1. **Sensor-Enabled Homes and Personalised Care for Senior Singaporeans Living in the HDB Environment**

SHINESeniors, or Smart Homes and Intelligent Neighbours to Enable Seniors, is a SMU-initiated effort to make community care services effective through innovations in care delivery by leveraging on Information and Communications Technology (ICT). It aims to create sensor-enabled homes in support of ageing-in-place. The sensors, installed in the homes of seniors, can help community volunteers to better monitor, support them and respond in a timely manner to calls for help or falls. Through SHINESeniors, it is hoped that the cost of care delivery will be lowered significantly given the lower reliance on manpower.

Essentially, a sensor-enabled home could monitor the environment (air quality, noise levels, temperature, humidity, etc) and the daily living patterns of a senior (physical activities, fall detection, medication adherence, mobility patterns, etc.) in a non-intrusive manner through its fixed and mobile sensors. Thereafter, it is able to communicate and sense-make real-time data to a network within the community by detecting anomalies or unusual living patterns of the respective senior so that timely intervention can take place.

SMU will be partnering with A*STAR, Eastern Health Alliance, a voluntary welfare organization, GoodLife! and Tata Consultancy Services to develop the sensor-enabled home over three years. They will also be working in close collaboration with the government agencies of Ministry of Health (MOH), Housing and Development Board (HDB), and Urban Redevelopment Authority (URA).

Dr. Hwee-Pink TAN
Lead PI, SHINESeniors Project
Associate Professor of Information Systems (Practice)
Academic Director, SMU-TCS iCity Lab
Singapore Management University

Dr. Hwee-Pink TAN currently leads a team of 10 technology and social science researchers to bring together Internet of Things technologies, and social-behavioural research to enable and sustain ageing-in-place, leading, in a broader sense, to intelligent and inclusive societies, in close partnership with A*STAR, TCS, various government agencies, as well as Voluntary Welfare Organizations.
Prior to joining SMU in March 2015, he spent 7 years at the Institute for Infocomm Research (I2R), A*STAR, where he was a Senior Scientist and concurrently the SERC Programme Manager for the A*STAR Sense and Sense-abilities Program. In this programme, he led a team of 30 full-time research scientists and engineers to design, pilot and evaluate architectures to support large scale and heterogeneous sensor systems to enable Smart City applications. In recognition of his contributions, he was awarded the I2R Role Model Award in 2012 and 2013, and the A*STAR Most Inspiring Mentor award, TALENT and Borderless Award in 2014.

He graduated from the Technion, Israel Institute of Technology, Israel in August 2004 with a Ph.D. In December 2004, he was awarded the A*STAR International Fellowship to conduct postdoctoral research at Eindhoven University of Technology (Dec 2004 to Jun 2006) and Trinity College Dublin (Jul 2006 to Mar 2008) on the design and evaluation of wireless networks. He is a Senior Member of the IEEE, has published more than 100 papers, has served on executive roles for various conferences on wireless sensor networks, and is an Area Editor of the Elsevier Journal of Computer Networks

2. **Development of Integrated Multi-physics Urban Microclimatic Modelling Tool – Wind and Thermal, Solar Irradiance/Shading and Acoustic Noise Mapping**

One of the key R&D challenge to achieve high liveability in residential town is to develop solutions to improve human comfort and enhance environmental qualities. Studies have shown that urban areas could experience higher ambient temperatures, due to the presence of more concrete surfaces that traps heat. With more activities, noise level will increase. Conducting large scale urban microclimatic modelling during the town planning and urban design stage is important for planners and designers to establish feasible mitigation strategies and translate them into planning and urban design guidelines. To enhance liveability, critical environmental factors identified in this project are thermal and aural comfort.

Existing environmental simulation platforms are able to quantify some of such effects individually. However, most if not all of such platforms are not able to account for the interaction of the complex multi-physics. These platforms require different input models which make simulation laborious and time consuming. To alleviate the above weakness and draw greater synergy, 3D digital models used for planning and urban design visualisation will be adopted for an urban climatic modelling tool.

This research project involves the development of an open source multi-physics environmental modelling tool, which aims to capture interrelationships between wind flow, temperature, solar irradiance, day lighting and noise propagation in a common simulation platform. It seeks to develop an integrated urban microclimatic software platform with the coupling of Computational Fluid Dynamics (CFD), solar shading and environmental noise modelling for urban planning purpose. The first Proof of Concept study on Punggol site and subsequent scalability study for modelling quarter to half of Singapore size (200 - 400 km^2) will be performed. The scale of the simulation allows for the effects of buildings, terrain, vegetation, water bodies, road pavements and urban elements to be fully captured. The tool will be verified and calibrated with ground truth measurements under typical urban conditions.

Dr. Poh Hee Joo
Research Scientist & Capability Group Manager
Fluid Dynamic Department
Institute of High Performance Computing

Dr POH Hee Joo holds the position of Research Scientist and Capability Group Manager (Environmental Flow) in Institute of High Performance Computing (IHPC), A-STAR. He is also an Adjunct Assistant Professor to the Mechanical Engineering Department and Building Department of National University of Singapore (NUS). He is the pioneer Adjunct lecturer for BCA Green Mark Professional course module for Computational Fluid Dynamics (CFD) Airflow Modelling for Green Buildings. He has over 15 years work experience in CFD research and consultancy jobs, and has personally been involved in more than 70 CFD projects, mainly focusing on system design and building ventilation simulation works. Since 2010, he has been appointed as external assessor for the BCA Green Mark criteria and performed assessment for more than 25 CFD Natural Ventilation projects. In 2013, he has also been appointed by BCA Green Mark as member of the specialist committee for assisting BCA to chart the CFD criteria for Non-Residential Buildings. In recent May 2014, he had also been nominated by Ministry of National Development (MND) Singapore to be honoured as a World Cities Summit Young Leader in recognition of his contribution to the field of urban liveability and sustainability to attend the inaugural WCS Young Leaders Symposium, in Singapore.

3. **Biophilic Town: A Framework for Landscapes to Enhance the Environment of High-Density Towns**

Humans are thought to have an innate dependence on contacts with nature for their well-being based on the theory of “biophilia”. However, modern urban environments in high-density cities more often than not, preclude satisfying encounters with nature and do not adequately consider that cities, despite their highly man-made nature, are still part of the natural world and have reciprocal relationships with natural biophysical and geochemical processes. Such inadequacies in the design of cities manifests not only in problems associated with human well-being, but also in contemporary problems created by urbanization, particularly its effects on climatic change, resource use and biodiversity loss. Biophilic design, as with other ideals of city planning, such as “sustainable city”, “resilient city”, “humane metropolis”, “regenerative design”, “landscape urbanism”, “ecological urbanism”, and “biophilic city”, “biopolis”, “garden city”, etc., proposes a more calibrated approach on how nature is incorporated into city planning for human well-being and environmental health. However, as a relatively new concept, it has yet to be effectively translated into actionable knowledge in city planning and urban design. In addition, it is also unclear how design and greenery may influence behaviour and produce the social capital that is necessary for well-being. This project seeks to understand such relationships and synthesize from the wide range of related concepts, a framework that can be used for the planning and design of biophilic HDB townships. The research uses a holistic approach to incorporate theoretical and conceptual ideas from planning disciplines, and perspectives of policy makers, planners and stakeholders such as communities and NGOs to create a planning tool which we can be more adaptive to current urban challenges than one promulgated by an academic approach alone. The framework will be tested in new towns being planned by HDB through design workshops, and positive lessons from the research will be integrated into current planning and design processes and norms.

Dr. Tan Puay Yok
Associate Professor
Department of Architecture
School of Design and Environment
National University of Singapore

Dr. Tan Puay Yok is an Associate Professor in the Department of Architecture in the School of Design and Environment of the National University of Singapore, where he also serves as the Co-Director in Masters in Environmental Management programme, and research and teaching leader for landscape studies. His research, teaching and professional activities focus on the theory, policies, and practices of urban greening and ecology of the built environment. Puay Yok is active in international collaborations, grant reviews for several national research grant programmes, and also contributes regularly as a reviewer for a number of international journals. He currently serves in the Editorial Advisory Board of Landscape and Urban Planning and CITYGREEN. He publishes widely in journals, books, and technical guidelines for the landscape industry, and advises on landscape design and planning projects in the region as means of transferring knowledge from the academia to practice.

4. **Abating traffic noise through a holistic approach of noise monitoring, analytics and control (MAC)**

Traffic noise from road, rail, and aircraft has been a nuisance to many residents staying in high rise building near major highways, roads, railway tracks, and along the flypass zone of aircraft. The usual approach is to simply close the window and switch on the aircon. However, due to our tropical climate and the increased emphasis on power saving in household electricity bill, open window will improve the ventilation of the interior of the room and enjoy natural cooling with no cost. Building barriers to surround road and railway track will incur high expense and degrades visual impact for road users, graffiti is also a major problem, and thus, making our urban environment less pleasant. We propose an active approach of noise mitigation, which uses noise to cancel noise. It works on a simple law of physics by superpositioning noise entering the room with a noise of similar amplitude but opposite phase (i.e. anti-noise), resulting in a quieter overall noise level. However, to effectively cancel noise coming through an open window, will require several sensors to detect the type of noise coming in before generating a wavefront of anti-noise (through an array of loudspeakers) to cancel the intruding noise. In order to react to changes in the traffic noise, soothing sound tracks can also be played to cover-up (or auditory mask) the residual noise that resulted from the active noise control approach. This hybrid approach of noise control is more suited to cover a broader bandwidth of noise with changing noise patterns, and thus, make our residential living environment more conducive and less stressful. However, to achieve a good noise control scheme, we need to have some knowledge on the type of traffic noise that residents in a particular block is facing and also to know the human preference in noise perception, as some noises are deemed to be more annoying than others. Therefore, there will be efforts on noise monitoring through an array of microphones mounted onto a moving vehicle and coming up with a uniquely Singapore noise preference database. This information can be programmed into the memory of the noise controller to intelligently generate the best anti-noise wavefront with masking sound to turn an annoying noise into something less annoying for residents.

Dr. Woon-Seng Gan
Associate Professor
School of Electrical and Electronic Engineering
Nanyang Technological University

Woon-Seng Gan is currently an Associate Professor in the School of Electrical and Electronic Engineering at the Nanyang Technological University. His research interests are in the areas of active noise control, adaptive signal processing, audio processing, and directional sound system. He has published more than 230 international refereed journals and conferences, and has granted seven Singapore/US patents. He has also co-authored three technical books (published by Prentice Hall, IEEE, and Wiley) related to his research work. He is currently a Fellow of the Audio Engineering Society(AES), a Fellow of the Institute of Engineering and Technology(IET), and a Senior Member of the IEEE. He is also widely consulted in the industry, and has successfully completed several research grants from NRF, MoE, and ASTAR. He is the series editor of the SpringerBriefs in Signal Processing. He is also an Associate Technical Editor of the Journal of Audio Engineering Society (JAES); Associate Editor of the IEEE Transaction on Audio, Speech, and Language Processing (ASLP); and Editorial member of the Asia Pacific Signal and Information Processing Association (APSIPA) Transactions on Signal and Information Processing. Currently, he is serving in the technical committees of the international IEEE Signal Processing Society on Design and Implementation of Signal Processing Systems (DiSPS), and the Industry DSP Technology (IDSP).

5. **The Sonic Crystal Project - meeting the trio challenges of providing natural ventilation, daylight and noise mitigation**

Good natural ventilation, natural lighting and quiet ambience are desirable characteristics for every household but these are typically difficult to achieve at the same time in high rise and city dwellings. Transparent glass windows are good for natural daylighting but typically will need to be closed for reducing noise which in turn will prevent natural ventilation. The main objective of the proposed research program is to establish an innovative solution with the use of suitably designed sonic-crystal window structures in the form of periodic array of glass panels which will ensure a good balance of natural daylighting, noise mitigation and natural ventilation. The outcome of the project will have a major impact for every household with reduced energy usage due to good balance of natural ventilation and natural daylighting while ensuring a highly liveable residential environment with good noise mitigation. The design of sonic-crystal window structure in terms of spacing and layout of the proposed periodic array of glass panels would be dependent on the environmental noise intensity, frequency and profile for ensuring optimal design and utilization of materials. Additional sound absorbing materials and other features such as Helmholtz resonators could be incorporated at the side edges to enhance the noise mitigation. The prototypes would be demonstrated at the residential high rise building of Cinnamon College as well as the new 30 story residential cum office building for the Yale-NUS College within the University Town.

Dr. Lee Heow Pueh
Associate Professor
Deputy Head
Department of Mechanical Engineering National University of Singapore

Associate Professor Lee Heow Pueh is currently the Deputy Head (Research) for the Department of Mechanical Engineering, National University of Singapore. He was awarded the PSC Overseas Merit Scholarship for his undergraduate study and graduated with first class honours from Cambridge University. He did his full time National Service at the Traffic Police Department and was awarded the Commissioner of Police High Commendation for his contribution. He obtained his PhD in Mechanical Engineering from Stanford University. He was seconded to the Institute of High Performance Computing (IHPC) in 2002 and subsequently assumed the role of Deputy Executive Director for research since 2003 till 2009. His early research focused on the mechanics of robotic manipulators, mechanism designs, sound and vibration and the mechanics of ultrasonic motors. His more recent research focuses on mechanics in medicine, mechanics of biofouling and acoustics. He has more than 300 publications in peer review journals with a H factor of 30. He has several funded research projects as PI or Co-PI with A*STAR, MOE, NRF, SMA, PUB, TDSI and DSO National Laboratory.

6. **Noise mitigation solutions for the building envelope with green and intelligent sound absorbing materials**

Noise is one of the important factors determining the quality of life and liveability in urban areas. As we further intensify the land use, it is inevitable that buildings will be exposed to higher ambient noise level generated by various noise sources such as vehicular traffic and economic activities. To address the issue of high noise levels while maintaining natural ventilation is a challenge. In a high-rise high density living, the building envelop often constitutes to the primary path for external noise sources to travel into the living environment. Through the collaborative efforts from IMRE, IHPC, HDB, and NEA, this project is committed to investigating and developing advanced technological solutions enabled with green and intelligent sound absorbing materials to improve aural and thermal comfort in the living environment. This project also aims to study the technical effectiveness of new window designs that can substantially reduce noise transmission, and at the same time maintain ventilation function to achieve good thermal comfort and resource efficiency. Besides residential developments, the green and intelligent sound absorbing materials and noise mitigation technologies developed in this project can also be adopted for other commercial and industrial buildings.

Dr. Yao Kui
Principal Scientist
Manager
Sensor & Transducer Programme
IMRE, A*STAR

The project PI, Dr. Yao Kui, is a principal scientist and the manager for Sensor & Transducer Programme at IMRE, A*STAR. He has worked on intelligent functional materials, particularly piezoelectric, acoustic, and energy transduction materials and their device applications for about 20 years. He co-authored about 150 journal papers, filed 30 primary patents, and delivered about 28 keynote and invited lectures in international forums on functional materials and devices applications. He has also led many industry collaboration projects in this area. Five patents have been licensed to industry.

7. **Life Safety and Structural Fire Safety of Mega Underground Caverns in Singapore**

Effective fire safety designs for underground structures heavily depend on fire and structural analysis, early detection systems, evacuation strategies, smoke control system, etc. Currently, for underground structures in Singapore, the national Fire Code stipulates 4-hour fire resistance rating. To satisfy this requirement, the concrete elements have to be very massive. This poses significant construction challenges due to limited access to movement of huge construction vehicles and equipment as well as massive cost involved. Besides structural safety, the research programme will also address life safety of occupants. While these design considerations for above-ground infrastructure are well established, the same cannot be said for mega underground developments.

The project is led by a team of structural, mechanical and materials science faculty members and engineers from Nanyang Technological University (NTU). The aim is to develop an integrated, cost-effective solution for ensuring structural fire safety and life safety of occupants in underground structures. This project will lay the foundation for the knowledge and expertise required to support future underground developments. This research is multi-disciplinary, involving materials science engineering (with ceEntek Pte Ltd), evacuation analysis, fire modelling, heat transfer, structural analysis and fire detection/suppression analysis. The scientific data collated will support SCDF, JTC and DSTA in the development of safe, robust and cost-effective design standards for Singapore's underground developments.

To achieve the goal, the NTU team is undertaking this project in close collaboration with the above-mentioned public agencies on a wide range of work scope including fire load determination, assessment on early detection/suppression system, assessment of structural stability under varied fire conditions and development of a system to aid evacuation process. In addition, the research will evaluate the most recent advancements in construction materials with and methodology worldwide to provide safe and cost-effective solutions for the fire safety of underground structures and life safety of occupants.

Dr. Tan Kang Hai
Professor
School of Civil and Environmental Engineering
Nanyang Technological University

Professor Tan Kang Hai obtained his BSc(Eng) (First Class) (1986) and PhD (1989) from the University of Manchester, UK. Prior to joining NTU, he worked as a graduate engineer in Ove Arup & Partners, UK. He won the UK Institution of Structural Engineering Henry Adams Award in May 1989 for the best original research paper published in the UK Institution of Structural Engineers for that year. A registered Professional Engineer in Singapore, he has been teaching at the School of Civil & Environmental Engineering, NTU since 1990. He has been involved with Fire Service Shelter Department since Nov 2001, when he obtained a BCA grant for a research project to develop a performance-based design guide for structural fire engineers. He was a member of Fire Code Review Committee on "Code of Practice for Fire Precautions in Buildings 2002" and chaired four technical sub-committees on the development of National Application Documents for Eurocode related to structural fire calculations.

Currently, he is a member of the panel of review for certifying Fire Safety Engineers and a member of Fire Safety Appeals Board Committee, the final arbitration body in Singapore for building fires. He completed an ASTAR project with SCDF to explore tensile membrane action to reduce fire protection for secondary beams. Currently, he is Director of Protective Technology Research Centre, NTU. He works on defense- and security-related research projects with DSTA, MHA and JTC. His research areas include behaviour and modelling of steel and concrete structures under fire conditions, strut and tie modelling of reinforced concrete structures, and progressive collapse resistance and numerical simulations of structures. He conducted realistic scale laboratory tests on progressive collapse resistance of structures, structures in fire, and numerical simulations using his own developed software FEMFAN3D. He has 125 SCI international journal papers and over 160 conference proceedings. He has graduated 14 PhD and 13 MEng students. With his supportive and capable team of research staff and PhD students, they form the Fire Engineering Research Group At NTU (FERGAN).

8. **Structural and Social Impacts of Rock Blasting on Nearby Environment**

The drill and blast method is one of the most practical and economical choices for breaking up rock mass, a critical step in underground space creation by rock excavation. This method is also used in hilly areas by removing the outcrop rock. However, blasting operation in urban areas may have an adverse impact on buildings and facilities, as well as communities nearby. Therefore, there is a need to understand the impact of the drill and blast operation on the surrounding environment.
The main objectives of this research project are 1) to investigate the impact of rock blasting on nearby structures, through advanced numerical modelling and small-scale field tests; 2) to study the social impact of blasting-induced vibration and noise on nearby communities through surveys, field observations, as well as psychological measurements.
The outcome of the project will provide valuable information to various government agencies in developing guidelines on rock blasting induced vibration/noise control. The results will also assist planning for efficient outcrop rock removal and ensure that future blasting operations take into account social and psychological factors.

Dr. Zhao Zhiye
Interim-director, Nanyang Centre for Underground Space
School of Civil and Environmental Engineering
Nanyang Technological University

Assoc Prof Zhao Zhiye is the interim Director of the Nanyang Centre for Underground Space (NCUS), School of Civil & Environmental Engineering, Nanyang Technological University, Singapore. Over the last ten years, his research focuses on rock mechanics and rock engineering, especially in the area of advanced numerical modelling and rock cavern analysis under dynamic loads. He was a PI of the following research project teams: Underground Technology and Rock Engineering program (2003-2014, DSTA), Jurong Rock Cavern project (2007-2013, JTC), NTU campus underground exploration study (2012-2013, SEO/NCUS). He is a member of the editorial board of the International Journal of Tunnelling and Underground Space Technology, and currently serves as the president of the Society for Rock Mechanics & Engineering Geology (Singapore).

9. **Psychological, health and social parameters associated with working in underground spaces**

Underground developments are increasingly becoming common in major cities around the world. In Singapore, several malls and offices are underground. Thus, investigation of the underground environments for work is an increasingly important consideration for cities where space is a premium. However, the way the underground environment can be designed to promote critical parameters such as human performance, happiness, social life and health has never been rigorously and scientifically examined. This research program will examine and increase our understanding of how underground environments impact on human psychology, social behaviour and health. In addition, the program will assess the attitudes and beliefs of Singaporeans on working in underground environment. The target is to set the necessary scientific basis for the development of underground spaces that are liveable, enjoyable, healthy, safe and productive.

Dr. Soh Chee Kiong
Professor
School of Civil and Environmental Engineering
Nanyang Technological University

Soh CK received his BEng from Concordia University, Canada, SM from MIT, USA, and PhD from University of Wales College of Cardiff, UK. Prior to joining NTU, he worked as an offshore engineer with McDermott South East Asia and as a marine surveyor with Noble Denton & Associates Singapore. Over the years at NTU, he has held various appointments such as sub-dean and vice-dean of the School of Civil & Structural Engineering, head of the Division of Structures & Construction, head of the Division of Structures & Mechanics, Assistant Director of Research at the NTU Office of Research, and Associate Chair (Administration) of the School of Civil & Environmental Engineering. He just stepped down as the Acting Chair of the School of CEE on 30th June 2014. Soh CK is also a Fellow of the Singapore Academy of Engineering since 2012.

As an offshore engineer, Soh CK had designed, fabricated, installed, hooked up and commissioned at least a dozen offshore platforms, including laying the then largest submarine pipeline in the E11 gas field for Sarawak Shell. As a marine surveyor, he had reviewed and approved on site numerous construction and marine operations carried out in the shipyards in Japan, Korea, Indonesia, Malaysia, Brunei and Singapore. As an academia, Soh CK has published more than a hundred SCI-tracked journal papers, one of which received the American Society of Civil Engineers Best TCCP Paper Award in 1996, another received the IES-IStructE Singapore Best Structural Paper Award in 2001, and yet another has in 2011 been identified by the Council of Canadian Academies as a top-1% most highly cited paper in its field in the world. His current research interests are in sustainable urban systems and in using smart materials for structural health monitoring, damage prognosis and energy harvesting. He has also co-authored a book on "Analysis and Design of Offshore Structures" in 1991, a PC-based courseware on “Intelligent Interactive Tutoring System for Engineering Mechanics - Statics” in 2000, and another book “Smart Materials in Structural Health Monitoring, Control and Bio-mechanics” in 2012. In addition, Soh CK received the NTU CoE First Year Common Engineering Teaching Excellence Award in 2004. That class had more than 1,800 students.

10. **Microbiological, Chemical and Physical Interactions in Rock Cavern Water Storage**

The primary objective of this research project is to explore the feasibility of storing water in underground spaces such as caverns. Three modules are proposed to achieve this aim, namely to conduct (a) laboratory tests; (b) numerical modelling; and (c) a preliminary design of caverns in Singapore's context. These modules entail:

1. Development of a laboratory model to examine the physical, geochemical and biological processes in an underground environment and to provide data for model validation and tests for various technical, commercial and industrial purposes;
2. Development of mathematical models by integrating the related ecological and hydrodynamic processes to simulate and predict water quality in an underground cavern environment, and to evaluate various pre- and/or post-treatment requirements; and
3. Development of a pilot cavern concept which aims to extend the small-scale laboratory tests to real in-situ tests in a real size water storage pilot cavern (with an estimated size of 20x30x100 m^3) for potential subsequent investigations, to study the complex water/mineral/man-made materials interactions, and to verify the water quality models.

Dr. Chiew Yee Meng
Professor and Head of Division
Division of Environmental and Water Resources Engineering
School of Civil and Environmental Engineering
Nanyang Technological University

Dr Chiew is a Professor in the School of Civil and Environmental Engineering at NTU and is presently holding the appointment of Head of Division of Environmental and Water Resources Engineering. For more than 10 years, he has and continues to serve as an Associate Editor of Journal of Hydraulic Engineering, American Society of Civil Engineers (ASCE) and is a member of the editorial board of the IES Journal and Journal of Patent in MENG. He also has served as a member of the international committee on scour and hydraulic engineering – International society of soil mechanics and geotechnical engineering and Fluvial Hydraulics Section, Technical Division III: Geophysical Hydraulics, International Association of Hydraulic Research. He was the Chairman of the 2nd International Conference on Scour and Erosion, held in Singapore in 2004.

Dr Chiew has more than thirty years of research and consulting experience in the field of hydraulic and coastal engineering, sediment transport, scour and erosion. He particularly is interested in scour at hydraulic structures such as bridge piers, submarine pipelines, ship propellers, jets, etc. and how such erosion affects the integrity of the surrounding structures and sediment bed. His research interests also include how turbulence affects fluvial and coastal hydraulics and their overall engineering impact. Recently, he has started working in the area of climate change impacts on the urban environment. He has acted as a specialist consultant for many governmental agencies and private organizations both in Singapore and internationally.

Dr Chiew publishes widely in archival journals and conference proceedings, having published close to 150 titles in his area of expertise and specialization. He also has been invited to give keynote lectures and seminars throughout the world in his area of research specialization.