

## **Annex A: SIA-NUS Digital Aviation Corporate Laboratory's Research Activities**

The new SIA-NUS Digital Aviation Corporate Laboratory (Corporate Laboratory) seeks to create and potentially commercialise innovative technologies, support the acceleration of the digital transformation of Singapore's aviation sector, and redefine the air travel experience. The objectives are to drive traveller-centric digital services, ensure security and safety in air travel, and enhance organisational effectiveness and workplace productivity for SIA and Singapore's aviation sector.

The Corporate Laboratory will leverage NUS' multi-disciplinary research expertise across artificial intelligence (AI), machine learning, data science, operations research and analytics, optimisation, automation, sleep studies, as well as design to develop digital technologies at the systems-level. It will tap on research capabilities from the following areas:

- Business School – Department of Analytics and Operations
- College of Design and Engineering – Department of Biomedical Engineering, Electrical and Computer Engineering, and Division of Industrial Design
- Duke-NUS Medical School – Chronobiology and Sleep Laboratory
- Institute for Health Innovation and Technology (iHealthtech)
- Institute of Operations Research and Analytics
- School of Computing – Information Systems and Analytics

Research will also be conducted in the following areas:

### **Revenue Management and Dynamic Pricing**

The aim is to develop a new approach to design optimal price tiers for air tickets and manage seat inventory, leveraging modern analytical tools and technologies that can perform deep data analytics in airline revenue management system. Currently, SIA faces challenges in the areas of price elasticity estimation, dynamic pricing, and competition. These challenges require the development of a customised solution for SIA. Expertise, infrastructure, and relevant background work done at NUS' Institute of Operations Research and Analytics (IORA), Business School, School of Computing, and Department of Industrial Systems Engineering and Management will be tapped on to add value to the proposed projects in this area.

### **Transforming Competency and Skill Development**

The Corporate Laboratory will look at deploying technology to enhance training within the aviation industry. Specifically, the projects will use eye tracking technology to quantify and personalise training programmes for pilots, and tap on Augmented Reality (AR) and Virtual Reality (VR) technology to complement existing training programmes, providing SIA with greater learning flexibility. In the first project, eye tracking technology will be used to develop a data-driven and competency-based training framework, which will provide an objective approach to training, as well as potentially reduce the number of required hours in flight simulators and training cost. In the second project, the use of AR and VR will help to complement existing training programmes for new cadets as well as the routine refresher courses for current flight and cabin crew by providing greater flexibility in where they can train. It will also include more types of scenarios and situations that can be simulated.

### **Employee Wellness**

The aim is to develop a fatigue modelling and prediction algorithm that can be customised for every pilot and cabin crew based on different fatigue factors. This will allow SIA to enhance

pilot and cabin crew safety and well-being while upholding levels of performance. In addition, this project aims to achieve a more comprehensive picture of the well-being of SIA's flight crew, and provide guidelines on fatigue mitigation strategies to improve employee wellness. The outcomes that the Corporate Laboratory aims to achieve include accurate individual-based fatigue modelling and prediction, fatigue management approaches and cumulative fatigue modelling. Expertise and relevant background from NUS' School of Computing and the Duke-NUS Medical School will be tapped on to add value to the proposed projects in this area.

### **Passenger Comfort, Sleep and Cabin Service**

The aim is to create new products, services, and processes that will improve passengers' comfort, sleep, and wellness on board SIA flights. This will be achieved by combining insights from different research approaches, including data analytics, behavioural and sleep science, design processes, as well as the organisational knowledge and practices of SIA. The Corporate Laboratory will focus on developing innovations in the following key strategic areas related to the in-flight experience:

- (1) Enhancements to SIA's Cabin Seat Product Offerings:** The team will develop and implement novel sensor-based methods for collecting and mining data that can be used for the purpose of analysing comfort on long-haul flights. The data mining seeks to uncover critical insights on seat comfort, which will then be translated into specifications and measurement targets to enhance SIA's cabin seat products.
- (2) Novel Features to Improve Customers' Sleep on Board Flights:** Evidence-based insights on in-flight sleep quality will be used to design a sleeping environment that can be adapted to optimise passengers' sleep. This includes enhancing seat comfort in ways that facilitate the initiation and maintenance of sleep, optimising environmental factors that affect sleep (e.g. light, sound, and touch), and the scheduling of cabin services in a manner that minimises the disruption of passengers' sleep opportunities.
- (3) Pushing SIA's Superior Customer Experience to New Heights:** To elevate SIA's superior customer experience and renowned in-flight service to the next level, the team aspires to develop an in-house solution to deploy a sensor-based, data-driven technology platform. The concept involves capturing, interpreting, and anticipating real-time passenger needs, as well as designing suitable service interventions to address passenger comfort both at an individual and cabin level. The solution processes real-time physiological variables (e.g., cold/hot, hunger or thirst, sleepiness, fatigue) to determine passengers' physiological state so as to inform or, where suitable, prescribe actions for the cabin crew.