BU STUDENTSHIPS 2020

PROJECT DESCRIPTION

PROJECT DETAILS

PROJECT TITLE

E-Drone: Transforming the energy demand of supply chains through integrated UAV to-land logistics for 2030

PROJECT SUMMARY

Vans are the fastest-growing category of licensed road vehicle in the UK with growing CO2 emissions. Vans performing service functions make up the large proportion of activity and, given the need to reduce energy use and emissions, alternative operating practices are being seriously investigated. Our proposed research into how Unmanned Aerial Vehicles (UAVs) and land logistics systems can be combined and managed will provide fundamental new understanding into the impacts of regulation and operating criteria on energy efficiency. UAVs are increasingly seen as a new mode to assist in last-mile logistics. Medical logistics could be the first domain to utilise UAVs on a commercial scale, with preliminary analysis on pathology logistics within Southampton indicating that UAVs would significantly reduce CO2 emissions. With the NHS spending an estimated £2.5 billion annually on pathology logistics and with patient numbers rising, there is a need to re-think how logistics costs could be reduced whilst improving bleed-to-diagnosis times for patients and energy demand.

The UAV global market is estimated to grow from $2 billion in 2016, to nearly $127 billion by 2020. This will have a significant impact on both controlled and uncontrolled airspace. The greatest barrier to UAV adoption into logistics fleets is the current lack of integration of UAVs within civil airspace which requires development of suitable air traffic rules. The true energy savings and overall viability of UAVs in this domain will only be realised when the regulations governing their use and the operational implications have been quantified through simulation.

The research vision is to examine the energy reduction potential of logistics solutions involving UAVs operating alongside sustainable last-mile delivery solutions (cargo cycles and walking porters via micro-consolidation points). This involves understanding UAV operations in airspace shared with manned aircraft. The project focuses on a case study and trials based around NHS pathology sample transportation in the Solent region. Within this larger project, the studentship will contribute to the following key research objectives:
1. Investigate the collective transport and energy impacts of current 'business-as-usual' NHS pathology logistics across the Solent region;
2. Understand stakeholder concerns about UAVs;
3. Understand the regulatory and governance needs associated with UAV interventions that will lead to energy benefits in logistics.

The research outcomes will be trialled by Meachers Global Logistics and Steve Porter Transport as part of the project and will provide them and other carriers with evidence of the tangible benefits from adopting UAVs into their logistics fleets. The outcomes of the project will provide evidence for UAV regulation and management policies for shared airspace highlighted as a key requirement by the Department for Transport, the Civil Aviation Authority and NATS. Critically, the project will also provide the first concrete evidence of the energy demand benefits of integrating UAVs with land logistics under real operating and regulatory conditions.

ACADEMIC IMPACT

The project will be of relevance and benefit academics across areas of transport energy demand, logistics, social science, simulation/modelling, medical and business operations management and airspace management systems because E-Drone will:

1. Provide fundamental understanding in how new shared airspace regulations may impact on energy performance of Unmanned Aerial Vehicle (UAV) deliveries and how this might reframe current knowledge of UAV logistics opportunities.
2. Advance knowledge in how multi-modal supply chains involving land-to-UAV and UAV-to-land logistics interchanges might be best optimised using powerful metaheuristic algorithms to reduce overall energy demand.

3. Explore new business models based on shared UAV-primary logistics fleets and the operational and regulatory conditions under which such systems will and will not be energy and cost effective
4. Contribute to theoretical knowledge of societal understandings of UAV use, that extend beyond end-user acceptance studies, providing knowledge that will help determine UAV operation parameters in logistics and other fields.

The studentship will focus on number 4, but contribute to 1, 2 and 3.

The fact that the project is undertaking a trial with commercial partners (Meachers Global Logistics, Steve Porter Transport, Zedify, Parcelly, Southampton Airport, Motion robotics) and public organisations (NHS, Southampton City Council, NATS) will help the academic community learn from a live business application of the concepts being developed. This will also quickly ascertain their wider transferability to other logistics related sectors and the barriers and challenges that will be faced. The techniques and skills developed during the project, particularly in the areas of shared airspace regulation, schedule optimisation of UAV-to-land logistics and societal understandings of UAVs will advance academic studies in the core disciplines of airspace and transport management and planning, operational research and social science.

SOCIETAL IMPACT

Primary logistics providers and last-mile solutions companies will trial services for shared UAV-primary pathology logistics. Key benefits are anticipated to arise from i) new business models based on UAV-primary logistics fleets that would be viable for reducing energy demand, ii) improved response times for time-critical service needs opening up new UAV markets, iii) understandings of risks, costs, human resource needs and time.

Local Authorities - will be able to evaluate the viability of UAV strategies for their locations with benefits related to CO2 emissions and congestion together with improved air quality.

NATS and Airports – will understand the controller requirements for UAV management and be able to plan national strategies for mixed airspace management based on new understanding of regulatory needs, different operating criteria, multiple uncertainties (e.g. shifts in demand), risks and the system energy efficiency.

NHS services - will realise opportunities to improve the effectiveness of public services and quality of life benefits for patients through: i) reduced logistics energy demand and costs leading to savings on the estimated £2.5 billion spent annually on pathology logistics; and ii) more even demand on laboratory staff through time-efficient deliveries of pathology products throughout the day and improved bleed-to-diagnosis times for patients.

UAV developers – will be able to develop guidance for UAV manufacturers in terms of design criteria which consider actual flight paths, separation rules, collision avoidance and risk mitigation requirements as well as the effectiveness and energy efficiency of different types of UAV in a variety of logistics scenarios and operating conditions.

The general public - will benefit through more effective public services reducing overall traffic levels, energy consumption and greenhouse gas emissions. This leads to quality of life benefits related to improved health service provision and direct health benefits due to reduced air pollution.

DEVELOPMENT OPPORTUNITIES

The project's involvement with stakeholders provides pathways for academic skills development, working with industry through: i) direct involvement with NATS in terms of air traffic control concepts for shared airspace management; ii) collaboration with primary and last-mile logistics providers to understand commercial optimisation tools, iii) visualisations of simulations to illustrate and aid understanding of choice outcomes; and iv) training tools that facilitate interaction with simulations to understand choices. The successful candidate will be offered opportunities for joint paper authorship with researchers from the larger team at University of Southampton, UCL and University of leads, extended visits to partner sites as well as specific placement opportunities with the industrial collaborators. The successful candidate will present their work at key national and international practitioner and academic conferences.

SUPERVISORY TEAM	
First Supervisor	Prof Janet Dickinson

Additional Supervisors	Dr Katherine King Prof Tom Cherrett (University of Southampton)
Recent publications by supervisors relevant to this project	Cohen, T., Stilgoe, J., Stares, S., Akyelken, N., Cavoli, C., Day, J., Dickinson, J., Fors, v., Hopkins, D., Lyons, G., Marres, N., Newman, J., Reardon, L., Sipe, N., Tennant, C., Wadud, Z., Wigley, E. 2020. A constructive role for social science in the development of automated vehicles. Transportation Research Interdisciplinary Perspectives. https://doi.org/10.1016/j.trip.2020.100133 Rafter, C. B., Anvari, B., Box, S., & Cherrett, T. (2020). Augmenting traffic signal control systems for urban road networks with connected vehicles. IEEE Transactions on Intelligent Transportation Systems. DOI: 10.1109/TITS.2020.2971540 McLeod, F.N., Cherrett, T.J., Bektas, T., Allen, J., Martinez-Sykora, A., Lamas-Fernandez, C., Bates, O., Cheliotis, K., Friday, A., Piecyk, M., Wise, S. (2020). Quantifying environmental and financial benefits of using porters and cycle couriers for last-mile parcel delivery. Transportation Research D, DOI: https://doi.org/10.1016/j.trd.2020.102311 Dickinson, J.E., Filimonau, V., Cherrett, T., Davies, N., Hibbert, J.F., Norgate, S. and Speed, C., 2018. Lift-share using mobile apps in tourism: The role of trust, sense of community and existing lift-share practices. Transportation Research Part D: Transport and Environment, 61, 397-405. Cherrett, T., Dickinson, J., McLeod, F., Sit, J., Bailey, G. and Whittle, G., 2017. Logistics impacts of student online shopping – Evaluating delivery consolidation to halls of residence. Transportation Research Part C: Emerging Technologies, 78, 111-128. Kim, S., Filimonau, V. and Dickinson, J.E., 2020. The technology-evoked time use rebound effect and its impact on pro-environmental consumer behaviour in tourism. Journal of Sustainable Tourism, 28 (2), 167-187. Smith, A., Robbins, D. and Dickinson, J.E., 2018. Defining sustainable transport in rural tourism: experiences from the New Forest. Journal of Sustainable Tourism, 1-18

INFORMAL ENQUIRIES
Please contact the lead supervisor on the following email for informal enquiries: jdickinson@bournemouth.ac.uk
ELIGIBILITY CRITERIA
The BU PhD and MRes Studentships are open to UK, EU and International students. Candidates for a PhD Studentship should demonstrate outstanding qualities and be motivated to complete a PhD in 4 years and must demonstrate: • outstanding academic potential as measured normally by either a 1st class honours degree (or equivalent Grade Point Average (GPA) or a Master's degree with distinction or equivalent • an IELTS (Academic) score of 6.5 minimum (with a minimum 6.0 in each component, or equivalent) for candidates for whom English is not their first language and this must be evidenced at point of application.
ADDITIONAL ELIGIBILITY CRITERIA

HOW TO APPLY
Please complete the online application form by **13th January 2021.** Further information on the application process can be found at: www.bournemouth.ac.uk/studentships