Minutes

MAGIC Partners Meeting		
9.19.2017	1030-1700	Imperial College London
Attendees	Michael Herzog, Huw Woodward, Elaine Paterson, Rod Jones, Paul Linden, Megan Davies-Wykes, Alan Robins, Will Lin, Marko Tainto, Nick Martin, Matthew Johnson, Jimmy Lirvat, Chris Pain, Dimitrios Pavlidis, Elsa Aristomedou, Maarten van Reeuwijk, Rosella Arcucci, Laetitia Mottet, Reza Ansari, Helen ApSimon, John Polak, Janet Barlow, Anders Helgeland, Espen Akervik, Christina Vanderval, Matteo Carpentieri, Z Tong Xie, Vina Kukadia, Bill Legassick, Shiwei Fan, Jiyun Song, Henry Burridge, Roger Street, Jakob Sprickerhof, Dunhui Xiao, Jovan Pantelic, Jake Hacker	

Welcome	
	Paul Linden
Discussion	

- Aim of the project: To develop a new tool for urban planners and regulatory authorities based on a uniform system- for long term planning and new modelling.
- Context- at the heart is Fluidity Model which is being developed at ICL- idea is to use this plus data and other models to develop a useful output tool.
- Consortium works through networking, PhDs, main committee, Steering Committee, Partners Committee, Exec and local management committees, MAGIC circle.
- Rosella Arcucci is the newest member of the team and will be working on data assimilation at ICL.
- Over the past 6 months the project has concentrated on the test site- a naturally ventilated building at LSBU and we are now monitoring indoor and outdoor measurements and meteorology. These measurements are being backed up by wind tunnel testing and lab models of the site. Models of the room and test site are being conducted using the Fluidity model. There are also EnergyPlus models of test room.

MAGIC – PDRA Discussions	
Discussion	Shiwei Fan: • Responsible for the indoor and outdoor monitors which examine CO2, CO, NO2, temperature, humidity and barometric pressure. The indoor monitors are in the test room and the outdoor monitors are within a 300 meter radius of the test room. Some initial analysis of the data has been undertaken. There is also a people counter to monitor the number of people in the room and the camera to measure window positions, as well as weather station in place. A PM sensor will also be deployed in due course. • Shared some initial results from the data and there are some daily patterns of interest that can already be established – in particular the difference between indoor and outdoor monitors, as well as the daily fluctuations and weekend variations in the data. • More in depth data analysis will take place going forward, but more data is also needed e.g. residential gas consumption and traffic data • Recommendations from Henry Burridge- look at thermal stratification within the room • London Atmospheric Commission are the best organisation to discuss residential gas consumption, rather than commercial gas companies • Currently don't have any measurements of the air tightness of the room- there is some research from Southampton which may help with this this Will Lin: • Measuring flow characteristic for wind directions in the wind tunnel – want to characterise wakes of tall buildings vs typical urban flows and these results can be compared with the physical data and the models being developed. • Examining 149 buildings and 5 wind directions using fairly standard methods • Presented results from one direction, presenting typical boundary layer characteristics. There is very strong wake effects from the tall buildings- being seen 3-4 building widths downstream of the individual buildings.

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- Next phase of the work is to look at surface pressure on the test site building.
- Janet Barlow asked what the impact of the tall building wake is on the test site building- it is probable that this will cause some turbulence increase and therefore this may impact indoor-outdoor air exchange- perhaps something to be examined later down the line.

Laetitia Mottet:

- Wind tunnel and simulation (Fluidity) comparison
- From NW wind direction we can see the wind follows the channel down London Road- confident there will be a good agreement between the data from the wind tunnel experiment and the Fluidity model.
- When comparing the simplified (for the wind tunnel) and real life geometry of the buildings- there is a good agreement, but more work needs to be undertaken
- Future work will add traffic models, thermal effects, indoor modelling and coupled indoor and outdoor models, as well as continuing the comparison between the wind tunnel experiment and simulations.

Megan Davies-Wykes:

- Looked at simulations inside a model room that is being cross-ventilated- using Fluidity. Also looked at how to couple internal and external sensor data. Is also considering a laboratory model of the room and wind movement.
- Examined the impacts of: scale, wind direction, window size and heat and wind on the test room in the laboratory
- There is spatial variation and heat effects seen the room. The next steps are to compare these Fluidity results with the laboratory experiments. Future work will also include pollutant sources and change inlet flow conditions.
- Experiment will consist of a water flume which has a model room inside the space and measure flows through the room, changing a number of parameters such as ventilation rate and heating

Jiyun Song:

- Simulating indoor-outdoor exchanges of the test room using EnergyPlus model. The model examines a number of parameters, such as solar distribution and shadow calculation, surface heat balance, heat convection and conduction, air heat balance, air contaminant mass balance and air network.
- Mutual reference points for pressure and velocity to ensure validity of the EnergyPlus model: reality (Weather station), wind tunnel measurements, and CFD simulations.
- Examined the effect of different combinations of window openings
- Opening windows cools the room and the cross-ventilation has the greatest cooling properties of the room.
- Fluctuations in CO2 levels were also examined on the model – this assumes humans are the greatest contributor of CO2 and examined the impacts of different window opening combinations.
- Next step is to change the combinations of window openings on indoor temperature and pollutants be coupling of EnergyPlus and CFD wind tunnel. In the far future, JS would like to examine the impact of climate change on building energy consumption and impact of building use on microclimate.
- Wind speed data is quite high for a building this size- perhaps need to reconsider this data going forward- need to consider the real data and the wind tunnel data to ensure that the impacts of building height and weather state data are negated as much as possible going forward.

Marko Tainio- CEDAR	
	• Senior Research Associate in Cambridge Clinical School in a public health centre called CEDAR • TIGTHAT project- towards integrated global transport and human health • Research themes in public health modelling- health and environmental impacts of replacing current transport methods with more active methods of transport. The centre looks at influencing policy by improving health through transport choices. • Two examples of the CEDAR work look: at the health effects of the London bike sharing system and whether air pollution negates the health benefits of cycling and walking. The centre has also created a tool for the Department for Transport to help them plan where to build bicycle names. • Current project- TIGTHAT – MRC Global Challenge Foundation Award, which looks at low and middle income countries.

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- The project examines personal travel data and how this will be influenced by different scenarios using data from e.g. injury data and physical activity models.
- Previous studies in this area have been in high income countries, where the outdoor environment is very different- less polluted and generally safer. The study is focusing on Lima, Sao Paulo, New Delhi, Bengaluru and Visakhapatnam (and possibly two African cities –if data is available).
- Currently considering what to do if data (e.g. pollution and travel) is not readily available.
- Output of the project is to create a tool to calculate the health effects of transport scenarios all over the world (including Low and Middle income countries).

Henry Burridge- ICL

- Presented PhD student's research on Large Eddy Simulations of Buoyancy Driven Flows: Plumes and Natural Building Ventilation
- Localised sources of heat give rise to warm plumes of air. Buoyant warm air can drive a ventilating flow via a high and a low level vent. External air flow induces pressure differences. Wind induced pressure difference drive a ventilating flow.
- Examined data much like Megan's MAGIC work in the laboratory.

MAGIC Circle RoundTable Discussion

- Jovan Pantelic- UoC, Bekley- large scale sensors and how we would operate buildings if we had indoor and outdoor building pollutant information. Sees MAGIC as fundamental to sensor placement.
- Jake Hacker- Arup- cities and infrastructure are of optimum importance to the work of the organisation e.g. internal and external environmental flows and air pollution.
- Jimmy Lirvat- Dyson- want to reduce contaminants in their end market products; improving and understanding outdoor air quality is important to improving indoor quality- MAGIC is therefore important to Dyson's current strategy
- Nick Martin- NPL- European Body- SEN has a committee looking at both outdoor and indoor air sensors; need to ensure you get quality for the sensors.
- Vina Kukadia from BRE- currently looking at pollution disturbance studies- looking at the outdoor and indoor environments and the impact on health. Consider building ventilation, including air filtering. Major interest is an integrated approach to designing buildings.
- Z-Tong Xie- UK Urban Mechanics special interest group co-convener- all are welcome to come to the next meeting in November to discuss
- Henry Burridge and Cath Noakes (University of Leeds) - Low Energy ventilation special interest group- all are welcome to the next meeting in December in Leeds which will look at ventilation and health effects.

Matthew Johnson- Airlabs

- The company focuses on air cleaning technologies, clean air delivery systems and pollution sensors, with the vision to use building facades, bus shelters etc. to clean our air
- Questions for MAGIC include: best placement of air cleaning systems, design sensor networks and how do we combine active and passive components for optimal performance in urban areas?
- Have examined the physical oxidation of hydro chemicals and looked at various ways to clean air using systems varying from a shipping container to installing a bench in London to working with the Body Shop to clean air in bus stops as part of a marketing tool
- Currently developing an air cleaning tool for cars called Airbubbl and will be starting a Kickstarter campaign next month
- Have installed pollution monitors at the MAGIC site to examine pollution data – this data will support the MAGIC project

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Espen Akervik- FFI

- FFI – Norwegian Government Agency- Espen is based in the Applied Fluid Dynamics Research Group which examines defence and societal-security applications- much work examines the dispersion of pollutants
- Full scale scenario and investigative work, development of operational models, fundamental research
- Discussed case study work such as the environmental impacts of a wood chip factory fire that spread legionnaires disease- modelled CFD vs wind tunnel measurements and found good correlations at low level.
- Have looked at non-neutral releases in Oslo (e.g. of chlorine and ammonia) - helped the local fire brigade look for residues after a bomb explosion a few years ago.
- Currently looking at short term impacts of dispersion- need to look at how flows in cities are influenced by buildings. Can now generate 150km^2 geometry suitable for computation in one day and use this in combination with CFD models to examine plume density and distribution.
- Current topics- stratification, dense-gas release, air-sea interaction and explosive dispersion.
- Evidence that dense-gas effectively eliminates turbulent exchange of momentum near walls.

Steering Group Feedback

- Attendees were Jimmy Lirvat, Espen Akervik and Jakob Sprickerhof
- Plan is to meet again through Skype to finalise the meeting and culminate minutes with the members of the Steering Group that couldn't attend today's meeting.
- Discussions were centred on the need to guide the MAGIC project going forward and helping raise awareness of the project to the public and policy makers.
- Need to be able to monitor the advancement of the project- would like to see the expected project outputs so that the project can be monitored and what we want the project to achieve at the 6 month meetings.
- Would be helpful to assess the risks of the project and come up with the mitigation strategies for these risks.
- Will circulate some initial minutes, meet via Skype and submit the results via Skype- will also decide on the committee chair and vice-chair.

Concluding Remarks

- Plan to provide a version of the whole system by mid-2018 to include the Fluidity model and validate against field measurements. Fast running and cost-benefit models and there will be a critical review by EPSRC and will work on any deficient/additional aspects in the second half of the project.
- There are a number of linked PhD students and there is the possibility of funding for a new student at LSBU starting in 2018- we are looking for industrial sponsors to co-fund 50% of this project. Anyone interested in getting involved with this should speak with Elsa (£10k/yr over 3 yrs).
- The project has been active in trying to extend its networks over the past few months such as ReFresh, Met Office, UK Fluids Network and CIBSE NV Group
- Communications will continue- 1-1 meetings can also be requested.
- Thank you to ICL for hosting the meeting today and for everyone for attending and participating in the meeting, in particular for those who presented at the meeting.