Civil Aviation Authority of Singapore

1 Singapore Aviation Accident/Incident Reporting System

The Singapore Aviation Accident/Incident Reporting System (SAIRS) was conceptualised in mid 2008 and implemented in early 2010.

SAIRS was ingeniously designed to perform safety trending and analysis at aggregated state level by (i) adapt the European software to operate in Singapore environment and framework, (ii) interface with local airlines, maintenance organization and aerodrome operator’s systems, (iii) integrate the electronic safety data collection with storage, (iv) sharing aviation safety data with other states should the need arise.

With SAIRS, Singapore is the first in SE Asia to collect safety data according to ICAO standardized format electronically.

The key benefits gained from the implementation are:
• Paperless system;
• Enhance Singapore aviation safety through In-depth safety data trending and analysis;
• Preventive actions and safety recommendation can be devised;
• Show casing Singapore as an advanced civil aviation center of excellence by sharing the capability with regional states; and
• Ease of data sharing with ICAO.
MyTransport.SG (www.mytransport.sg) is LTA’s new mobile channel providing a comprehensive range of travel information for both motorists and public transport users on a single platform. Launched on 16 March 2010, it is an extension of the WAP mobile services that are currently available on ONE.MOTORING and PublicTransport.SG. This new mobile site was designed with smartphones in mind to cater to a growing population of savvy users who demand user-friendly information on the go.

Using this mobile platform, commuters can easily search between different key transit and traffic information, as multiple information is accessible on a single mobile site. This simplifies the process of checking on road conditions, ERP locations/rates, parking availability in town, Park and Ride car parks, public/premium bus services, MRT/LRT stations, taxi call numbers and even the latest COE bidding results, since all the travel tools are located on one main site.

Location-based services are also available for mobile phones with location-sensing capability. Commuters are able to locate the nearest land transport points of interest such as bus-stops and MRT/LRT stations at a touch.
3 Green Pavement: Sustainable Roads using Recycled Materials

The use of recycled waste materials has provided the industry with alternative resources for road pavement construction and maintenance, and relieved Singapore from relying solely on imported granite aggregates. Unlike previous efforts where recycled materials were used on selected layer of the road pavement structure, the team conceptualised the idea of constructing every layer of the road pavement structure with a mix of recycled waste materials – making this a truly “Green Pavement”.

In the composition of the Green Pavement, 20% and 30% of reclaimed asphalt pavement (RAP) from “milled waste” was used in the asphalt concrete for the asphaltic wearing and base course layers respectively. Incineration bottom ash (IBA), a residue from the incineration of waste, was used to replace the non-asphaltic sub-base and base layers.

LTA has amended the specifications of Materials and Workmanship for Road Works in June 2010 to include these recycled waste materials as alternative materials for road pavement construction.

The success of Green Pavement will enable LTA to reduce Singapore’s dependence on natural aggregates in road construction. Furthermore, the use of the processed incinerated waste in pavement construction could potentially prolong the life-span of Pulau Semakau as a landfill for another 25 years!

\[1\] by product of milling defective asphalt road pavement and conventionally used as non-asphaltic road sub-base material
**Land Transport Authority**

### 4 B2C: The Recyclable Bio Ball Filtration System

B2C is an integrated silt filtration system, using principles of filtration, sedimentation and adsorption to convert brown water to clear water. The success of this filtration system lies in the application of bio balls with custom made cage to fit in any drainage system. This innovative idea came from the team’s aspiration to have a better silty water management system and work towards a sustainable living environment.

Adopting the use of B2C provides higher silt filtering efficiency and reduces the amount of chemicals used in treating the water before discharging into water catchments. This eco-friendly silt treatment system is five times lighter than the conventional method and needs relatively less maintenance which is translated to annual cost savings up to $460,000 per site. Moreover, it also enhances workers’ productivity and safety on site. This system has huge commercial potential as its cost-effective solution to convert brown water to clear water offers tremendous benefits.

B2C is a simple versatile system that can be adopted in other areas of wastewater treatment. Developing and developed countries can also adopt this low cost intermediate technology for their wastewater treatment to turn water from brown to clear.
5 Integrated Distance-Based Fare Charging for both the Bus and Rail Systems

Distance Fares was one of the key initiatives under the LTA’s Land Transport Master Plan and was launched on 3rd July 2010. To encourage commuters to take the most efficient routes, this new fare structure charges commuters based on the total distance travelled in a journey, without incurring a transfer penalty when they switch between different transportation modes.

A key ingredient for distance-based fare charging is a software component developed by LTA Fare Systems Division called the Fare Computation Module. This module is the basic building block of Distance Fares throughout the system and it ensures consistency of computation across all modes. It enables testing to be carried out on the new fare structure without affecting current revenue service.

Despite a tight schedule and budget, the development team delivered the system within a year and developed several innovative solutions such as the Fare Computation Module and a Pool-Based Revenue Apportionment module. To accelerate testing activities
without compromising quality, an Automated Fare Validation tool was also developed.

Based on the Automated Fare Validation Tool, the online Fare Calculator was introduced to the public through the Public Transport @ SG portal. This portal helps the public to calculate the fares and plan their journeys. These innovations have helped the public to understand and use the new Distance Fare system without any major technical problems.
Maritime and Port Authority of Singapore

6 Development and Implementation of an Innovative Low-cost Broadband System for Maritime Use

Though high-speed internet can bestow operational and crew welfare benefits, its cost is usually the major barrier preventing many ship operators from entering the broadband arena. To address this, the project aims to develop a low-cost alternative solution to help maritime users adopt broadband technology onboard vessels. A joint collaboration effort under MPA’s test-bedding and development project, Singtel’s Asynchronous Maritime VSAT or “BigValue Maritime Broadband solution” optimises a vessel’s existing satellite technologies of onboard equipment such as TVRO and Inmarsat Fleetbroadband.

Such a reduction in costs is possible by separating the download and upload requirements of Internet activity, and channelling download data through a ship’s satellite television antenna. The asymmetrical nature of the Internet means that the majority of traffic is shore-to-ship. Given that a satellite TV antenna is able to provide broadband speeds, this hybrid model brings about cost savings, not just in airtime but also in initial equipment investment. The fast and cost-effective downlink enable applications such as provision of on demand video or audio contents, and access to the latest movies or karaoke videos.

The solution also enables businesses to reduce operational costs, increase productivity and services through the adoption of automation and remote communications tools for monitoring and
tracking of assets and goods such as containers, reefers and other high-value assets both in ports and onboard ships.
7 ANCHORAGE-VIEW: Real-time Anchorage Capacity, Prediction and Monitoring System

The Port of Singapore plays host to more than 100,000 vessels annually. A large part of the navigable sea space within port waters has to be allocated as anchorage space for vessel to carry out their operations in port.

MPA envisioned that in order to better serve the industry and optimise anchorage space, a system capable of delivering an overall picture of the anchorage utilisation in port was needed to enhance anchorage management.

The project was funded under MINT Fund. The system was designed to allow the users to have an overall view of the status of the anchorages and assess the anchorage utilisation. It is able to provide forecast of anchorage utilisation up to 48 hours in advance based on the declared ‘Notice of Arrival’ submitted. The user is presented with a graphical colour coded overall picture of the capacity and dwell time of the anchorages and the vessels at anchor.

The system is also equipped to automatically allocate anchorage space for incoming vessel based on their choice of preferred anchorage and/or defined alternate anchorage. The assignment of anchorage space to vessel is base on the existing port rules and regulation. This was made possible by interfacing the anchorage-view system with existing systems in the control centre such as the Port Traffic and Management System (PTMS) and radar systems.

With the introduction of this system, it will enable MPA to optimise the usage of anchorage space and improved the information sharing processes.
Figure 1 (above): Overall graphical user interface view

Figure 2 (above): Selective anchorage graphical user interface view
8 Design and Implementation of a data communication network for LORADS-III and other Air Traffic Services Systems

The Long Range Radar and Display System (LORADS-II) is used by air traffic controllers to control flights in the Singapore Flight Information Region and at Changi Airport. It comprises an automated Air Traffic Control (ATC) system and associated radars and communications systems, which have equipment widely spread over Changi Airport. The system will be replaced with a new system called LORADS-III which requires a high speed data network to support its real-time exchange of information. For existing LORADS-II system, the data communication network predominantly comprises of copper-based cables which inherently carry limited bandwidth.

With understanding of the former, a detailed study on the distribution of critical ATC sites and separate assessments in terms of network needs for varied systems was carried out. The collated information was then utilised in mapping out the design and physical routing of the infrastructure prior to implementation of a new optical fibre-based network and architecture for LORADS-III and other Air Traffic Services (ATS) systems.

The key benefits of implementing such a network are:

- High-bandwidth inter-site connectivity make possible at lower cost and through improved network design;
- High-Availability network infrastructure attributed to its redundant and diversified design;
- Efficient management of resources for future networking requirement of ATS provision.
Land Transport Authority

9 MobileP@y: Purchase your e-Day Licences on-the-move

With the implementation of the electronic Day Licence (e-Day Licence) and MobileP@y system on 23 Nov 2009, an Off-Peak Car/Weekend Car (OPC/WEC) user is now able to purchase the e-Day Licence via MobileP@y while he is on-the-move. Buying an e-Day Licence is just an SMS away.

Step 1
For registered users, simply SMS “LTA <space> EDAY<space> BUY<space> DDMMYY” to 74729 where DDMMYY is the date of the e-Day Licence you wish to purchase.

Step 2
You will receive a call from our Interactive Voice Response (IVR) System. Please get ready your MobileP@y PIN and 3 digit CVV2 number found at the back of your credit card.

Step 3
You will receive a confirmation SMS to inform you of a successful transaction.

This is the first mobile-SMS payment service introduced by a government agency to offer credit card as a payment mode and does not rely on an e-Wallet or ‘top-up’ concept. As it also complies with the PCI DSS², MobileP@y users can be assured that their customer account and credit card data are kept confidential and managed in a secure manner.

The MobileP@y system is developed to allow transactions over SMS instead of the usual mobile web. This eliminates the need to download any application onto mobile phone and other compatibility issues. This m-service is complemented with an Interactive Voice

² Payment Card Industry Data Security Standard, which is a worldwide information security standard defined by the Payment Card Industry Security Standards Council.
Response (IVR) System which offers an added security on the authorisation of a transaction. Collaborating with local telco company has helped to reduce the development of the system by $150,000.
Land Transport Authority

10 Energy Efficient and Sustainable Design for First Underground 66kV Substation in Singapore

The underground 66kV electrical substation (ESS) will supply the power required for the new Downtown Line MRT. This will be the first of such design to be implemented in Singapore. The innovative design of adopting natural ventilation and water mist system to cool and protect the transformer rooms reduces the energy consumption compared to other designs, resulting in a more energy efficient system.

In order to eliminate the need to provide mechanical ventilation plant to these rooms, the design leverages on the buoyancy effect of hot air and the high ceiling. Computational Fluid Dynamics (CFD) simulations were performed to assess the effectiveness of natural ventilation. Results from the simulations demonstrated that the design room temperature criteria can be met under different operating conditions of the transformer.

In addition, water mist system is adopted in place of conventional water spray system to protect the rooms by leveraging on the better cooling effect of smaller water droplets to cool the fire. CFD simulations were also performed to demonstrate that water mist system is as effective as the conventional water spray system in controlling transformer fire. Water mist system uses less water and hence smaller mechanical plant is needed.
With these approaches, significant annual savings of up to $250,000 can be achieved. An energy efficient and sustainable underground 66kV substation is born!
11 Noise Enclosure for a Friendlier Environment

Installing half-height platform screen door at the existing elevated MRT station platform can be very challenging due to the limited working hours (between 0100 to 0430 hours daily) and the proximity of the residential blocks to the stations (the shortest distance is 40 metres).

The noise enclosure, developed in collaboration with Singapore Technologies Electronics Pte Ltd (STE), was aimed to reduce and contain high noise levels of construction activities from the residential areas.

This enclosure was designed to be light-weight and mobile. It has managed to reduce high noise level substantially by 10 dB(A), which is equivalent to 90% reduction in sound pressure level, or 50% reduction in human perceived volume.

With reduced noise output from worksites, there are fewer disturbances to the residents which are reflected in a sharp drop of the number of complaints received during these ongoing night works.

In addition, the noise enclosure has the potential to be re-deployed and re-used for other works such as maintenance of existing railway, hacking of road and etc, resulting in more cost savings in future.
Land Transport Authority

12 Development of Anti-Stick Paint for Road Facilities

Illegal advertisements that are pasted on street furniture such as lamp posts, traffic light posts and directional sign posts over time has marred the beautiful streetscape in Singapore. LTA has been actively carrying out enforcement against the offenders to remove these illegal advertisements on public streets island-wide. This active enforcement has put a tremendous strain on LTA’s resources and moving forward, there was a need for LTA to have a more productive, cost–effective and sustainable solution.

To solve this problem, LTA collaborated with a paint specialist in Singapore to research and develop an “Anti-Stick” paint by enhancing the non-stick property of an existing paint used for self-cleansing. After the creation of this anti-stick paint, an experimental trial was conducted along a sheltered linkway in a MRT station and the effectiveness of the non-stickiness was monitored for several weeks. As the initial trial result proves promising, a pilot project was further extended to a few locations at Marine Parade, Geylang Road and Sims Avenue to re-affirm the effectiveness of this anti-stick paint on different street furnishings. With these successes, the anti-stick paint was deployed in phases to 16 other hotspots.
To maintain the same level of cleanliness, the average annual cost of deploying LTA’s contractors to remove and clean the street furniture to LTA is $225,000. With anti-stick paint, the average annual cost is estimated to be $70,000 resulting in annual cost savings of $155,000. Moreover, the use of anti-stick paint has increased productivity by re-deploying LTA resources to much better use instead of more frequent site visits.
Green Man Plus (GMP) is an innovative system conceptualised by LTA team that extends the travel time for elderly pedestrians at selected pedestrian crossings. GMP leverages on the existing senior citizen CEPAS concession card originally designed to identify the elderly for travel on the public transport network and activate the extension of the crossing time.

Since the launch of GMP in October 2009, there has been an estimated 3,700 activations of the system per month for the 5 signalised pedestrian crossings in Ang Mo Kio, Jalan Bukit Merah and Toa Payoh Central area. The project was successful in extending the travel time for elderly pedestrians and this additional time allows them to cross the road more comfortably and safely.

GMP was well received by elderly citizens who felt that GMP had provided more assurance and instilled a higher confidence in them when travelling at the pedestrian crossings. The system also facilitates active participation by elderly residents in community
events and encourages greater integration of the elderly within the community.

The next phase of GMP is to extend the system to the physically handicapped and expand it to more locations island-wide.
Ministry Of Transport (MOT)

14 Enabling Productivity Gains through Collaborative Workspaces

Meetings at MOT are a common sight and are essential for presentation and discussion of transport-related and corporate matters. Many meetings rely very heavily on the secretary for the collation and verification of meeting materials. In addition, a large volume of papers is printed by participants of the meetings.

Collaborative Workspaces is one of the Knowledge Management (KM) capabilities identified under the MOT KM initiative. An instance of Collaborative Workspaces is the PS-AD Meeting Workspace which revitalises the meeting process.

Its primary innovation is in the design and customisation of available ICT platforms and features to deliver a value-adding meeting preparations and execution process. With the Collaborative Workspace, participants are empowered to self-service and update (directly) meeting materials (e.g. documents, calendar events) “anytime, anywhere” prior to the actual meeting. More importantly, the online platform greatly
reduces the workload of the secretary. For example, he is no longer required to collate updates. In addition, features such as auto-generation of collated information into MS Office documents enable users to do things never before by a click of the button. Participants are able to view contents in specific formats instantly by selecting certain input criteria (e.g. date range, data category, etc) compared to the laborious way of manual data formatting. They can also choose to be notified instantly of any meeting updates by subscribing to the meeting newsfeed, without waiting for the latest copy to be collated and circulated via email.

Last but not least, MOT is one of the pioneering agencies to deliver this capability and a number of agencies have modelled or indicated interest in this project.
Maritime and Port Authority of Singapore

15 Critical Resource System to Boost Productivity of the Marine Industry

Ship building is an internationally competitive business, in terms of prices, quality and time-to-delivery. Faster delivery time increases competitive advantage. Being capital intensive, any time reduction in decision, planning, execution and delivery will result in cost advantage over competitors for the shipyards and their customers. Currently, shipyards’ project management systems are manual and semi-autonomous, adding time and layers to the document flow process and making tracking and managing projects time-consuming and difficult. Current IT systems exist but are not integrated to connect, exchange and analyze data.

To further improve the shipyards’ productivity, MPA supported a project to devise a solution to facilitate business process flow management, project optimization and scheduling in the marine industry, particularly shipyards based on the concept of Multi-Project Critical Chains management. The project was led by Astoria Pte Ltd in collaboration with SIMTech.

AstorPlan, the decision-support system developed performs rescheduling based on the selected optimization strategy, facilitates in optimal utilization of critical resources over
multiple projects, and is capable of highlighting resource conflicts, over allocation, potential bottlenecks and other operational issues. The offshore and marine sector could potentially benefit from the enhanced productivity of up to 15% cost and time savings, especially in the case of a multi-project environment typical in the industry.
16 Environmental Monitoring and Management Plan (EMMP) for the Reclamation of Pasir Panjang Terminal Phases 3 and 4

Traditional methods for environmental management of dredging and reclamation works close to sensitive marine habitats have generally not provided the level of control necessary to ensure preservation of these habitats. Obtaining the level of control necessary to assure Authorities and Non-Government Organizations of compliance with the Environmental Quality Objectives requires quantifiable compliance targets covering multiple temporal and spatial scales. Of equal importance are effective and rapid response mechanisms, to allow feedback of monitoring results into compliance targets and work methods.

MPA has engaged DHI Water & Environment (S) Pte Ltd as specialist consultant to implement a pro-active feedback EMMP for the reclamation of PPT Phases 3&4. The feedback EMMP operations are carried out on a daily basis making use of various tools and resources. The EMMP project team works 7 days a week to follow the Contractor’s reclamation schedule. Online sensors are deployed to continuously measure turbidity, currents, dissolved oxygen and noise. Quarterly
marine habitat surveys on corals and seagrass are conducted by marine biologist and daily monitoring of sediment release is measured on site by survey vessels using advanced sediment flux monitoring equipment. Daily feedback EMMP activities include the calculation of sediment spill per single reclamation/dredging trip and comparing to the prevailing spill budgets. The numerical hindcast model simulates every spill trip and results evaluated together with sensor data in relation to the operations. Such innovative use of continuous feedback of information within the EMMP provides MPA a responsive and reliable system that allows unexpected impacts to be mitigated prior them becoming significant and allowing reclamation of PPT Phases 3&4 to proceed despite in close proximity to sensitive marine habitats and facilities.