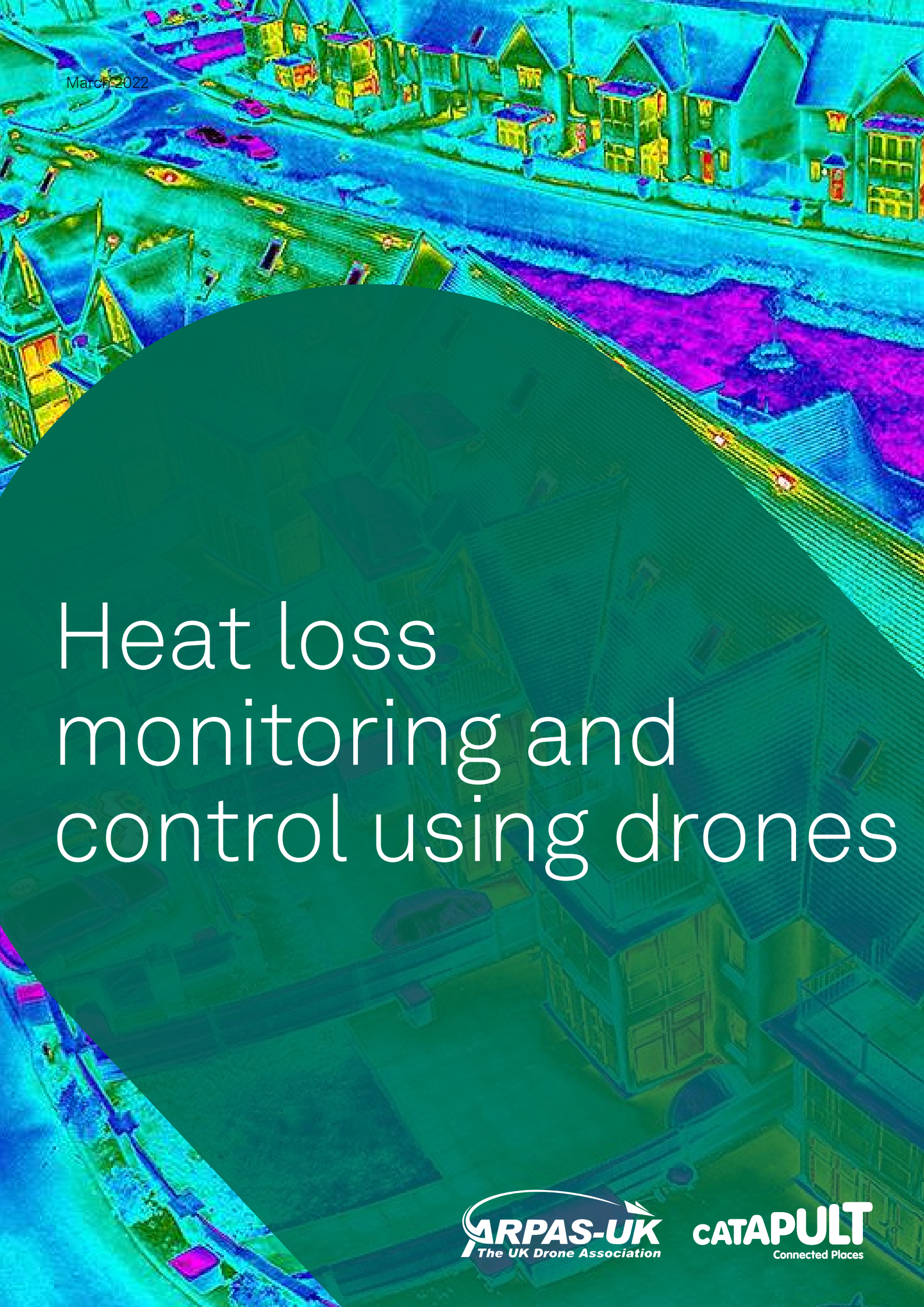
March 2022



Heat loss monitoring and control using drones

ARPAS-UK The UK Drone Association

CATAPULT Connected Places

Using thermal imaging drones as a tool to accurately find heat loss, reduce carbon emissions and identify poorly performing housing stock.

Benefits

How can drones help?

- Identify heat loss without disrupting or destroying the built environment
- Quickly and cheaply identify problems in locations that are not easily accessible
- Enable faster and more effective scanning of large areas and property stock

Impact

Economic £ £ £ **Social**

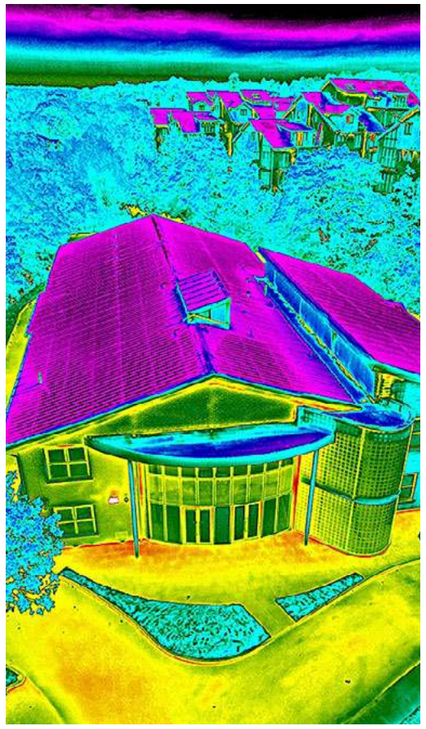
Why does this matter?

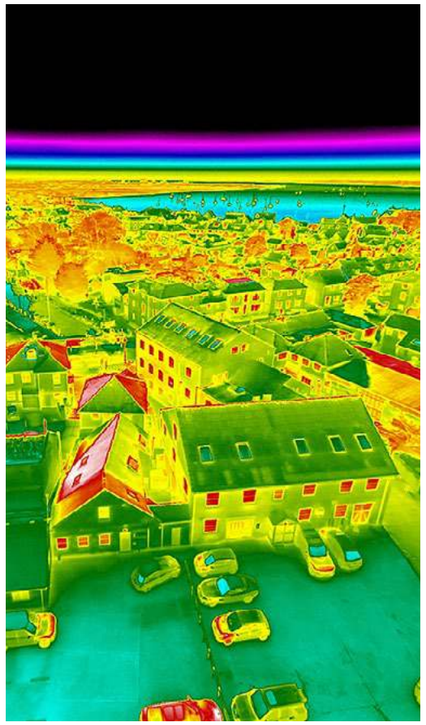
Home insulation and energy efficiency are key topics not just for homeowners and tenants but also for the government if it is to meet its ambitious CO2 reduction targets. Homes account for approximately 15% of the UK's greenhouse gas emissions through their use of oil and gas for heating and hot water. These emissions need to be cut significantly by 2030 to help meet the UK's legally binding climate goals, according to the Committee on Climate Change.

Why drones?

Whilst considerable efforts have been made towards constructing thermally efficient buildings, along with retrofitting older building stock, there is still no mechanism to provide verifiable evidence as to the actual performance of a building. Far too often there are discrepancies between what's been designed and what's been built, in turn creating large performance gaps through all stages of the building life cycle. As an inspection tool, aerial thermal imaging can accurately pinpoint areas for improvement, as well as being able to monitor the effectiveness of any remedial works.

The costs associated with retrofitting, and the thousands of pounds spent on buildings that didn't need it are considerable. Time and time again, property owners, local authorities and housing associations will start a retrofit project before understanding where the heat is being lost. Drone-enabled thermal imaging enables project managers to visualise these areas of improvement before the tender stage - helping to minimise costs and maximise budget.





Requirements

About thermal imaging

To accurately determine heat loss (or gain), it's recommended that there is a minimum temperature difference of at least 10°C between the inside and outside of a building. Whilst this is relatively simple to achieve in winter (with the heating being on), it does mean that these conditions are harder to meet during warmer months. Equally important is that buildings should be free from solar gain (the effect of the sun heating the building fabric), meaning that most thermal imaging surveys should be conducted several hours after sunset.

Action Plan

What needs to be done to make this happen?

Certification → → → → → Industry

Thermal imaging cameras cannot take accurate readings without adjustments. Factors such as reflected apparent temperature and emissivity must be calculated to collect reliable information. When data is not collected properly (for example during the day), operators can quickly mistake functioning building elements as faults, leading to expensive and unnecessary remedial works. To avoid this, accredited training to a national standard (such as ISO 18436) should become mainstream, if not mandatory.

Knowledge → → → Operators and Industry

Thermal imaging is a quantitative and established method for accurately measuring energy and heat loss, without disrupting the built environment. Despite this, infrared technology is still considered fringe within industry, with public perception of thermal drones being largely based on TV and movies. Further knowledge sharing at higher education level and above is needed to actualise the benefits of thermal imaging for new generations.

Regulation → Government, Regulator and Industry

Currently, thermal imaging is not a requirement for building completion. Whilst an invaluable tool for identifying faults and maximising retrofitting budgets, a thermal survey can still be viewed as an unnecessary cost due to the lack of direct requirement

Related use cases

With thermal imaging cameras getting smaller and drones flying for longer, emergency services across the country are now able to conduct aerial search and rescue operations quickly and more effectively. When a person goes missing, speed is of the essence and infrared drones are able to scan large areas quickly and efficiently - even at night.

For law enforcement, police forces across the UK have started to utilise thermal drone technology for identifying hot roofs in domestic properties - a typical indicator for cannabis farms. Through identifying significant heat and energy emissions, police drone pilots can focus on areas of interest, guiding a ground-based team in real-time.

Another industry that's been revolutionised by thermal drone technology is renewable energy, especially in the case of photovoltaic panels. Prior to modern drones, solar panels were manually inspected with hand-held thermal imaging cameras - a process that would take several weeks for a large site. Utilising an aerial vantage point, drone-mounted thermal cameras can now inspect a large site in a matter of hours, providing pixel-by-pixel temperature data and acting as a reference point for any on-site technicians.

Future use cases

As automated drones become more widespread, there could be a multitude of opportunities for the real-time monitoring of domestic and commercial buildings. In these scenarios, automated drones could be used to routinely check and inspect assets for heat loss, alerting owners immediately of any building problems or defects.

ARPAS-UK would like to acknowledge the contribution of iRed in researching the content of this document.

More information

Find out more about business and research programmes, projects and opportunities. To get involved with Connected Places Catapult email: drones@cp.catapult.org.uk for more information or visit the Connected Places Catapult Opportunities page.

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