Fossil free transport economy – drones in the Stockholm region

APIS is a project affiliated to KTH Centre for Sustainable Aviation with funding from TRV.

The master theses will contribute with development in various fields that ultimately will result in concept which may be scaled up and a plan for a future fossil free transport economy. We need to prepare for simulating drone operations, identify required drone operations from a business perspective, regulatory perspective and implementation perspective:

- a tool, SAFTu will be develop and will be applied to conceptual operations scenarios – with hypothetical drone urban landing areas (vertiport)
- Future operations will be analysed from various perspectives
    - with respect to noise impact of the people living in the surrounding area.
    - Scenarios will have to include choice of in-flight routing, acoustic measures at the vertiport, frequency of drone landing and take-off etc.
    - Assessment of feasible system will depend on Stockholm municipality's decision for the air space, for location of Vertiports, which in turn will be balanced with neighbours' annoyance and regulations for noise and annoyance.
    - Decision support will have to be developed for various stakeholders, regulators, city planners, drone enterprises, neighbours etc.

This project provide a multidisciplinary array of four main areas for projects, which may be combined or studied separately:

Drones – future fossil free transport economy in city areas (1-2 person taxi or goods drones)

Noise and annoyance – impact on society? potential innovation blocker? decision support?

System modelling and analysis – drone operation, Stockholm city, air space, vertiports etc.

SAFTu – User-friendly noise simulation tool for drone noise sources and operations

Drone system economy – demand estimation, economic feasibility, development of network and services.

Inspirational descriptions of projects:

Project 1: Noise impact metrics, measures, scenarios and evaluation, noise associated annoyance from drone operation is assessed for drone operation for people affected both on technical level and with respect to society level. Measures for mitigation and control are investigated, including effective acoustic specification of new UAVs and the potential effect of noise control measures on novel vertiport installations. *(Performance measurements, regulations, human perception and behaviour)*

Project 2: System description, stakeholder needs and implementation framework, addresses the envisioned transportation and implementation system including city planning processes and regulations for drone operations and best practice in noise annoyance mitigation strategies. *(System change and implementation, system of systems, engineering systems models and methods)*

Project 3: SAFTu development for usability and functionality, deals with prediction methods, specifically: adapting the present existing SAFT methodology and code for future aircraft, like drones and electrical aircraft. *(Computer science, programming and modelling, software development)*

Project 4: SAFTu development for usability and functionality, deals with prediction methods, specifically: to establish a validated and well-documented platform based on existing tool SAFT for analysing effects of variations in flight routes and airframe settings at different atmospheric conditions. The code should be easy to use and be well suited to the needs of the users. *(Computer science, programming, usability, software development)*

Project 5: Demand estimation of UAM focuses on estimating the potential volume of traffic for UAM logistics, estimating the percentage of users' choice of UAM for use cases compared to preexisting modes of transport, and the market for UAM for near-term and long-term scenarios; provide insights for capacity building and considerations for logistics design *(marketing, optimisation, modelling)*

Project 6: Economic feasibility of UAM implementation in Stockholm, calculating costs and benefits projected for UAM implementations and operations by 2025-35. through general methodologies such as cost-benefit analysis and market share estimation. *(finance, marketing, optimisation, modelling)*

Project 7: Systems analysis for UAM logistics network design, case of Stockholm, addressing infrastructure (vertiports) aspects for the parameters: emissions, noise metrics, and impacts on ecosystems in a city environment; possible comparative study with road-bound logistics vehicles. *(innovation, system analysis, decision support, criteria models, optimisation)*

Project 6: Security – cyberthreats. What are vulnerable areas of this system, drone technologies, hazard and risk analysis on cybersecurity (may also include safety regulations and operations),

The project partner network is available for co-supervision and support for data, contacts, software etc.

This includes experts on: Acoustics, policy and regulation in aviation and city planning, drone manufacturers and businesses, operations, systems analysis, SAFT software etc.

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