and C5 in the specific category (Part 16 and 17). The network remote ID solution can be implemented as optional in these classes.

The direct remote ID solution requires a direct Broadcast from the UA in real time of at least the following data:

I. UAS operator registration number and the verification code provided by the Member State during the registration process,
II. unique serial number of the UA compliant with ANSI/CTA-2063-A-2019
III. the time stamp, the geographical position of the UA and its height above the surface or take-off point;
IV. the route course measured clockwise from true north and ground speed of the UA;
V. the geographical position of the remote pilot or, if not available, the take-off point; and
VI. an indication of the emergency status of the UAS;

The implementation of the direct remote ID solution can be either included into the UA or as an Add-on solution attached to the UA.

3.1 DJI's direct remote ID implementation

Remote ID doesn't have to be costly or complex. For the past two years, DJI has demonstrated a Remote ID method that is effective, free, automatic, and requires no service-provider middlemen.

DJI's system was built to conform to the forthcoming ASTM International standard for broadcast drone remote ID, developed over a period of 18 months by a broad group of industry and government stakeholders. The upcoming EU direct remote ID standard is currently under development by ASD STAN but as well will be complying to the direct remote ID standard from ASTM which allows a global harmonization at this stage. The DJI solution uses the Wi-Fi Aware protocol for mobile phones, which allows the phones to receive and use the Wi-Fi signals directly from the drones without having to complete a two-way connection. In DJI's preliminary testing, the Wi-Fi Aware signals can be received from more than two kilometer away, depending on the surroundings of the area.

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Remote ID: For a Safer Airspace

By Thomas Markert, Dedrone GmbH

The Reason Why

The use of unmanned aerial systems, commonly known as drones, has increased considerably in recent years and poses a major risk for companies, organizations, government authorities, and private individuals. Drones can be procured at a low cost and can be flown without special technical expertise or training and do not feature standardized identification. Many users are unaware that specific regulations and laws are governing the use of drones. In private use, they are usually used for impressive landscape shots, but criminals use the drones for smuggling contraband into prisons, spying on critical infrastructure, and disrupting airport operations. If a pilot does not comply with the regulations and flies illegally over a private property, a public event, government property, or otherwise, it is difficult to find out who controls the drone. With the popularity of drones in the global market and commercial operations, it's clear that there's only more coming to the skies, and it is time for a comprehensive approach to integrating drones safely into the airspace.

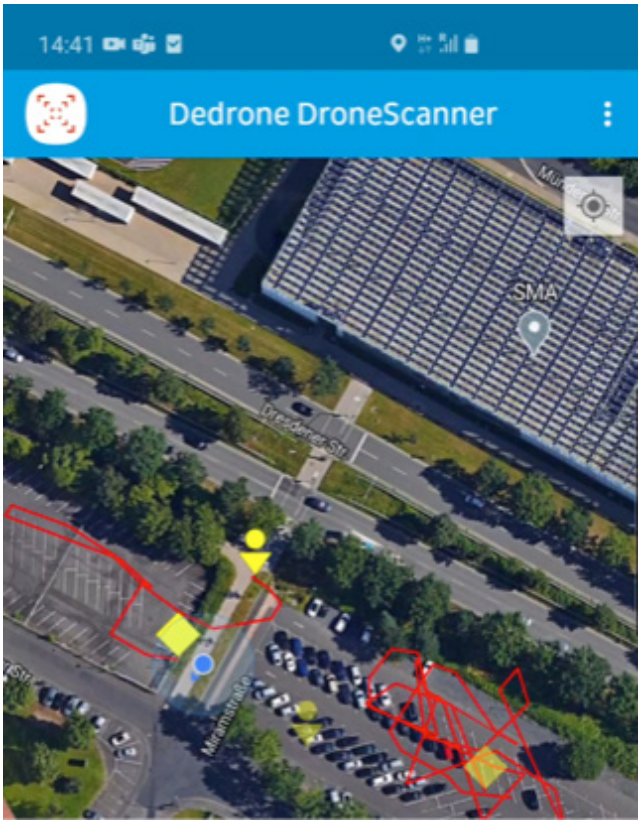
European Commission Enacts Regulation

In 2019 the European Commission issued several regulations of a regulatory framework on drones . Regulation 2019/945 requires drones to transmit a remote identification. A new working group of ASD-STAN, comprising drone manufacturers, national law enforcement, government agencies, and drone detection technology company Dedrone, was tasked to develop a common standard prEN4709-002 for *Direct Remote ID*, which provides the basis for the easy identification of every registered drone in the European Union.

This Is Remote ID

Direct Remote ID is a technology that enables the identification of a flying drone from a distance based on radio signals. Similar to a license plate on a car, Remote ID is intended to provide greater transparency in unmanned aviation. According to the European standard Remote ID comprises the pilot registration number, the drone serial number, and position and other operational data. In the event of a violation of the applicable laws and regulations, the Remote ID can be used to file a complaint with the authorities.

In order to support the definition of the European standard for *Direct Remote ID*, Dedrone has developed a smartphone app that displays all drones transmitting Remote ID in the vicinity. The app can receive Remote ID with all wireless technologies defined: Bluetooth 4.x, Bluetooth 5.x, Wi-Fi Aware, and Wi-Fi Beacon. Besides the pilot registration number and the drone serial number, the app visualizes the position, speed, and heading of the drone and the position of the pilot. Remote ID of multiple drones can be received and visualized.



Detection With Remote ID

The drone-based shutdown at London Gatwick airport in December 2018 shows that drones in the wrong place can cause significant operational and financial harm. Law enforcement has found it difficult to arrest drone pilots because it is often not possible to determine their exact position in a timely manner. The drone itself can rarely be confiscated, as many laws protect the interference with a drone flight.
With the introduction of Remote ID and integration into drone detection systems, security providers and law enforcement have a complete, detailed view on all drone activity, both legal and noncompliant. Remote ID data, such as the drone serial number, operator ID, or the pilot's exact position, complements the data provided by drone detection technology. Remote ID and drone detection data enable security teams and law enforcement to react more focused on drone threats posed by reckless and criminal pilots when layered together.

However, Remote ID does not replace drone detection systems for several reasons. Many users will continue using their drones, which are not yet equipped with Remote ID. Also, self-made drones are not required by law to transmit Remote ID. The current version of Remote ID does not feature an authentication mechanism, which makes the receivers of Remote ID prone to spoofing.
The upcoming standard for Direct Remote Identification is a milestone on the way to safe and flexible use of drones in the European airspace. But it is not the sole solution for airports, critical infrastructure, and prisons where every drone needs to be detected.

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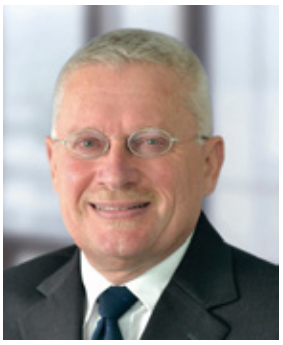
AMBOS, ArGUS, MIDRAS, ORAS – Forschung gegen gefährliche Drohnen

By Hans Peter Stuch, Fraunhofer FKIE

Abwehr gefährlicher Drohnen



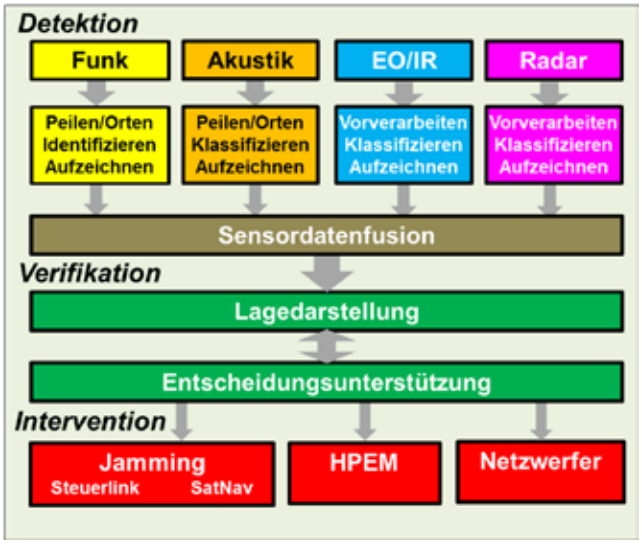
Nach einem Wahlkampfauftritt der Kanzlerin in 2013 wurde die Notwendigkeit der Abwehr unwillkommener Drohnen sehr plakativ durch die deutschen Medien publiziert. Den Sicherheitskräften standen keine adäquaten Mittel zum Erkennen und Bekämpfen solcher Drohnen zur Verfügung. Diese Ausrüstungslücke galt es zu schließen – zumal schon zwei Jahre später der G7-Gipfel auf Schloss Elmau stattfinden würde. Dafür wurde eine Konfiguration von auf dem – meist militärischen – Markt verfügbaren Komponenten zur Drohnenabwehr zusammengestellt. Es gab noch kein marktverfügbares ausgereiftes System, das zuverlässig anfliegende gefährliche Drohnen erkennen und bekämpfen konnte. Vor diesem Hintergrund nahm das BMBF die Aufgabe der Drohnenabwehr in die Themenliste zur zivilen Sicherheitsforschung auf. So entstandenen schließlich die Projekte AMBOS, ArGUS, MIDRAS und ORAS, die ab dem Frühjahr 2017 von den jeweiligen Konsortien bearbeitet wurden.

1.1 E pluribus unum

Der Umgang mit Drohnen als Bedrohung erfordert abhängig von den Umständen und der jeweiligen Situation die Funktionalitäten Detektion, Verifikation und Intervention. Diese Aspekte wurden in den vier Projekten mit jeweils eigener inhaltlicher Ausrichtung bearbeitet.

Die Demonstratoren AMBOS und MIDRAS umfassten Komponenten aller drei Funktionsgruppen. ArGUS sowie ORAS setzten das Erkennen von gefährlichen Drohnen in den Fokus der Arbeiten und verfügten deshalb nicht über Interventionskomponenten.

AMBOS Abwehr von unbemannten Flugobjekten für Behörden und Organisationen mit Sicherheitsaufgaben



Die Daten der beteiligten Sensoren Radar, Funk, Kamera und Akustik werden miteinander fusioniert. Das Ergebnis dieser Fusion sind Tracks, die an die Lagedarstellung übergeben werden. Die mit ihr eng gekoppelte Entscheidungsunterstützung erlaubt dem Nutzer aus dem Sicherheitsbereich einen schnellstmöglichen Einsatz von Abwehrmaßnahmen gegen anfliegende Drohnen. Der Jammer stört die Funkverbindung von der Fernbedienung zur Drohne und die Signale der Satellitennavigation. Mit der HPEM-Komponente (High Power Electro-magnetics) kann die Bordelektronik der Drohne gestört werden und ein per Netzwerfer verschossenes Fangnetz die gefährliche Drohne kinetisch stoppen.

AMBOS hatte Anwendungen der deutschen Polizeien im Blick, die mit sechs Behörden als assoziierte Partner im Projekt mitarbeiteten. Besonderen Niederschlag fand diese Mitarbeit in der Ausgestaltung von Lagedarstellung und Entscheidungs-unterstützung.

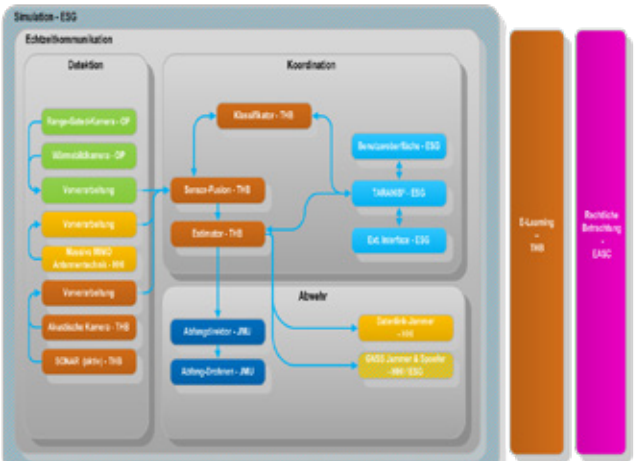
Projektkoordinator: Hans Peter Stuch, Fraunhofer FKIE
ArGUS Assistenzsystem zur situations-bewussten Abwehr von Gefahren durch UAS

Das Einsatzassistenzsystem soll Drohnen durch kombinierte Sensorik frühzeitig erkennen und analysieren. Radar, Kameras, Mikrophone und Mitschnitt des Funkverkehrs zur Basisstation ermöglichen die Identifikation und Prognosen über die geplante Flugroute. Auf Basis derartiger Informationen wird das ArGUS-Assistenzsystem den Einsatzkräften eine Bedrohungsanalyse erstellen und gegebenenfalls nutzergerecht Gegenmaß¬nahmen empfehlen. Exemplarisch wurde ein solcher Demonstrator unter Verwendung von Funk- und Kamerasensoren aufgebaut.

Projekt-koordinator: Dr. Gunther Grasemann, Fraunhofer IOSB

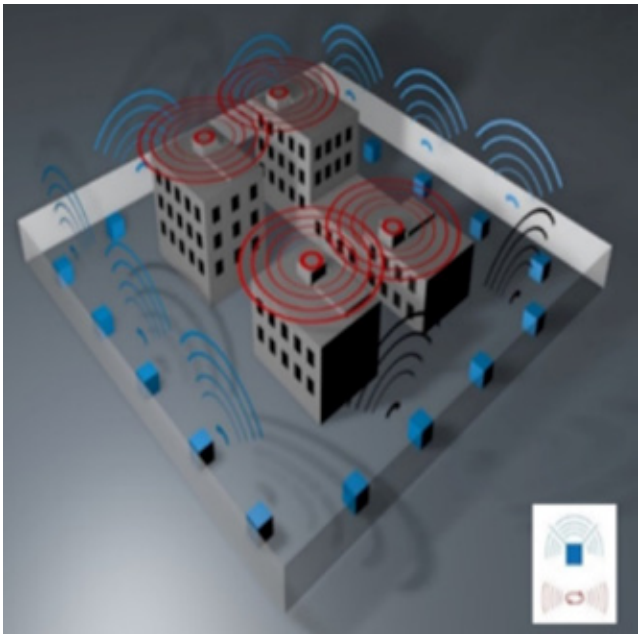
MIDRAS Mikro-Drohnen-Abwehr-System

Das Projekt hatte das Ziel, die bestehenden Systeme um innovative Techniken für Erkennung und Abwehr von Mikro-Drohnen zu erweitern. Das System soll sowohl die Detektion und Klassifizierung der Drohnen als auch den Einsatz von situationsge-rechten Abwehrmaßnahmen ermöglichen.



Die Abwehrmaßnahmen konzentrieren sich auf einen situationsangepassten Technologieeinsatz, der u. a. die Störung und Beeinflussung der Funksteuerung und GPS-Signale umfasst. Falls notwendig, kann letztlich auch der Einsatz von Abfang-Drohnen vorgesehen werden.
Projektkoordinator: Andreas Lenz, ESG

ORAS Sensorgestütztes Überwachungs- und Alarmierungssystem zur Detektion und Verfolgung unbemannter Flugsysteme



Es wurde ein Detektionssystem realisiert, das es erlaubt, anfliegende Kleinstflugkörper zuverlässig zu erkennen. Hierzu wurden neuartige schwenkbare optische Sensoren und elektronisch ausrichtbare Radar- und Antennensysteme entwickelt. Kombiniert mit einer schnellen Datenverarbeitung können so selbst bei unübersichtlichen Umgebungen, wie z.B. Veranstaltungsplätzen in Innenstädten, anfliegende Objekte erfasst werden. Dabei kann das System sowohl fest installiert als auch mobil eingesetzt und unabhängig von äußeren Witterungseinflüssen und Tageszeiten betrieben werden.

Projekt-koordinator: Dr. Dirk Nüssler, Fraunhofer FHR

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Integration Into Urban AirSpace – What's This 'Urban' Thing?

By Franziska Biermann and Sabrina John

Even if cities seem to be more favoured in terms of infrastructure than rural areas, other problems arise in the urban environment: for example, fewer and fewer hospitals have their own laboratories or pathologies because their departments have been centralised to optimise structures. As a result, urgent pharmaceuticals and tissue samples have to be transported through the usually dense urban road traffic. This becomes particularly challenging when tissue samples are taken from the patient and have to be examined during surgery to determine, for example, whether the surgeon has removed all abnormal tissue. In these and some other medical cases, there is a great interest in significantly reducing transport times.

The Medifly Hamburg project deals with the question of what added value unmanned aircraft can provide by using the third urban dimension for the transport of medical goods. Divided into two project phases, the feasibility of flights with unmanned aircraft systems (UAS) in urban airspace and in the control zone of Hamburg Airport was successfully demonstrated in February 2020. For this purpose, test flights were carried out between the Bundeswehrkrankenhaus and the Marienkrankenhaus over a distance of about five kilometers.

In the second phase, the focus will be on expanding regular operations to a route network involving several hospitals.

The flights are to be automated: The UAS will be informed in advance of the flight route agreed with the authorities and will fly it independently. The flight is always monitored by a remote pilot. The aim is to find out what conditions for drone traffic in cities already exist and what gaps still need to be closed.

But what is important when it comes to integrating drones into urban airspace? In addition to coordination with the civil aviation authority, air traffic control, when flying in controlled airspace, and other airspace participants, cities are a key stakeholder. It is true that the cities do not have a legislative function, as the laws are drafted at national or European level. However, this does not mean that they do not have a say in the design of their airspace. As soon as a U-space regulation comes into force, the cities and municipalities will decide where U-space airspaces will be established. They will also have the possibility to set conditions for certain airspaces, such as a minimum flight altitude or daytime flight bans. Furthermore, it is the responsibility of the cities to decide which goods may be transported by drone. For example, they can decide to allow transport for medical purposes only, while the often-mentioned pizza drone has to remain on the ground. Last but not least, cities also represent the interests of their citizens and are therefore the first place to go for complaints. In this respect, it is in the cities' own interest to implement solutions which, if possible, meet with broad acceptance among the population.

In 2017, the Windrove drone network was founded on the initiative of the City of Hamburg. The aim was to bring Hamburg's drone community together and to query the needs of the industry and respond to them wherever possible. One year later, Hamburg became the first German city to join the European Urban Air Mobility Initiative. The projects developed in this context, of which Medifly Hamburg was the first, are actively supported by the city.

In some projects, the city of Hamburg is even an active project partner and is directly involved in the design. This not only results in advantages for the projects, which thus receive first-hand information on the framework conditions or support in bringing other stakeholders to the table. The city and its employees build up their own knowledge about drones and urban air mobility, which in turn enables them to make informed decisions about their airspace. In addition, they can assess at an early stage where the city may need to invest in infrastructure in order to integrate drones into the airspace in a safe and, above all, scalable manner.

This shows that the previous strategy of classifying drones as aviation is very short-sighted. Of course, there are points of contact with manned aviation and regulations for peaceful and safe coexistence must be found. On the other hand, however, it must also be recognised that this is not enough. In contrast to manned aviation, drones fulfil more the function of a personal device that adapts to the needs of the user. While in commercial aviation there is an understanding that passengers arrive at a certain place at a certain time in order to board the aircraft, drones rather fall into the category of individual service providers. In the future, parcels can be delivered to the recipient when he or she is actually at home and thus determine the time of delivery himself or herself.

In order to successfully integrate unmanned aircraft into the airspace, it is therefore necessary to involve the cities and municipalities at an early stage. Otherwise, not much may be left of the predicted growth rates. This is because cities are the designers of their own airspace and, in case of doubt, decide on the scope of drone traffic.

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Automated stock information – are drones the game changer for safe and secure inventory management?

By Benjamin Federmann, doks. innovation GmbH

The new normal

SARS-CoV-2 hit logistics with full severity. While individual areas such as eCommerce, food logistics, medical device logistics and some areas of technology logistics were able to benefit from the effects of the pandemic in the short term, many other areas of logistics have almost come to a standstill. The “new normal” - a sustainable handling of global risk scenarios in connection with environmental factors or even extreme medical situations - has quickly become a reality due to the innovation management of companies prepared in the fields of digitalization and automation.. Medium-sized companies or representatives of third-party logistics providers (3PL), who must operate at very low margins and have not been able to adequately adapt to possible threat scenarios that result in a lock or shutdown, have clearly lagged behind the competition.

The need for automation

The Bundesvereinigung Logistik (BVL e.V.)1 sees the economy in a critical situation, from which, based on all known forecasts, it will be able to gradually free itself in the first quarter of 2021 at the earliest. The Deutsche Verkehrszeitung (DVZ)2 adds that this recovery must go hand in hand with digitization and automation of critical processes along the supply chain. This also includes the topics of digital twins and automated data acquisition, analysis, and processing. The human being is recognized as a critical factor along the global process and value chains. While these factors have already become apparent in areas such as the meat industry or agriculture, logistics has so far been spared. This can and will change if, similar to the areas mentioned, unknown staff must be called in temporarily for seasonal activities such as inventory and other related tasks.

Drones for logistics

Other industries have already benefited significantly from the use of unmanned aerial vehicles or drones (UAV or UAS). Digital agriculture is almost unthinkable without the support of aerial photographs, sensor data from the air (multi- or hyperspectral data) or volume information based on point clouds. Land surveying, digital construction sites and industrial inspections have also benefitted from automated drones for many years. In comparison, logistics is still in the early stages of development. While the topic of drone transport is still reaching the limits of the regulation of air traffic, the use of drones in areas such as logistics with block storage outdoors or pallet racks in warehouses can already be implemented today. The first successful pilot projects have shown that drones offer essential added value in terms of cost and time savings – reductions of 80% and more are possible - as well as relief of human resources in connection with inventory recording in the area of pallet racking warehouses or empties storage areas in the automotive industry. Another aspect is the independence of additional staff for inventory tasks. Experience in connection with COVID-19 has shown that drones that can automatically collect data and complete flights have a positive influence on reducing the risk of infection if direct contact between employees can be avoided..
In addition to automation, using a digital image of reality provides a number of reasons to rely on drones paired with artificial intelligence in logistics.

A digital twin

Based on the analysis of the Fraunhofer Center for Applied Research, innovative technologies and digitization are two of the main drivers in the further development of logistics. According to the study, however, these fields must not be an end in and of themselves but must directly contribute to optimizing process quality and effectiveness. In an environment that is still characterized by many manual activities that are taken over by staff. Accuracy, planning security and seamless communication play crucial roles. At the same time,

short contract periods between logistics service providers and customers influence the scope for innovation in the medium and long term. Automation is only possible where flexibility and agility can be maintained. New technologies, which are associated with high initial investments, are only slowly gaining acceptance on this basis. The automated, digital, and regular comparison between target and actual values in enterprise management systems (WMS or ERP) can, however, be carried out with the help of drones without high investments and a far-reaching intervention in the established process landscape. With the most advanced solutions, such as the inventAIRy XL or summAIRy. sky, it is already possible to take stock in off-peak times without the use of valuable employees. Both systems can be activated at the push of a button from a control center and then autonomously record the basic data for later evaluation of the inventory. This data is also processed automatically: the information collected is processed with an upload to a local server or a private cloud and then transferred to the WMS or ERP process control systems. In addition, such solutions also offer a 1-to-1 twin of reality in visual form, archive the status quo, and create evidence security and provide image data that can be used for further analysis (detection of anomalies, inspection tasks, empty space detection, target area exceeded, etc.) with the help of machine learning (ML).

The future of logistics drones

As soon as drones are used in logistics on a large scale, there will be numerous other application scenarios in addition to inventory recording. Process monitoring, monitoring of critical systems and inspection tasks on shelves, smoke alarm systems or other relevant indoor areas. The limits of what is feasible can be pushed further with the requirements.

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Make it Fly – Easy and Safe

By Dr. Klaus Scho, Germandrones GmbH

Corporate Philosophy

Germandrones GmbH has set themselves the goal to develop most innovative, reliable, and predictable UAV technology “Made in Germany” which shall support and meet our customer requirements in best manner. Products and services from Germandrones are characterised by a high-quality standard, industrial robustness and clearly structured operating concepts, regardless of whether they are intended for the inspection / surveillance of critical infrastructures, the support of police, rescue and security agencies or the transport of relief supplies.
Following the example of natural songbirds, our flight systems are designed for fast airborne locomotion and high stability in flight, thus enabling reliable control in adverse weather conditions. Our system combines the advantages of a fixed wing aircraft with those of a copter drone. The modular concept of the Songbirds allows the use of a wide range of cameras and sensors. The equipment can be varied according to the respective flight mission.

Our core competence is the in-house developed mission planning software which enables to fly VTOL-systems and complement payloads safe in various conditions.

The Songbird

The Songbird is the product name of the VTOL developed by Germandrones to serve our clients with a reliable aircraft able to implement our flight-planning advantages. The Vertical Take Off and Landing (VTOL) combines the advantages of a multi-copter drone and a fixed-wing aircraft. Take-off and landing regardless of a runway, catapult or net and very long flight duration.
The Songbird has been industrially manufactured on behalf of Germandrones since 2019 and is used by Germandrones as the main system for their software platform.
Some applications have been integrated into the Songbird system and other systems, such as Video transmission, surveillance, surveying with high-resolution cameras, LiDAR applications, transport of medical goods and special sensors like multi spectrum cameras.
Actual flight times are up to 2 ½ hours. With a Maximum Take Off Weight (MTOW) of 15 kg and payloads up to 4,5 kg in addition to batteries can be integrated. Further systems with payloads up to 10 kg or new tactical versions will widen the Songbird family in future.

All systems have a standard flight controller, which Germandrones engineers

The Software

Germandrones is a developer of software platforms for the operation of VTOLs. Germandrones is also an integrator of applications based on VTOL systems and PixHawk PX4 environments.

The Human Machine Interface (HMI) of the software is our Ground Control Station (GCS). The GCS is the integral component of all applications, which can be used universally on all drones that use a PX4 stack.
Additionally, to creation of flight paths with a high level of safety the GCS supports BVLOS flights by a number of integrated and approved safety routines, e.g. to land the system even without any motor support, or interfaces with UTM communication technology.
Although our recommendation is to use Songbird-systems for qualified missions the use of alternative aircrafts / drones can be supported by our software.
Germandrones is also an integrator for all applications based on the GCS. Customer-specific wishes and requirements have already been successfully implemented.
Germandrones develops and integrates cloud-based solutions for evaluating of the generated data.
The data is processed with AI methods to achieve considerable cost savings for the customer compared to conventional methods and at the same time to improve the data quality.

The Solutions

Supervising security and intelligence operations
Our surveillance solution is mainly used to clarify an unknown situation from a remote location. Operators are fire brigades, police, border patrol or special forces. Operation might be live – aerial reconnaissance during operations or post procession for regular aerial photography of objects or situations

Surveillance of critical infrastructures

The aim of this solution is to prevent or detect faults in infrastructures in order to ensure operation and reduce costs, e.g. by regular monitoring of pipelines, power lines, railways or roads. Very large areas can also be monitored. In near future systems will be deposited at a pre-defined location and starts fully automatically from a hangar to either follow up a disturbance or to fly over it regularly with automatic recharge

Transport of goods

The infrastructure in many regions of the world is a dramatic reason for transport delays and medical supply. Some places are even hard to reach by land or water in general or after natural disaster. The transport time can be drastically reduced with drones, e.g. to supply hospitals with blood reserves, tissue samples or medicines

Precision agriculture and wildlife

The population is increasing worldwide, more and more food has to be produced without exploitation of our planet. VTOL-drones with specified sensors, e.g. multispectral cameras support the analysis of agriculture areas and generate high output with minimized usage of pesticides and fertilizer. UAV also support rangers and other stakeholders with regard to wild-life animals

Detection of drones

Assault or espionage drones are becoming an ever-greater threat. Since these operate in the air, it is difficult to recognize the danger early on from the ground. Therefore, it is often easier to monitor areas from the air. We offer solutions to monitor a wide area and detect drones and controllers by triangulation

The Summary

Our users shall concentrate on their respective task and not on piloting the aircraft – usage must be easy.
The result is a flight system with several safety routines and integration into existing and future airspace systems. This enables largely automated and safe flights - with just one push of a button.

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Drone Tracking via mobile network

By Jan-Eric Putze, Droniq GmbH

Challenge – Integration of UAS in existing ATM environment

UAS operations currently generally take place at low altitudes within airspace that is presently uncontrolled. However, this airspace is also heavily used for all manner of existing civil aviation activities, contains valuable infrastructure and is subject to transient conditions. General aviators within low-altitude airspace typically operate under Visual Flight Rules (VFR). Under VFR, the responsibility is on each aviator to maintain separation from other aircraft and obstacles through constant observation of the vicinity and other users of the airspace.

Our strategy – Using the existing mobile network for enabling UAS operations

Cellular mobile networks have already been proven as a major enabler in many industry verticals. For this reason, mobile networks have already been considered for data communication needs in the context of UAS operations. Given their far extended aerial reach, their worldwide standardized technology, highly developed capacity and capabilities and established procedures for users, cellular networks are candidates for playing a significant part in setting up a controlled and reliable system for UAS operation. At the beginning of 2019, DFS Deutsche Flugsicherung and Deutsche Telekom founded Droniq GmbH to use the existing mobile network for UAS position transmission and for integrating them in the existing airspace eco-system – safely and fairly.

Making UAS visible

Currently, most UAS are too small, fly too low, and are built from material not suited for radar reflection to be detected by air traffic control using existing technologies and systems. Droniq has developed the “HOD4track” (Hook-on-Device) to make drones visible and to give the remote pilot an overview of aircraft movements in the area of his drone mission. Thanks to its low weight, the HOD4track can be attached to any aircraft. It contains an LTE modem and a SIM card. The device transmits its current GNSS position via LTE to the UAS Traffic Management (UTM) system of DFS. The device is capable of receiving FLARM and ADS-B from surrounding air traffic and sending this data additionally to its own position to the UTM system. The remote pilot receives the UAS own position and the position data of other relevant air traffic in the vicinity via the web based UTM tracker. At the same time, the HOD4track transmits its position via FLARM (flight alarm). In this way, the aircraft also becomes visible to other airspace users in the vicinity who use FLARM.

Product features:

- LTE modem to track aircraft via LTE
- Dimensions: 58mm x 38mm x 9.5 mm
- Weight: 35 g without antennas
- Power supply: 5 V (external power supply, such as a power bank or aircraft’s power supply), energy consumption < 400 mA
- Internal antennas: Built-in LTE antenna can be activated optionally
- External antennas: LTE, GNSS, FLARM and ADS-B antennas
- Compatible with all FLARM systems in aircraft and UAS
- Broadcasts its own position via FLARM
- Sensors: Barometric sensor

Potential Impact - More safety and visibility in uncontrolled airspace

Thanks to its light weight, the HOD can be attached to any drone or other aircraft (helicopters, gliders) that fly under visual flight rules. Currently, there is no transponder obligation in uncontrolled airspace in Germany, all systems used for positioning such as FLARM are used voluntarily. Droniq's HOD could not only be a way to integrate UAS into the airspace, but also to provide general visibility in uncontrolled airspace. If all airspace users were equipped with an HOD, this would be an enormous step towards greater safety in uncontrolled airspace.

Integration into the UAS

The HOD4track can be easily attached to any drone as a "drag and drop" equipment. However, this is not a long-term solution. Therefore, Droniq has also made the device available as an OEM version especially for drone manufacturers. This means that the unit can already be built into the aircraft by the manufacturer. Some manufacturers are already testing the integration.

Vision – Creation of European standards for UAS tracking

Mobile technology is already a standardized technology for data transmission and identification of terminal devices used globally by billions. Similarly, the world of air traffic control is based on globally recognised standards and procedures. The technology of the UAS has developed very rapidly and disruptively. Accordingly, there are still no technical standards in the field of UAS tracking - neither at national nor at European level. By using the mobile radio standard and a standardised data interface to the UTM system, which in turn is based on the existing ATM infrastructure of DFS, HOD-4track can be a first basis for the development of a European standard for tracking UAS.

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HOD4track consists of LTE modem to track aircraft via LTE and of four antennas (LTE, GNSS, FLARM, ADS-B)

3.5 Jahre BVLOS Betrieb in Schweizer Städten

By Markus Farner, Schweizer Bundesamt für Zivilluftfahrt

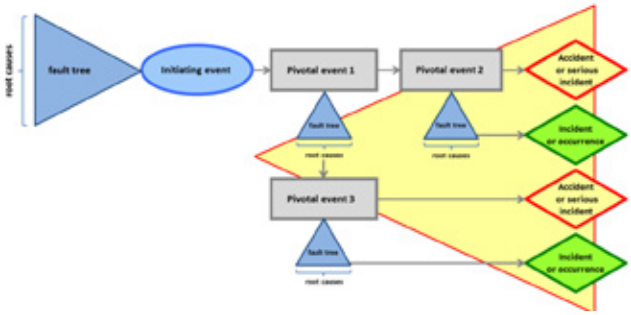
1 Rückblick und Entwicklung:

Am 24. April 2010 wurde durch das Schweizer Bundesamt für Zivilluftfahrt (BAZL) die erste Bewilligung für BVLOS Flüge von Drohnen über Schweizer Territorium ausgestellt. Die Bewilligung wurde für einen Schwarm von bis zu 13 Drohnen ausgestellt, die sich gegenseitig kontrollierten und koordinierten. Die Flüge waren limitiert auf 150m AGL und durften nicht über dicht besiedeltem Wohngebiet oder über Menschenansammlungen stattfinden.

Seither erteilte das BAZL regelmässig Bewilligungen für BVLOS-Flüge, die jedoch alle ausserhalb städtischer Gebiete durchgeführt wurden.

Ende 2013 veröffentlichte das BAZL eine erste strukturierte Richtlinie, die aufzeigte was erforderlich ist um eine Genehmigung für Flüge zu erhalten, die nach Schweizer Recht eine Genehmigung erfordern. Die Grundlagen dieser „Guidance for Authorizations for Low Level Authorizations of RPAS (GALLO)“ basierten auf dem ASCOS Projekt der EU.

Die Grundlage war ein Bow Tie mit den zwei Fragen im Zentrum, «was passiert wenn» und «warum konnte dies geschehen».



Natürlich waren ebenfalls ausreichend Informationen zum geplanten Betrieb und der eingesetzten Technik erforderlich um diese Fragen ausreichend beantworten zu können.

Darauf basierend mussten Mitigations-Strategien entwickelt werden um eine ausreichende Sicherheit zu gewährleisten. Im Wesentlichen also der gleiche Ansatz wie heute im Specific Operational Risk Assessment (SORA).

Basierend auf diesem GALLO war es für uns möglich Anträge entgegenzunehmen die BVLOS Flügen über Städten zum Ziel hatten.

Entsprechend erreichte uns von der Schweizer Post im Herbst 2014 eine Anfrage zu einem möglichen Einsatz von Drohnen in der Stadt Lugano zum Transport medizinischer Proben. Verschieden Schritte und Testreihen waren erforderlich, aber am 9. März 2017 wurde die entsprechende Bewilligung ausgestellt.

Seit März 2017 haben wir nun bis heute in der Schweiz BVLOS Flüge über den Städten Lugano, Bern und Zürich.

Ich gehe davon aus, dass die Leser mit dem SORA das als GM zur neuen Drohnenregulierung 2019/947 Art. 11 zur Anwendung kommt einigermassen vertraut ist. Entsprechend gehe ich hier nicht weiter auf die darin enthaltenen Anforderungen ein.

Rückblickend kann jedoch festgestellt werden, dass es entscheidend war, die wirklich erforderlichen Daten zur Verfügung zu haben. Es ist offensichtlich, dass auch in Städten das geplante Überfliegen von Menschenansammlungen vermieden werden soll. Statistische Daten zur Bevölkerungsdichte sind hier keine Hilfe. Es liegt auf der Hand, dass das BAZL nicht die zuständige Stelle ist um zu beurteilen wo zu welcher Zeit Menschenansammlungen entstehen. Um diese Angaben zu erhalten ist der Kontakt mit den lokalen Behörden erforderlich. Im vorliegenden Fall Lugano fand auch eine Begehung der Örtlichkeiten statt.

Botschaften, Konsulate, Gefängnisse etc. sollen nicht überflogen werden und aus pietätsgründen ist das Überfliegen einer Beerdigung nicht angezeigt. Auch diese Angaben können nur die lokalen Behörden liefern und erfordern oftmals eine kontinuierliche Koordination des Drohnenbetreibers mit den lokalen Behörden.

2 Vorfälle 2019:

Im Januar 2019 fiel eine Postdrohne während eines Fluges am Fallschirm in den Zürichsee und im Mai 2019 stürzte ebenfalls eine Postdrohne fast ungebremst in einen Wald in der Stadt Zürich. Diese Vorfälle bewogen die betreibenden Partner Schweizer Post und Matternet zu einem vorübergehenden Unterbruch des Betriebes, die Bewilligung wurde jedoch vom BAZL nicht entzogen.

Beide Unfälle wurden von der Schweizer Unfalluntersuchungsstelle (SUST) untersucht. Bei keinem der Vorfälle kamen Menschen zu Schaden.

Beide Vorfälle sind auf technische Probleme zurückzuführen, die zu Änderungen am Design der Drohne führten. Beim ersten Vorfall wurde die Stromzufuhr zur Positionsbestimmung unterbrochen, beim zweiten Vorfall führten Vibrationen zu unterschiedlicher Fluglage der redundanten Lagesensoren. Das Auslösen des Fallschirms ist in diesen Fällen vorgesehen. Beim zweiten Vorfall wurde die Befestigungsleine des Fallschirms durchtrennt wodurch die Drohne nur gebremst durch die Selbstrotation der Propeller in den Wald stürzte.

3 Schlüsselelemente für den sicheren Betrieb:

Die detaillierte Untersuchung der Vorfälle und deren Ursachen und Folgen zeigten uns die Wirksamkeit der SORA Methodologie auf um einen sicheren Betrieb zu gewährleisten. SORA sieht zur Bestimmung des „Final Ground Risk“ drei Mitigierungen vor:

1. Strategische mitigierung, also dort fliegen wo weniger Menschen sind
2. Reduzierung der Aufschlagsenergie
3. Einen Notfallplan um eskalierende Effekte zu vermeiden

Dadurch wird eine Sicherheitskette erreicht die auch bei Versagen eines der Sicherheitselemente schwerwiegende Auswirkungen vermeiden soll.

Der zweite Vorfall hat aufgezeigt, dass durch eine sorgfältige Wahl der Flugroute und einem effizienten Notfallplan schwerwiegende Auswirkungen wirksam verhindert oder verringert werden können, auch wenn die Reduzierung der Aufschlagsenergie fehlschlägt. Etwas provozierend kann daher gesagt werden, Dank den Vorfällen wissen wir das SORA funktioniert.

4 Schlussfolgerung:

BVLOS Betrieb über Städten ist möglich wenn das GM zu Art. 11 der 2019/947 (SORA) als Grundlage der Zulassung dient. Eine besondere Beachtung sollte jedoch den Daten geschenkt werden die zur Beurteilung des Risikos zur Anwendung kommen sowie der Beurteilung der erforderlichen Mitigierungen im Falle eines technischen oder operationellen Problems.
Die Flüge in Lugano und Zürich sind in der Zwischenzeit wieder Aufgenommen worden, so das weitere Erfahrungen gesammelt werden können.

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BVLOS in European Sky: Risk and Responsibility Aspects

By Vladislav Tamrazyan, EMPIC GmbH

1 Status Quo

The mass flights beyond visual line of sight (BVLOS) – a dream of many European drone operators and pilots – seems to become true very soon. Thanks to the rapid development of the UAS industry in the last decade it was already for a long time not a technical question anymore but a regulation issue that made BVLOS an exception but not the reality. Our a bit more conservative society as always wants to proceed if only very sure and careful. This could be seen well at the example of electric scooters - it took quite a while for some of our countries before scooters appeared on our roads. Something similar happened with unmanned vehicles flying long distance. While this is being actively practiced in developed Asian countries and Americas, where approach of trial and errors prevails over being very careful regarding the civil drones, or in Africa, where it became a matter of life, the European companies backed by very progressive drone technologies had to satisfy their appetites with the test flights only or operations abroad.

2 BVLOS but Not Blind

Now that we have a new risk-based regulation developed by EASA in close cooperation with subject matter experts from the aviation security domain the BVLOS flights should be not an exception anymore but reality although maybe not yet a normality for everyone. Although the regulation was postponed due to the situation around COVID-19, it will come into force on the last day of yet 2020, and NAAs are now trying their best to get compliant by that date. From the other side the situation with worldwide declared pandemic could be considered as a catalyst that makes clear how important it is to have operations, where human is not directly involved and not “on board”, and how many duties civil drones could take over from people, in case humans are not able or not allowed to be physically present in the loop.

Although the new regulation may still have some gaps to be filled and questions to be cleared, we now have enough base to start with and the regulation based on the risk exposed by the UAS operation sounds to be a very reasonable and healthy approach. Compared to non EASA countries, where, saying simplified, only commercial or not commercial usage plays a role, the European approach really stands out and hopefully will contribute to the increase of acceptance level in the society for the UAS operations generally and for BVLOS in particular. With this concept the specific operations risk assessment (SORA), which is a “default” recommended methodology of risk assessment becomes a fundamental skill for aviation authorities, drone operators and drone manufacturers. Indeed, as one of the “fathers” of SORA Lorenzo Murzilli said once at the EASA workshop, why should you care whether you were hit by a commercial or non-commercial drone, important is to avoid such a situation.

The ease for a drone operator to be authorised to conduct a BVLOS operation now will strongly depend on the risk exposed by the operation and how good the risk could be mitigated. Here regulation offers flexible enough mechanisms to proceed. From the three introduced operation categories: open, specific, and certified, the BVLOS operations mostly covered by the specific (this category name is where the word “specific” originally comes from in the SORA abbreviation).

For the BVLOS operations with the low and middle risk level (defined as SAIL in SORA) the operational authorisation must be submitted by the operator and approved by aviation authority. If a UAS operator is going to use drones for some standardised and well described operations with low risk level, they could make use of even easier procedure. In such a case the operator should just send a declaration of operation to the authority for one of the established so-called standard scenarios. This declaration does not require any approval from NAA. The most interesting and exciting part here, how many kinds of BVLOS operations would be treated as standard scenarios with low risk and therefore could be covered by a declaration. For now from the existing two EASA standard scenarios STS-01 and STS-02 only the second one is dedicated to the BVLOS operations and is applicable for the flights in rural areas under certain conditions (below 120 m with UA MTOM <25 kg and up to 2 km range when using airspace observers). The operators passionate about BVLOS looking forward to further standard scenarios from EASA with hope there will be more of them covering the BVLOS flights. Meanwhile in the transition phase that is planned until 2022 the UAS operators can submit declarations of national scenarios, which must be completely replaced by EASA scenarios in future. For the high-risk operations with SAIL V and VI and for all BVLOS operations in urban environment the operated UAS would require a certification. This is special case when depending on the risk level and operation environment the same UAS could be subject to either specific or certified category operation.

Regarding the BVLOS operations there is another aspect besides the risk which must be considered. It is the responsibility of the drone operator in case something went wrong during the operation. The responsibility in its turn is closely bonded with the ability to identify the UAS operator and insurance, which drone operators must have. Here the effort put to make this identification possible depends on the category of operation. For the case BVLOS flight is conducted in the specific category the identification is assured by the obligation of UAS operators to be registered in the national register, whereas each operator gets a unique UAS operator registration number in an EASA compliant format that supports interoperability for the operations across borders. All the drones of an UAS operator then carries and broadcasts the same ID. This idea has been widely compared with the number plate of a car, which is not completely correct comparison, since if someone has more than one car all of them still would have a different number plate and in the case of operator ID of an UAS operator it is one to many relation, meaning that each and every drone flown in specific (or open) category have the same number on board. For the case BVLOS flight is conducted in the certified category each UAS is treated as a usual aircraft and gets its unique registration mark so that it can be easily traced back who is the operator and owner of the aircraft.

To sum up we can conclude that for Europe going beyond visual line of sight is not going crazy and at the same time beyond VLOS is not beyond possible anymore.

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Medical Delivery in Urban Areas: The Power of Backup Systems and Hardware-in-the-Loop Simulation

By Daniel Cracau & Alexander Köthe, AlphaLink Engineering GmbH

1 A brief Introduction and Motivation

Unmanned aircraft in the class below 25 kg (sometimes even below 150 kg) typically have only a single redundant flight control system and data links to the ground. This means that even a single fault in the flight control system can endanger people, ground infrastructure or other aircraft. A current example is a lost survey drone in Britain, or a test drone from the renowned company UAV Navigation, which continued its flight uncontrolled after the communications link was broken [1]. Redundant systems for unmanned aircraft are usually out of the question for reasons of cost and weight.

For this reason, AlphaLink Engineering GmbH develops a backup system, which ensures the safe operation of unmanned aircraft (initially: mass less than 25 kg). The backup system terminates the flight in a safe manner if a critical error occurs, e.g. in the flight control system. This backup system thereby provides a simple dissimilar redundancy. It is intended to enable the operation of unmanned aerial vehicles (UAV) in airspace where UAV are prohibited for safety reasons if a single failure can have critical consequences.

The paper describes the integration of the backup system into the flight control system of an existing UAV including the actuators used for flight control and the higher-level systems, from which the commands to the control systems come. In fault-free operation, the backup system behaves transparently, i.e. the commands of the higher-level systems are forwarded directly to the actuators. As soon as the backup system detects a fault, it reacts correspondingly.

With the followed approach, the backup system itself is safety critical and must be developed with processes like those used in manned aviation. However, these are not yet finally defined for this class of aircraft. The processes for the hardware and software development of complex safety-critical systems in aviation are extremely complex and represent an enormous hurdle for smaller companies developing UAV. This is true both in terms of cost and the necessary expertise and infrastructure. The backup function is much simpler than the overall flight control function. Hence, it is reasonable to assume a large-scale applicability of the system that justifies the single effort of the complex development process.

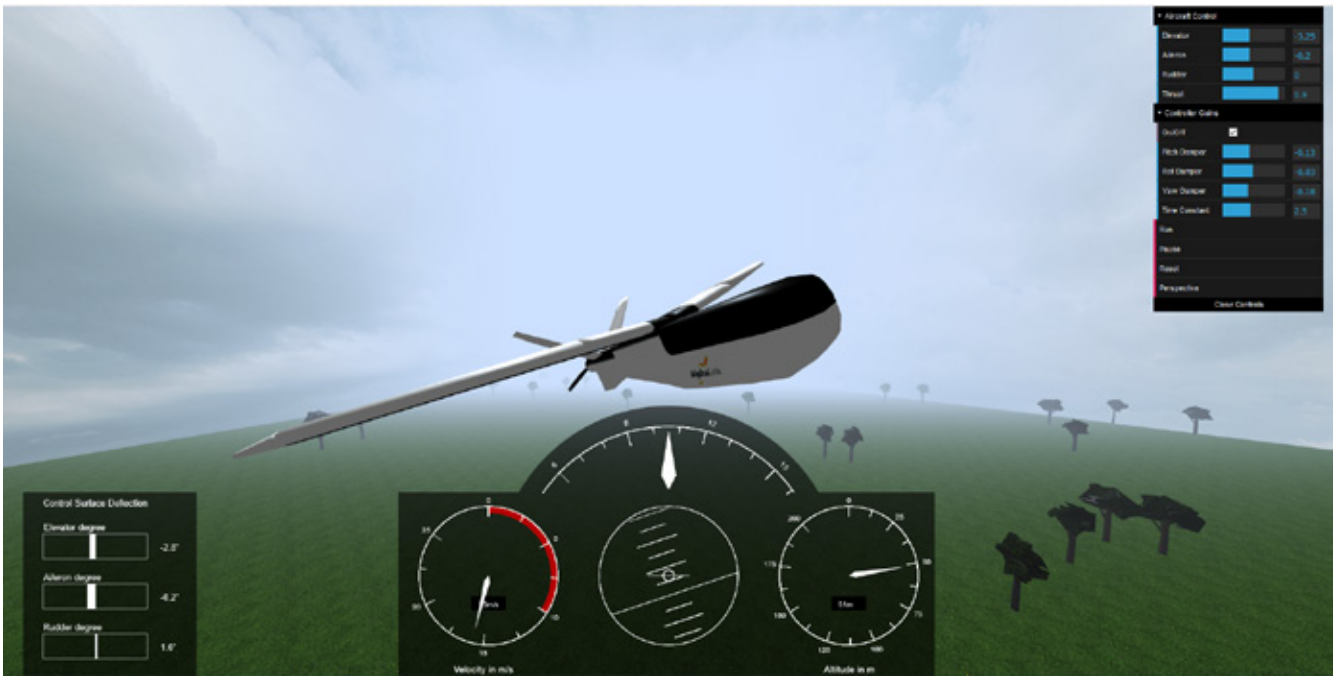
Since an unmanned aircraft with the backup system can continue to operate safely even in the event of a fault of certain higher-level systems, it can comply with the uniform European regulations for the operation of drones and, for example, enable flights beyond visual range (BVLOS).

The paper also presents an application for the backup system to enable large-scale delivery of medical equipment. As part of a cooperation with a Berlin-based drone manufacturer, a UAV will be equipped with the backup system for BVLOS flight. First target to perform BVLOS flights for fast and secure medical transportation will be the German capital region Berlin. In total, the presentation of technology and application of the backup system demonstrates the benefits of civil drone use in Germany and Europe.

Along the paper, first, the backup system that enables BVLOS operation is described. Second, the testing approaches are presented. Last, in the outlook section, upcoming challenges are discussed.

2 BVLOS Operation with a Backup System

The market for unmanned aircraft continues to grow. A great potential of such vehicles is that they can also cover greater distances out of sight. This section describes the developed backup system and its advantages. At the end of the section, a planned extension is discussed.



2.1 Backup System to Prove higher Operational Safety

To prove that the flight is possible even outside of visual range, drone operators must perform the Specific Operational Risk Assessment (SORA) analysis. Based on aircraft, equipment, and operational scenario, a risk assessment results, which allows or prohibits the operator to fly out of sight. If the drone operator uses a Flight Envelope Protection System, which was developed based on an industrial standard, she can significantly reduce her risk in terms of the SORA analysis and, thus, fly out of sight.

Such a system was developed, which is functionally safe and both separated and sufficiently independent from other subsystems of the drone. The concept provides for the permanent monitoring of the drone's flight condition based on the measurement of attitude and rates. If the aircraft is outside its flight envelope, the system sends a signal to trigger a rescue system, which then launches a parachute. The backup system also monitors the position of the drone. If it flies, unintentionally, permanently into a forbidden area, the parachute can also be released. The same applies to impending collisions with other air traffic participants or the failure of other components, such as the battery or the radio connection.

The final system is based on a safety analysis, which has identified all critical points in the concept and secured them, for example, via redundancies. Functional safety and, thus, a safe flight out of sight can be guaranteed. The system can be used for both fixed-wing aircraft and copters. It complements existing hardware, such as the flight control computer, and due to its low weight, it can be integrated into many existing UAV.

2.2 The Advantage of Galileo-Based Position Data

Using Galileo as a primary source for position localization, dissimilarity is achieved and a single point of failure is excluded regarding determining the flight status of the drone in operation. The European system is more accurate than the secondary systems used: GPS or GLONASS.

It is planned to integrate a Galileo-enabled receiver into the backup system. The developed backup system aims to be a platform-independent component to be installed in existing and future drones. The GNSS position data are used to determine flight envelope and to check the flight path (geofencing). This in turn helps confirming the correct operation of the medical delivery drones. Because the Galileo data are a source of information independent from GPS data, dissimilarity is achieved and the backup system is qualified for safety-critical use, as required in drones. The specific equipment used is the receivers (hardware) that track the position information provided by Galileo and the software that allows interpreting the information in a correct way.

For the first time, the system itself introduces a platform-independent backup system for drone manufacturers/operators. This system is developed based on ISO 61508 to achieve functional safety. This will allow a safe operation, which protects people, objects and other air traffic participants (manned & unmanned). Using Galileo position data as part of the backup system to determine the correct flight path of the drone eventually enables BVLOS operation. The independent Galileo position data provide the possibility to guarantee a precise localization of the drone, which in turn helps to confirm correct (safe) operation of the delivery drone.

The next section reports about the last step of the development process: testing and validation.

3 Simulation and Testing

Before the actual operation of the new backup system, extensive testing of the component itself and of the complete UAV system is necessary. This testing is not only relevant with experimental systems, but rather highly needed to confirm the required safety of future commercial products [2].

Both, a hardware-in-the-loop simulation and a virtual flight test is applied to guarantee safety and operational comfort of the new solution.

3.1 Hardware-in-the-Loop Simulation

Flight tests are expensive and time-consuming - every drone manufacturer is interested in ensuring that the flight test is successful and that the invested effort is worthwhile. Therefore, it is desirable to test as much as possible in advance.

Testing should be as close as possible to real flight tests and this is only possible with a hardware-in-the-loop (HiL) simulator. In HiL testing, the movement of the aircraft, the environment, and the sensors and actuators are replaced by a mathematical model. All other systems of the aircraft are tested in real life.

In cooperation with Vector Informatik, a HiL simulator was developed that can be used for Pixhawk flight control systems with CAN interface [3]. In a Simulink model, the nonlinear flight dynamics and the behavior of sensors and actuators are simulated. Data is transmitted via the interface to the CANoe software and then prepared for transmission via CAN interface using a DBC. Using hardware from Vector Informatik, the data is sent via CAN bus. The Pixhawk runs the PX4 flight stack which was modified.

The software was modified on operating system level to allow CAN bus communication. In addition, the sensor driver model was modified so that instead of the sensor data the values from the flight simulation can be read in. Besides the commands to the real actuators, the commands are sent back to the flight simulation via CAN interface. The implementation allows that all other software packages, like the extended Kalman filter, the flight controller or the output module, run like in real flight test. Furthermore, interaction with QGroundControl and the remote controller is possible.

Through the graphical interface of a Virtual Flight Test Environment, the flight movement can be followed in the browser. In flight simulation, disturbance variables such as gusts and turbulence can be simulated. Moreover, sensors can deliberately send wrong values or fail completely. This allows a safe testing of the entire system and further increases safety in unmanned aviation. The simulation model can be created for any drone tailoring the HiL simulator to the operator/manufacturer needs. This means that the system can also be tested prior to flight testing, saving time and money.

3.2 A Digital Twin: Virtual Flight Test Environment

The Virtual Flight Test Environment (VFTE) is a web-based flight simulation that enables flight tests to be performed to test controllers without the need for additional tools. An unmanned drone can be flown using the keyboard (see picture on top of the page).

In the preview version that is available free of cost, the aircraft can be controlled directly, or the flight characteristics can be influenced by a controller [4].

The user can either take a perspective in which he is directly behind the drone or observe the drone's movement from a fixed position on the ground. Displays allow the monitoring of flight parameters. In the mode where the user has a fixed position, the displays can be used as a ground station. Behind the movement of the aircraft is a non-linear flight dynamic that simulates the real flight behavior - in addition, the dynamics of sensors and actuators are simulated.

In fact, what are the primary use cases for the VFTE? Before pilots go into real flight testing, the flight behavior can be tested in the simulation. This reduces the risk of crashes. Before new control concepts are tested in practice, the con-

cepts can be verified in the safe world of the virtual platform. System failures can be simulated in order to check the behavior in these exact cases of failure. The VFTE benefits every drone owner, every drone manufacturer and every researcher who wants to make sure that her real flight test is a success and saves costs. If demanded, any geographic area and any drone can be integrated into the VTFE. The web-based environment allows each stakeholder anywhere in the world to virtually test their copter or fixed-wing aircraft using a browser and keyboard only. The VTFE can be used in combination with the HiL simulator and the drone can be controlled directly via remote control or ground station.

4 Outlook

The backup system solution addresses the current and expected upcoming EU drone regulations and their specific focus on safety and risk reduction. Following an initial, highly urgent application case with a local Berlin partner and its Labfly drone (see picture in the right column), the solution was designed to fit with the needs of BVLOS drone delivery in Berlin. Having achieved that, it can be scaled to EU-wide applications following the harmonized regulations expected to come into effect by January 1, 2021. While BVLOS operation is already possible after individual approval in some cases, the backup system solution targets large-scale operation as a result from general flight approval, thereby enhancing the potential for drone delivery use across the continent.

Anticipating that third-country parties outside Europe will follow a well-functioning European solution, particularly in terms of future drone regulations, there seems to be a clear potential for positively impacting regions in Asia, where the medical drone delivery case is already started under a different regulatory framework.

Finally, further studies using the backup system and the delivery drone will be conducted to study the impact of integrated and decoupled transportation mechanism. This will be particularly important to evaluate the potential for medical drone delivery of different kinds, e.g. COVID-19 test kits or standard blood samples vs. aerial transportation of organs or other highly vulnerable goods.

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Interoperability and connectivity to unlock UTM and enable BVLOS

By Christian Janke Assistant Professor, College of Aeronautics, Embry-Riddle Aeronautical University Worldwide Campus

How can flight operations Beyond Visual Line of Sight (BVLOS) for Unmanned and Autonomous platforms be approved and certified, while maintaining the high level of safety commonly expected in manned aviation? How can a harmonized airspace usage of manned and unmanned platforms in controlled and uncontrolled airspace be achieved? What would be an acceptable performance of CNS (Communication, Navigation, Surveillance) – ATM (Air Traffic Management) technology for Unmanned Aircraft Systems (UAS) to assure an equivalent level of safety based on today's standards.

These questions still remain today the key challenges for the aviation industry, for both manned and the unmanned sector.

Looking at the three questions above in more detail, one could ask why solutions have not been identified and implemented much earlier. A neutral and consolidated approach must observe the current state of regulation and find regulatory means without overreaching with action-bias and higher burden for a still nascent industry.

For example, the BVLOS flight of a UAS must be consistent with the current operations of manned aviation under Instrument or Visual Flight Rules. Also, the communication system must meet the requirements of the operating conditions and maintain an equivalent level of safety. This means that safety- and security-critical information must be transmitted at all times with robust and redundant data links. This is primarily information that is required in connection with Unmanned Traffic Management Systems (UTM) to generate airborne targets with ID, position, altitude, flight direction, speed, etc.

A sustainable approach of UTM can only be successful when integrating both manned and unmanned aviation, hence the acronym should be altered in this meaning to Universal Traffic Management – UTM.

Equivalent level of safety (ELOS) considerations should be applied, when introducing, installing, and certifying new technology for a future UTM.

Currently, there is a reasonable number of airplanes and helicopters in uncontrolled airspace operating with "See and Avoid" measures to remain well clear from, and avoid collisions with, other airborne traffic.

Research has demonstrated that only See and Avoid operations lead to limited Situational and Spatial Awareness (SSA) by aircrews. Reasons for this dangerous lack of SSA can be the marginal performance of the human eye, fatigue, distraction, and poor Crew Resource Management (CRM).

The numbers just for Germany are shattering:

The German Aviation Accident Investigation Authority - BFU (Bundesstelle für Flugunfall-untersuchung) received a total of 490 reports of near misses, proximity warnings, and aircraft collisions in the years from 2010 to 2015. According to the classification of the BFU, there were 15 accidents, 31 serious incidents, eight incidents and 436 "not further worthy of investigation" events for this period. In total, 19 persons were killed, two persons were seriously, and 15 persons were slightly injured in the accidents.

The BFU concluded that in expectation of the increasing number of drones, See and Avoid must be regarded as insufficient. "Especially for low-lying police and rescue helicopters and partly for approaching and departing traffic, collisions with drones represent a newly emerging danger (besides bird strikes)."

As a realistic result and assessment, it has to be stated, that See and Avoid is already today outdated and given the growth forecasts cannot be the sole mean of collision avoidance.

Innovative approaches and a paradigm shift are needed, to overcome these challenges to assure safe aviation and harmonized interoperability in the future. Only this will be the key to unlock the potential of a digital future of aviation.

So, what if we apply the Internet of Things (IoT) into the airspace? Ironically, there is already technology available to support aircrews and ATM-personnel to maintain proper SSA. A harmonized interoperability between trackers, beacons, and transponders will be the key to unlock the potential of a digital future of aviation.
Keeping in mind the high levels of safety and assurance from manned aviation, there must be minimum performance standards for such connectivity and interoperability.

1. Ubiquitous connectivity in all situations and possible flight volumes (remote, rural, urban) must be assured through redundant data links to mitigate lost or compromised connectivity.

2. Commonly accepted truth values for state, position, and mission of the airspace participants through redundant means of localization and robust integrity levels need to be in place and certified.

3. Low-latency data links will be resilient against sudden changes and adapting flight profiles, e.g. for rescue helicopters and short-notice No-Fly Zones.

4. And after all Cyber Security needs to be implemented in such an airborne IoT approach. A well-known proverb in computer science says: The “S” in IoT stands for Security.

It goes without saying, that aspects data links need to be tamper-proof and resistant against spoofing. Also, the tracking information should be verifiable through the aforementioned data links. This high level of Cyber Security needs to be applied both for broadcast and networked data links for both manned and unmanned platforms. Only a collaboration of all stakeholders involved will unlock the UTM sphere and enable future applications, such as BVLOS for Unmanned Aircraft Systems.

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Scaling and Automation in Drone Cargo Applications

By Marc Schwarzbach, Phoenix-Wings GmbH

The use of drones to deliver goods can be seen as the third wave in drone applications. Mapping by drone has by now established as a mature and diverse, growing market. Surveillance applications are following with solid products becoming available.

Large steps are currently ongoing in cargo drone technology worldwide. The differences compared to the other use cases and therefore reason for the delay is seen in the following key challenges:

- BVLOS is essential for any drone cargo operation
- Automation at high levels is required
- Large capacity and therefore quick scaling is demanded

1 BVLOS

The most obvious requirement for cargo drone applications is the possibility to fly BVLOS.

Much work has already been put into the topic with big changes currently ongoing. Methods as SORA have been adopted by the industry and are leading to better, safer designs and operational concepts. The possibility to allow for more applications by increasing safety is clearly driving development.

However, lack of global harmonization and lack of consistency in the development of rulemaking (as for example seen in EASA NPA 2020-07 [1]) is slowing down investment in necessary, but expensive development for compliance.

2 Automation

As we move to larger amounts of cargo to be transported by drone, human involvement in the operation cannot grow at the same rate. Availability of trained personnel and cost limitations ask for an increase in automation of the whole process.

Special relevance are the roles foreseen in future operations. The role of a “pilot”, who actively “flies” the aircraft in a classical sense is not going to be present in most operations. “Operators” trained to different levels working at takeoff and landing sites as well as in remote control centers are going to dominate the workforce.

Pilots being able to recover aircraft from failure modes or unforeseen situations already today are better to be compared with test pilots in manned aviation since they need to be included in the design of complex systems and work closely with development engineers.

This change seems not to be fully foreseen in the current regulatory process as can be seen by the definition of “remote pilot” in many places. We encourage further discussion and clarification of terminology.

2.1 Example at Lake Kivu Challenge

Phoenix-Wings has demonstrated its vision of operation at the Lake Kivu Challenge as part of the African Drone Forum [2] held in Rwanda, February 2020. For performing the task of transporting medical goods over 24km to and from a remote island, the Conops was optimized to allow an operator with minimal training to safely receive and send back our VTOL aircraft at the remote island.

The procedure, including a simplified handheld interface, was accepted in the strict safety process necessary for flight permission. It also helped to win the sample return competition by optimized turnaround times. Additionally, the innovation award was received by Phoenix-Wings.

3 Scaling and Market

Aside from some specific applications like medical emergency delivery, most customers demand for larger amount of cargo to be transported. This demand can be fulfilled by either increasing aircraft size or adding more systems to a fleet and increase flight numbers.
It is expected that in long range applications covering several hundred kilometers, large drones will be the solution. On short to medium ranges, however, especially if many destinations must be covered in a network, an increase in number of flights might be the better solution. Phoenix-Wings is working on making these cargo drone networks a reality.
The advantage of fleet of smaller aircraft is that total cost of operating a cargo drone does not scale linearly with size. Additionally, regulation introduces steps into this relation (for example weight and wingspan limits for certain risk classes). Therefore, we will find many designs being optimized at these “barrier points” in the future.

If an economically feasible system will be possible in many cases depends on if the application is matching these regulation-driven designs. Test centers and corridors which allow demonstrating applications outside of these restrictions followed by safety analysis is therefore an important module of improvement.

4 Summary

Drone cargo applications will grow in numbers in the future. The places and the way this will happen is highly dependent on the upcoming development in regulation and therefore operation. Customers are now out of the phase of first enthusiasm and looking at hard facts and numbers.
We should openly address the issues and work for widely accepted applications and safe operations.
Also, proportionate adjustments of regulations should be considered if operations proving safe are blocked by artificial barriers in the rules.

References

[1] https://www.easa.europa.eu/document-library/notices-of-proposed-amendment/npa-2020-07
[2] https://www.africandroneforum.org/

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Detection of Uncooperative Drones

By Markus Wolf, HENSOLDT Ventures

A view on current solutions

The threat from uncooperative drones is a rather young one in the civil environment. Yet with drones and their capabilities developing at a tremendous speed it is also a constantly changing one.

As such, systems addressing this threat, both in detection as well as in mitigation, are equally not available in a “stable one-size fits-all” configuration. They are rather in a fluid state. What is considered a state-of-the art answer today might not be suitable at all already tomorrow.

In his presentation, Mr Wolf will provide an insight into the current market situation for Counter Unmanned Aerial Vehicle (CUAV) solutions.
Upon providing an overview on available systems he will describe the pros and cons of the todays predominantly chosen components.

Additionally he will describe the challenges and advantages of a system vs product approach before providing examples of existing installations.

Finally, the presentation will highlight some points to consider when looking into procuring a suitable CUAV system.

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exists since the year 2000 and is the largest and most experienced German speaking professional association for unmanned aviation in Europe.

It represents the interests of more than 200 members from research & development, manufacturers and suppliers as well as users and service providers from Germany, Austria, Switzerland, Italy, the Netherlands and France.

The association pursues the economic design and use of unmanned aircraft for the benefit of the population, the achievement of broad public acceptance and operational safety in the airspace without danger to persons and property on the ground.

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